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Source: Florida Entomologist, 96(2) : 663-669

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.096.0242

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GEOGRAPHICAL DISTRIBUTION AND NEW HOST ASSOCIATIONS OF *RHYSSOMATUS SUBTILIS* (COLEOPTERA: CURCULIONIDAE) NORTHWESTERN IN ARGENTINA

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The genus *Rhyssomatus* Schoenherr, 1837 includes 176 Neotropical and Nearctic species, many of which have agricultural importance because they are phytophagous during the larval and adult stages (O'Brien & Wibmer 1982; Wibmer & O'Brien 1986; Costa et al. 1988; Socías et. al. 2009).

Rhyssomatus subtilis Fiedler (Coleoptera: Curculionidae) "the black soybean weevil", has emerged as a major soybean pest in Northwest Argentina (NWA) during the last 3 yr. This species was recorded for the first time on soybean *Glycine max* (L.) Merr. (Fabales: Fabaceae) in 2006 in the vicinity of La Fragua (Santiago del Estero province). In the following season, it was detected at Rosario de la Frontera (Salta province), and in 2008 it was observed in Nueva Esperanza (Santiago del Estero province), and 7 de Abril (Tucumán province) (Table 1 and Fig. 1) (Socías et al. 2009). From its first detection in La Fragua until 2012, *R. subtilis* has been detected more frequently in soybean cultures in different localities of Santiago del Estero, Salta, and Tucumán provinces. In Mexico, another species of *Rhyssomatus* has been detected in soybean crops, which was identified as *R. nigerrimus* Fahraeus, 1837. The biology, damage, and behavior of *R. nigerrimus* in the field are similar to those described for *R. subtilis* (Lopez-Guillén et al. 2012).

The occurrence of *R. subtilis* causes significant losses in the NWA region. Adults produce damage by their feeding and oviposition during vegetative and reproductive stages of the soybean (Socías et al. 2009). The control of this pest is based mainly on the use of chemical insecticides (Casmuz et al. 2010a). Nevertheless, when the number of the black soybean weevils is high, the entire soybean crop is lost and has to be reseeded.

Given that *R. subtilis* had not been found in these areas before, it could be argued that this species is expanding its range in the region. For this reason, the objective of this study was to determine the geographical distribution and host associations of this species of Curculionidae in NWA.

Samplings from 2009 to 2012 were conducted to detect the presence of *R. subtilis* (Fig. 1) in different provinces of NWA. All localities monitored (42) were georeferenced. Samplings were made in soybean and dry bean [*Phaseolus vulgaris* L. (Fabales: Fabaceae)] growing areas during vegetative and reproductive stages. One hectare was monitored in each locality. In each hectare, 10 points with 10 to 15 plants of soybean and/or dry bean were sampled. By observations on the plants using a vertical beat sheet (Drees & Rice 1985), the presence of weevils was detected. The immature stages (eggs and/or larvae) were estimated by observation on the plants of damaged pods.

On soybean and dry bean crop plantations, *R. subtilis* was collected in 30 localities in Salta, Santiago del Estero and Tucumán provinces, located in an area of about 541,000 ha (Table 1 and Fig. 1). In general, the presence of the black soybean weevil was concentrated in localities in southern Salta, in northwestern Santiago del Estero, and in northeastern Tucumán province (Fig. 1).This species was not found in Catamarca province, which is southwest of Santiago del Estero province and the south of Tucumán province.

In dry bean plantations, the weevil was observed in 2 localities each of Tucumán (Tapia and Trancas), and Salta provinces (Rosario de la Frontera and La Candelaria) (Table 1 and Fig. 1). Preliminary observations showed that adults feed on the crop both in its vegetative and reproductive stages. The crop in its vegetative stage is attacked by adults that feed on tender sprouts of both seedlings and well-developed plants. The damage caused during the vegetative stage of dry

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TABLE 1. GEOGRAPHICAL DISTRIBUTION AND HOST ASSOCIATION OF RHYSSOMATUS SUBTILIS (COLEOPTERA: CURCULIONIDAE) IN DIFFERENT PROVINCES OF ARGENTINA.

Province	Department	Code	Locality	Coordinates South	Coordinates West	Host plant	*R. subtilis*	Year
Catamarca	Santa Rosa	1	Monte Redondo	27° 59' 57.0"	65° 30' 11.8"	Soybean	(-)	2011
		2	Puerta Grande	27° 58' 13.0"	65° 25' 06.2"	Soybean	(-)	2011
		3	La Zanja	27° 52' 54.4"	65° 20' 21.9"	Soybean	(-)	2011
Salta	Rosario de la Frontera	4	Infiernillo	25° 58' 58.4"	65° 05' 45.8"	Soybean	(+)	2010
		5	El Palomar	25° 50' 00.6"	64° 52' 47.6"	Soybean	(+)	2010
		6	Antillas	26° 04' 12.6"	64° 37' 24.7"	Soybean	(+)	2010
		7	Rosario de la Frontera	25° 49' 19.7"	64° 59' 01.8"	Soybean	(+)	2007*
						****Brassica campestris**	(+)	2010
		8	Santa Rosa	25° 39' 57.6"	64° 56' 58.1"	****Conyza bonariensis**	(+)	2010
						Soybean	(+)	2009
						****Sphaeralcea bonariensis**	(+)	2010
						Dry Bean	(+)	2011
	La Calendaria	9	La Calendaria	26° 06' 37.0"	65° 09' 28.3"	Soybean	(+)	2010
		10	El Ceibal	26° 08' 09.8"	65° 01' 05.1"	Dry Bean	(+)	2010
	San José de Metán	11	La Aguadita	25° 27' 09.1"	64° 57' 48.6"	Soybean	(+)	2010
		12	El Galpón	25° 23' 09.9"	64° 43' 05.5"	Soybean	(+)	2010
Santiago del Estero	Pellegrini	13	La Fragua	26° 05' 08.9"	64° 19' 31.1"	Soybean	(+)	2006*
						Soybean	(+)	2010
		14	La Nueva Esperanza	26° 12' 59.0"	64° 11' 30.0"	Soybean	(+)	2008*
		15	Quebracho Coto	26° 17' 11.9"	64° 26' 52.7"	Soybean	(+)	2010
		16	Rapelli	26° 25' 38.7"	64° 29' 52"	Soybean	(+)	2010
	Jiménez	17	Tinajeras	26° 40' 38.0"	64° 28' 27.0"	Soybean	(+)	2010
		18	Isca Yacu	26° 59' 53.1"	64° 36' 43.4"	Soybean	(+)	2010
		19	La Verde	26° 50' 33.0"	64° 42' 17.8"	Soybean	(+)	2010
	Río Hondo	20	La Donosa	27° 24' 24.0"	64° 56' 11.2"	Soybean	(-)	2010
Tucumán	Burruyacú	21	7 de Abril	26° 17' 07.0"	64° 29' 47.11"	Soybean	(+)	2008*
		22	Paja Colorada	26° 32' 37.7"	64° 40' 18.2"	Soybean	(+)	2010

(+) Locality where *Rhyssomatus subtilis* was found.
(-) Locality where *Rhyssomatus subtilis* was not found.
(*) First records of *Rhyssomatus subtilis* in Northwest Argentina (Socias et al., 2009).
(**) Plant on which *R. subtilus* adults feed, but on which they do not oviposit, and on which no immatures occur.
Note: Names of new host association records were checked in the Germplasm Resources Information Network, USDA, ARS, 2012.

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Table 1. (Continued) Geographical distribution and host association of Rhyssomatus subtilis (Coleoptera: Curculionidae) in different provinces of Argentina.

Province	Department	Code	Locality	Coordinates South	Coordinates West	Host plant	*R. subtilis*	Year
		23	Gobernador Piedrabuena	26° 44' 42.5"	64° 36' 52.7"	Soybean	(+)	2010
		24	Río Nio	26° 25' 27.4"	64° 55' 51.5"	Soybean	(+)	2010
		25	Taco Palta	26° 46' 45.7"	64° 59' 59.1"	Soybean	(+)	2010
		26	Puerta Alegre	26° 28' 40.3"	64° 38' 45.1"	Soybean	(+)	2010
		27	La Ramada	26° 42' 03.2"	64° 56' 46.0"	Soybean	(+)	2012
		28	Taruca Pampa	26° 35' 35.8"	64° 46' 53.5"	Soybean	(+)	2012
	Cruz Alta	29	San Agustín	26° 49' 57.2"	64° 51' 29.2"	Soybean	(+)	2011
		30	Pacará	26° 54' 20.2"	65° 9' 48.3"	Soybean	(+)	2012
		31	Las Cejas	26° 52' 03.0"	64° 47' 03.5"	Soybean	(+)	2012
	Graneros	32	El Jardín	27° 49' 03.4"	65° 18' 22.2"	Soybean	(-)	2010
							(-)	2012
		33	La Madrid	27° 40' 05.5"	65° 06' 53.9"	Soybean	(-)	2012
	La Cocha	34	Palancho	27° 48' 02.4"	65° 29' 06.8"	Soybean	(-)	2010
		35	Santa Rosa	27° 51' 00.5"	65° 25' 20.0"	Soybean	(-)	2010
		36	Rumi Punco	27° 57'27.5"	65° 32' 43.5"	Soybean	(-)	2010
		37	Casas Viejas	27° 46' 02.7"	65° 30' 54.4"	Soybean	(-)	2012
	Leales	38	Tres Pozos	27° 06' 23.4"	64° 55' 47.5"	Soybean	(+)	2011
		39	Los Puestos	27° 15' 29.9"	64° 58' 28.5"	Soybean	(-)	2011
		40	Soledad	27° 04' 58.8"	65° 09' 13.1"	Soybean	(+)	2012
		41	Viclos	27° 10' 46.4"	64° 56' 41.2"	Soybean	(+)	2012
	Simoca	42	Atahona	27° 22' 27.7"	65° 18' 33.5"	Soybean	(-)	2012
	Trancas	43	Tapia	26° 37' 3.6"	65° 15' 53.1"	Dry Bean	(+)	2010
		44	Trancas	26° 16' 31.4"	65° 16' 53.4"	Dry Bean	(+)	2010

(+) Locality where *Rhyssomatus subtilis* was found.
(-) Locality where *Rhyssomatus subtilis* was not found.
(*) First records of *Rhyssomatus subtilis* in Northwest Argentina (Socias et al., 2009).
(**) Plant on which *R. subtilus* adults feed, but on which they do not oviposit, and on which no immatures occur.
Note: Names of new host association records were checked in the Germplasm Resources Information Network, USDA, ARS, 2012.

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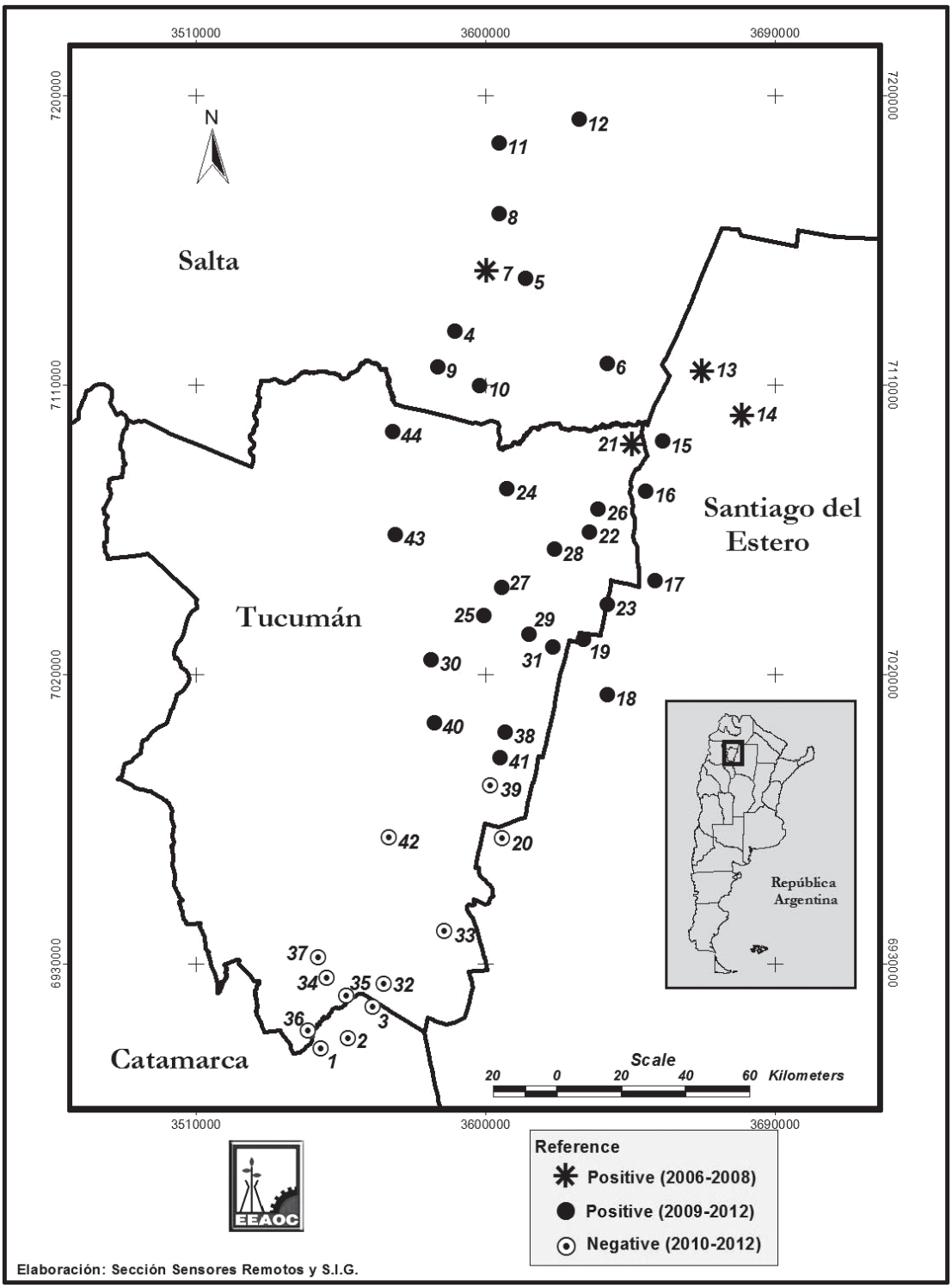

Fig. 1. Geographical distribution of *Rhyssomatus subtilis* in soybean and dry bean growing areas of Northwest Argentina.

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bean can cause the death of the plant or negatively affect its development. During the plant's reproductive stage (R8: pod fill) (Fernández et al. 1986), the female weevils deposit their eggs inside the pods (Fig. 2). After that, the larvae hatch and feed on the seed; and at the end of their last larval stadium, these larvae fall to the soil. In the soil, the individuals continue their development as hibernating larvae, pupae and adults during the winter season. Subsequently with the arrival of the first rains, the emergence of adult occurs.

It is important to mention that the damage produced by weevils on pods (feeding and/or oviposition), facilitates the development of phytopathogens in the seeds, which may lower the quality and performance of bean seed. The behavior and the damage produced by of *R. subtilis* on dry bean crop are similar to that produced in the soybean crop (Socías et al. 2009). Therefore, the next important steps are to identify the duration of the life stages and to quantify the damage caused by this weevil to the dry bean crop.

In Rosario de la Frontera (Salta province), during the spring season, and before soybean sowing, *R. subtilis* adults were found on the following weeds: *Conyza bonariensis* (L.) Cronquist (Asterales: Asteraceae), *Brassica campestris* (L.) Metzg. (Brassicales: Brassicaceae) and *Sphaeralcea bonariensis* (Cav.) Griseb (Malvales: Malvaceae) (Table 1). This weevil was observed feeding on these weeds during their reproductive stages. Ovipositor perforations and eggs were not found in these plants. These are not true hosts, because — although the adults feed on them—the females do not oviposit in the plants and they are not utilized by the larvae. This observation was reported by Bentancourt & Scatoni (1996); Capinera (1999), and Casmuz et al. (2010b). They mentioned that some host plants such as grasses and various pasture weeds, play an important role as reservoirs for the insect pests, which move from one to another species of grasses or crops, but are not true hosts, i.e., the pest does not reproduce on them. In Rosario de la Frontera (Salta province) farms where *R. subtilis* adults were found on the above

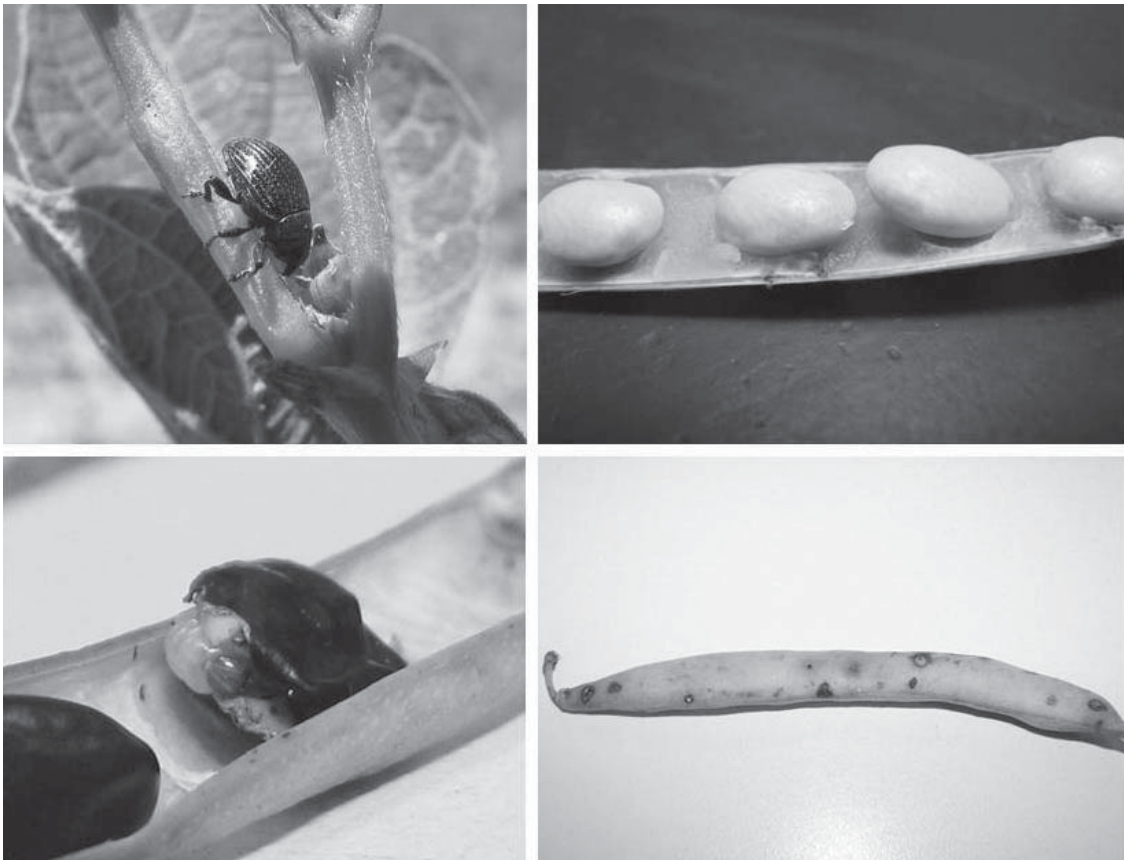

Fig. 2. *Rhyssomatus subtilis* life stages on dry bean crop: a (upper left), adult on the plant; b (upper right), exposed egg in pod; c (lower left), exposed larva feeding on seed; and d (lower right), bean pod showing feeding and oviposition punctures.

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mentioned weeds, which had sustained intense attacks by the weevils in the previous year. It is valuable to know that these weevils can be found feeding on a range of plants not accepted for oviposition and larval development. This makes it clear that prior to the time of growth of the soybean or dry bean crops, it is possible for the weevils to seek alternate hosts for potential infestation. This could be beneficial for those who are studying the weevil and its range extension.

This is the first report of this species developing on dry bean and feeding on the weeds mentioned. The results obtained in this study indicate that *R. subtilis* is expanding its distribution and produces direct and indirect damage on soybean and dry bean crops in northwestern Argentina. From its first detection in La Fragua in 2006 until 2012, this pest has dispersed about 87 km north, 136 km south and 99 km west in northwestern Argentina. Currently, this species of Curculionidae is located in an area of about 541,000 ha (Fig. 1).The expansion of the range of this pest could be facilitated by anthropic factors such as movement of agricultural machinery from weevil infested areas to weevil free areas. Similar observations were reported for *Aubeonymus mariaefranciscae* (Coleoptera: Curculionidae) (Giraldo & Alvarado 1990), an important pest of beet-root (*Beta vulgaris* L.), where its expansion is facilitated primarily by agricultural machinery. Therefore, it is crucial to adopt preventive measures to avoid or delay the expansion of *R. subtilis* to new regions.

Summary

Rhyssomatus subtilis, the black soybean weevil, has emerged as a major pest of soybean [*Glycine max* (L.) Merr. (Fabales: Fabaceae)] in northwestern Argentina during the last 3 yr. This species was detected in 30 localities of Salta, Santiago del Estero and Tucumán provinces comprising a total area of about 541,000 ha. This species was observed for the first time developing on dry bean [*Phaseolus vulgaris* L. (Fabales: Fabaceae)] crops and feeding on 3 unrelated weeds [*Conyza bonariensis* (L.) Cronquist (Asterales: Asteraceae), *Brassica campestris* (L.) Metzg. (Brassicales: Brassicaceae) and *Sphaeralcea bonariensis* (Cav.) Griseb (Malvales: Malvaceae)]. The damage produced by *R. subtilis* in dry bean crops is similar to that produced in soybean crops. The results obtained suggest that as of 2012, *R. subtilis* has greatly expanded its distribution since its first detection in 2006 and produces major direct and indirect damage in soybean and dry bean crops in northwestern Argentina.

Key Words: weevil, soybean, preventive measures, leguminous plants

Resumen

Rhyssomatus subtilis, el picudo negro de la soja, se ha vuelto una plaga emergente en el cultivo de soja [*Glycine max* (L.) Merr. (Fabales: Fabaceae)] en el Noroeste argentino durante los últimos 3 años. Esta especie fue detectada en 30 localidades de las provincias de Salta, Santiago del Estero y Tucumán, abarcando un área total de 541.000 hectáreas. Esta especies fue observada por primera vez en el cultivo de poroto [*Phaseolus vulgaris* L. (Fabales: Fabaceae)] y alimentándose sobre 3 malezas [*Conyza bonariensis* (L.) Cronquist (Asterales: Asteraceae), *Brassica campestris* (L.) Metzg. (Brassicales: Brassicaceae) y *Sphaeralcea bonariensis* (Cav.) Griseb (Malvales: Malvaceae)]. El daño producido por *R. subtilis* en el cultivo de poroto es similar al producido en el cultivo de soja. Los resultados obtenidos sugieren que hasta el 2012, *R. subtilis* tuvo una gran expansión de su distribución desde su primera detección en 2006, produciendo daños directos e indirectos en los cultivos de soja y poroto en el Noroeste argentino.

Palabras Clave: picudo, soja, medidas preventivas, plantas leguminosas

Acknowledgments

We thank Javier Carreras Baldres (SrySig, EEAOC) for his assistance in the preparation of the map. This study was supported by Estación Experimental Agroindustrial Obispo Colombres.

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