

DOI 10.7764/rcia.v46i1.1907

RESEARCH NOTE

## Arthropods of forestry and medical-veterinary importance in the Limarí basin (Coquimbo region, Chile)

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### Abstract

**J. Pizarro-Araya, F.M. Alfaro, R.A. Muñoz-Rivera, J.E. Barriga-Tuñón, and L. Letelier. 2019. Arthropods of forestry and medical-veterinary importance in the Limarí basin (Coquimbo region, Chile). Cien. Inv. Agr. 46(1): 40-49.** The Limarí River valley, located in the Coquimbo Region of Chile, is an important area for agricultural production that pertains to the transverse valleys ecoregion, known as Norte Chico. In recent decades, the continuous expansion of agriculture towards the dryland areas has favored the introduction and establishment of potential pests, such as arthropods, that may affect forestry crops and transmit zoonotic diseases. We analyzed the arthropod assemblages that were of forestry and medical-veterinary importance in the Limarí basin. After reviewing historical data, specimen collections, and the available literature, a total of 10 families, 39 genera, and 51 species of arthropods of forestry importance were recorded, 43.1% of which were of quarantine importance. Xylophagous groups of quarantine importance to the US included *Cryptotermes brevis* (Kalotermitidae), *Neoterius mystax* (Bostrichidae), *Tyndaris planata* (Buprestidae), *Rhyephenes humeralis* (Curculionidae) and *Phoracantha recurva* (Cerambycidae). Other quarantine insects of forestry importance recorded in the area included *Micrapate scabrata* and *Polycaon chilensis* (Bostrichidae). In addition, the groups of medical-veterinary importance were represented by 11 families, 14 genera, and 18 species, 9 of which were arachnids and 9 were insects. Among the identified arachnids, the most important genera were *Loxosceles* (Sicariidae), *Latrodectus*, *Steatoda* (Theridiidae) and *Rhipicephalus* (Ixodidae), whereas among the identified insects, the most important were *Triatoma* and *Mepraia* (Reduviidae), *Pediculus* (Pediculidae), and *Ceratophyllus* (Ceratophyllidae). We hope this study serves as a basis for the development of forest pest monitoring and control programs as well as an understanding of the potential risks posed by zoonotic agents and their implications for public health.

**Key words:** Agricultural cropland, arid zones, arthropods, Limarí Valley, Norte Chico.

## Introduction

One of the first studies to document potential pests in a valley of Chile's Norte Chico was conducted by Pizarro-Araya *et al.* (2009) in three localities of the Elqui Valley (Coquimbo Region). These authors recorded 181 arthropod species, 145 of which were insects and 36 were spiders. Among these arthropods, 36 insects and 1 mite were considered pests of agricultural importance that attack one or more host plants (e.g., *Macrosiphum*, *Rhopalosiphum*, *Myzus*, *Coccus*, *Pseudococcus*). The authors also identified species of medical importance, such as *Loxosceles*, *Latrodectus*, *Triatoma*, and *Mepraia*. In this same valley, Alfaro *et al.* (2011) examined the taxonomic composition and abundance of the assemblage of Orthoptera (Insecta), correlating spatial distributions via the NDVI (Normalized Difference Vegetation Index). This was the first attempt at identifying potential pest orthopterans (e.g., *Schistocerca cancellata*, *Conometopus sulcaticollis*, *Gryllus fulvipennis*) in this basin of the Coquimbo Region. Following the same line as these two previous studies (see Pizarro-Araya *et al.*, 2009; Alfaro *et al.*, 2011) that have examined the biological vulnerabilities of the basins of the semiarid region of Chile, the objective of this work was to examine the forestry and medical-veterinary importance of arthropods in the Limarí River basin (Coquimbo Region, Chile).

## Materials and Methods

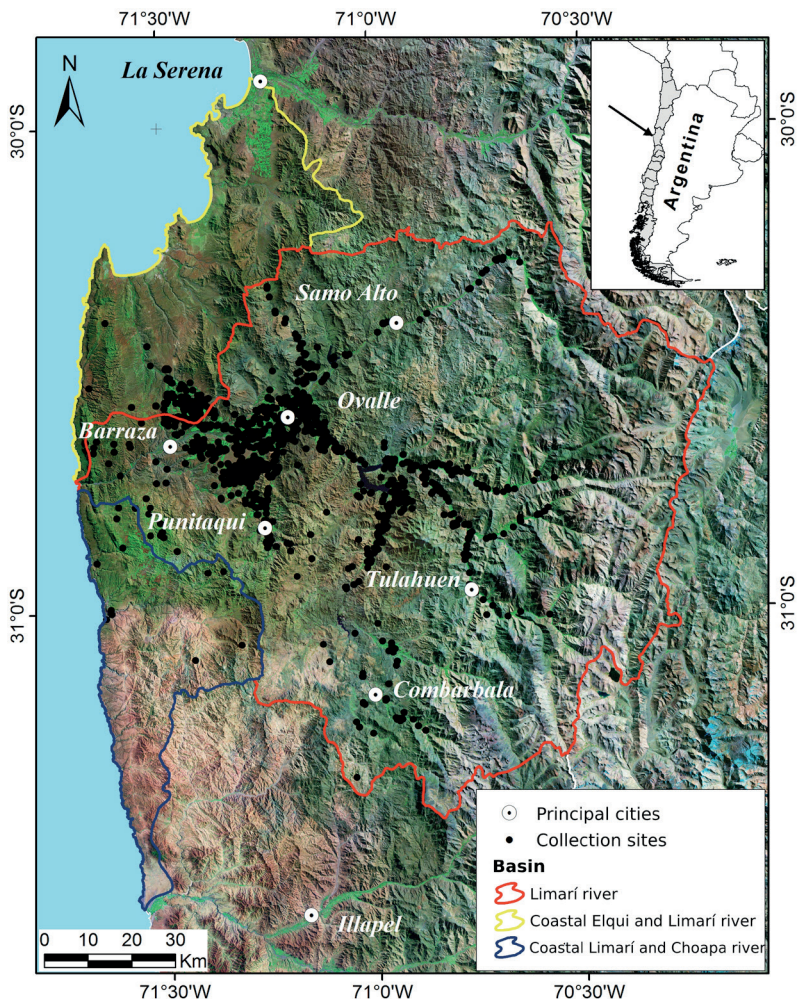
### *Study area*

The study area encompassed the three basins associated with, or influenced by, the Limarí River; they were the basin of the Limarí River itself, the coastal basin of the Elqui and Limarí rivers, and the coastal basin of the Limarí and Choapa rivers (Álvarez, 2018). The limits of these three basins were defined by the Instituto Geográfico Militar (IGM) at a 1:250,000 scale (Shapefile)(Figure 1). The predominant soil types

in the area were entisols, aridisols, and inceptisols, all of which showed some influence from the prevailing vegetation (Morales *et al.*, 2006). The climate was categorized by steppe type and ranged from steppes with abundant clouds on the coast to cold steppes in the mountains (Novoa and López, 2001). The mean annual precipitation exceeded 300 mm in the mountainous areas and reached 60-240 mm in lower sectors that were near the coast (DMC, 2001). The annual temperature was homogeneous in the coastal areas but varied in the interior valleys and mountainous areas (DMC, 2001). The vegetation in the interior areas was free from the influence of the sea and corresponded to an interior steppe scrubland (Gajardo, 1993; Squeo *et al.*, 2001).

### *Capture methods and data collection*

To identify the arthropods of forestry and medical-veterinary importance in the Limarí basin, the distributional data of arthropods of economic importance were collected by reviewing reference materials that were deposited in the following entomological collections: Juan Enrique Barriga Collection (JEBC); Laboratorio de Entomología Ecológica, Universidad de La Serena, La Serena, Chile (LEULS); and Museo Entomológico Luis Peña, Departamento de Sanidad Vegetal, Facultad de Ciencias Agronómicas, Universidad de Chile, Santiago, Chile (MEUC). Additionally, the Servicio Agrícola y Ganadero de Chile (SAG) provided data from their entomological records for Limarí Province that were obtained between 2009 and 2015. These records were complemented with distribution data that were obtained from the literature, manual collections, and net (Bioquip, Extra soft aerial bag, 38 cm net ring diameter) and UV light (166 LED light, 12 volt) captures that were conducted between June and October 2015. The captured material was cleaned, dried, and preserved in alcohol (70%) until processing and mounting. All the collected material was deposited at the Laboratorio de Entomología Ecológica of the Universidad de La Serena



**Figure 1.** Geographical location of the Limarí basin (Coquimbo Region, Chile) and spatial records of arthropods of economic importance used in this study.

(LEULS). The taxonomic identification of the arthropods followed the guidelines of associated, specialized literature.

## Results and Discussion

### *Arthropods of forestry importance in the Limarí basin*

The records analyzed during this study included a total of 10 families, 39 genera, and 51 species of arthropods of forestry importance, 43.1% of which were of quarantine importance. The xylophagous coleopterans of quarantine importance

to the US that were recorded in the Limarí basin included the genera *Bilyaxia* spp. (Buprestidae), *Mordella* spp. (Mordellidae), and *Neoterмес* spp. (Kalotermitidae). The xylophagous species of quarantine importance to the Limarí basin included *Lyctus chilensis* Gerberg and *Neoterius mystax* (Blanchard) (Bostrichidae), *Tyndaris planata* (Laporte and Gory) (Buprestidae), and *Rhyephenes humeralis* Guérin-Ménéville (Curculionidae). We also recorded the presence of the hymenopteran *Nematus oligospilus* Foerster (Tenthredinidae) and the isopteran *Cryptotermes brevis* (Walker) (Kalotermitidae), both of quarantine importance to the US. Lastly, the recorded species in the area

included the introduced cerambycids *Phoracantha semipunctata* Fabricius and *Phoracantha recurva* Newman, xylophagous species that feed on *Eucalyptus* spp. (Table 1) with a wide distribution in the basins of semiarid Chile. At present, *P. semipunctata* is an A1 quarantine pest for Asia (Bahrain) and Canada, an A2 quarantine pest for Africa (East Africa and Southern Africa) and a target of the Inter-African Phytosanitary Council (IAPSC). On the other hand, *P. recurva* is a quarantined species in the US; however, it was deleted from the EPPO Alert List in 2006. The main purpose of the Alert List is to draw the attention of EPPO member countries to certain pests that might present a risk to them, achieving early warning (EPPO, 2019). Regarding *P. semipunctata*, Lanfranco and Dungey (2001) note that this species is a threat only in the arid and semiarid regions of Chile, where *Eucalyptus* spp. are subject to high water stress. The main eucalyptus species that are used as a host plant by *P. semipunctata* include *E. globulus*, *E. camaldulensis*, and *E. delegatensis*, although damage has also been observed in *E. nitens*, *E. gunnii*, and *E. viminalis*. *P. semipunctata* damage is caused by galleries that are excavated by the larvae when they attack the phloem of green or recently cut wood (Paine *et al.*, 2011).

Other xylophagous coleopteran species that were widely distributed in the Limarí basin included *Dexicrates robustus* (Blanchard), *Micrapate scabrata* (Erichson) and *Polycaon chilensis* (Erichson) (Bostrichidae) (quarantine pests for United States), *Nathrius brevipennis* (Mulsant) and *Neohebestola viticollis* (Blanchard in Gay) (Cerambycidae) (quarantine pest for United States), *Calymmaderus sericeus* Pic (Ptinidae), *Oryctomorphus bimaculatus* Guérin-Méneville (Scarabaeidae) (quarantine pest for United States), and *Scolytus rugulosus* (Müller) (Scolytidae) (Table 1).

#### *Arthropods of medical-veterinary importance in the Limarí basin*

The arthropods of medical-veterinary importance are represented by both arachnids and insects and include a total of 11 families, 14 genera, and 18 species, 9 of which are arachnids and 9 are insects. Within the Arachnida, *Loxosceles laeta* (Nicolet) (Sicariidae) is the main zoonotic spider in the Limarí basin. Its distribution range encompasses agricultural ecosystems, drylands, and houses (Table 2) (Pizarro-Araya *et al.*, 2009; Alcayaga *et al.*, 2013). The condition caused by the bite of this spider, known as *loxocelism*, is an

**Table 1.** Records of insects (Insecta) of forestry importance found in the Limarí basin (Coquimbo Region, Chile): the scientific name, source, and economic importance are indicated. EEC = European Economic Community; 1 = SAG; 2 = JEBC; 3 = LEULS; 4 = MEUC.

Order	Family	Scientific name	Source	Economic importance
Coleoptera	Bostrichidae	<i>Chilenius spinicollis</i>	2	Xylophagous
		<i>Dexicrates robustus</i>	1, 2, 3	Xylophagous and polyphagous (dead wood, occasionally young plants with colihue stakes). A quarentenary species to the US.
		<i>Lyctus chilensis</i>	3	Polyphagous and xylophagous (dead wood, mainly burnt plants)
		<i>Micrapate humeralis</i>	2	Xylophagous
		<i>Micrapate scabrata</i>	1, 3	Polyphagous and xylophagous (dead or debilitated wood); affects vines and other species. A quarentenary species to the US
		<i>Neoterius mystax</i>	1	Xylophagous. A quarentenary species to the US

*Continuación Table 1...*

Order	Family	Scientific name	Source	Economic importance
		<i>Neoterius pulvinatus</i>	4	Xylophagous
		<i>Polycaon chilensis</i>	2, 3	Xylophagous. A quarentenary species to the US
		<i>Trogoxylon ingae</i>	2	Xylophagous
	Buprestidae	<i>Atacamita chiliensis</i>	2	Xylophagous of <i>Prosopis tamarugo</i> ; generalist xylophagous (dead wood)
		<i>Bilyaxia concinna</i>	1, 4	Generalist xylophagous of Rosaceae (dead wood). A quarentenary species to the US
		<i>Bilyaxia obscurata</i>	4	Xylophagous of <i>Schinus latifolius</i> and <i>Schinus polygamus</i> (dead wood). A quarentenary species to the US
		<i>Cylindrophora maulica</i>	3, 4	Generalist xylophagous of <i>Persea americana</i> and <i>Quillaja saponaria</i> (dead wood)
		<i>Ectinogonia buqueti</i>	1, 4	Generalist xylophagous of <i>Pinus radiata</i> and <i>Eucalyptus</i> spp., some <i>Prunus</i> sp. (live wood). A quarentenary species to the US
		<i>Ectinogonia minor gutierrezii</i>	2	Xylophagous. A quarentenary species to the US
		<i>Tyndaris planata</i>	1	Polyphagous and xylophagous (dead wood) of Rhamnaceae, Rosaceae, and others. A quarentenary species to the US
	Cerambycidae	<i>Achryson lineolatum</i>	2	Xylophagous
		<i>Ancylodonta tristis</i>	2	Xylophagous
		<i>Chiasmestes limae</i>	3	Generalist xylophagous of dead or dying hard woods
		<i>Emphytoecia suturaalba</i>	3	Xylophagous
		<i>Eryphus laetus</i>	1, 2, 3	Generalist xylophagous of <i>Eucalyptus</i> spp. (dead twigs and branches). A quarentenary species to the US (previously known as <i>Callideriphus laetus</i> )
		<i>Grammicosum maculicornis</i>	2	Xylophagous
		<i>Microcleptes araneus</i>	2	Xylophagous
		<i>Microcleptes variolosus</i>	2	Xylophagous. A quarentenary species to the US
		<i>Nathrius brevipennis</i>	2	Xylophagous
		<i>Neohebestola viticollis</i>	2	Xylophagous. A quarentenary species to the US
		<i>Neohebestola</i> sp.	1	Xylophagous of Malvaceae and Compositae (dead herbaceous twigs). A quarentenary species to the US
		<i>Oectropsis latifrons</i>	2	Xylophagous
		<i>Phoracantha semipunctata</i>	3	Xylophagous of <i>Eucalyptus</i> spp. (weak plants or recently dead wood). A1 quarantine pest for Asia (Bahrain), Canada and A2 quarantine pest for Africa (East Africa and Southern Africa) and Inter-African Phytosanitary Council (IAPSC)
		<i>Phoracantha recurva</i>	3	Xylophagous of <i>Eucalyptus</i> spp. (weak plants or recently dead wood). A quarentenary species to the US
		<i>Tacyba tenuis</i>	2	Xylophagous

Order	Family	Scientific name	Source	Economic importance
		<i>Tillomorpha lineoligera</i>	2	Xylophagous
		<i>Xenocompsa flavonitida</i>	2	Xylophagous
		<i>Xenocompsa semipolita</i>	2	Xylophagous
	Curculionidae	<i>Apocnemidophorus variegatus</i>	2, 4	Phytophagous and xylophagous of <i>Lithrea caustica</i> and <i>Schinus latifolius</i>
		<i>Rhyephenes humeralis</i>	1, 3	Generalist xylophagous of <i>Pinus radiata</i> and <i>Pseudotsuga menziesii</i> . A quarentenary species to the US
		<i>Scolytus rugulosus</i>	1	Xylophagous of debilitated <i>Prunus</i> sp.
		<i>Xylechinus</i> sp.	2	Xylophagous
	Mordellidae	<i>Mordella luctuosa</i>	1	Xylophagous of rotting wood. <i>Mordella</i> is a quarentenary genus to the US
		<i>Mordella</i> sp.	2	Xylophagous of rotting wood. A quarentenary species to the US
		<i>Mordellistena</i> sp. 3	2	Xylophagous of herbs
		<i>Mordellistena</i> sp. 9	2	Xylophagous of herbs
	Ptinidae	<i>Calymmaderus sericeus</i>	2	Xylophagous
		<i>Calymmaderus</i> sp.	1	Xylophagous
		<i>Stichtoptychus brevicollis</i>	2	Xylophagous
	Scarabaeidae	<i>Oryctomorphus bimaculatus</i>	3	Xylophagous of rotting wood. A quarentenary species to the US
		<i>Oryctomorphus maculicollis</i>	3	Xylophagous of <i>Puya chilensis</i> (dead stems)
Hymenoptera	Siricidae	<i>Tremex fuscicornis</i>	1	Xylophagous
Isoptera	Kalotermitidae	<i>Cryptotermes brevis</i>	3	Xylophagous. A quarentenary species to the US
		<i>Neotermes chilensis</i>	1	Xylophagous. A quarentenary species to the US
Lepidoptera	Cossidae	<i>Chilecomadia</i> sp.	1, 3	Xylophagous of numerous plants. A quarentenary species to the US

important disease in the area as a result of the high morbidity and mortality of the venom of this species, which has dermonecrotic, hemolytic, vasculitic, and coagulant effects (Parra *et al.*, 2002; Zambrano *et al.*, 2005). The LEULS has a few specimens of *Loxosceles* spp., most likely *Loxosceles coquimbo* (Gertsch) (A.D. Brescovit com. pers.), an endemic species of Elqui Province, Coquimbo Region.

Among the taxa of Sicariidae, the genus *Sicarius* Walckenaer is the most abundant and widely distrib-

uted of the spider assemblage. *Sicarius* individuals have errant habits and remain partially buried in the sand or under rocks, in places protected from the high solar radiation. Their bite is necrotic (Llinas-Gutiérrez *et al.*, 2004). The most important member of Theriidae is the black widow, *Latrodectus* sp., a zoonotic and phanerotoxic spider whose bite causes *latrodectism* (Canals *et al.*, 2004; Matteucci *et al.*, 2005). Its venom contains several neurotoxins that may cause a complex array of clinical symptoms (e.g., rapid heartbeat, high blood pressure, and priapism) or even death (Romero *et al.*, 2000; Alcayaga *et al.*,

**Table 2.** Records of insects (Insecta) of medical-veterinary importance found in the Limarí basin (Coquimbo Region, Chile): the scientific name, source, and economic importance are indicated. 1=SAG; 2=LEULS; 3=MEUC.

Class	Order	Family	Scientific name	Source	Economic importance	
Arachnida	Acari	Ixodidae	<i>Rhipicephalus sanguineus</i>	2	Babesiosis in dogs	
		Araneae	Scytodidae	<i>Scytodes globula</i>	2	Predator of <i>Loxosceles</i> sp.
		Sicariidae		<i>Loxosceles laeta</i>	2	Loxoscelism; predator of <i>Scytodes</i> spp.
				<i>Loxosceles</i> sp.	2	Loxoscelism; predator of <i>Scytodes</i> spp.
				<i>Sicarius</i> sp.	2	Predator of insects and spiders
				Theridiidae	<i>Latrodectus</i> sp.	2
				<i>Steatoda grossa</i>	2	Steatodism
				<i>Steatoda porteri</i>	2	Steatodism
				<i>Steatoda nobilis</i>	2	Steatodism
	Insecta	Blattodea	Blattidae	<i>Blatta orientalis</i>	2	Parasite and disease vector
		Hemiptera	Reduviidae	<i>Mepraia spinolai</i>	2	American trypanosomiasis
<i>Triatoma infestans</i>				3	American trypanosomiasis	
Diptera		Drosophilidae	<i>Drosophila melanogaster</i>	1	Polyphagous and phytophagous; Vector of pathogenic bacteria	
			<i>Drosophila</i> sp.	1	Polyphagous and phytophagous; Vector of pathogenic bacteria	
			Muscidae	<i>Musca domestica</i>	1	Vector of diseases
Hymenoptera		Formicidae	<i>Dorymyrmex</i> sp.	1	Potential vector of diseases	
Siphonaptera		Ceratophyllidae	<i>Ceratophyllus gallinae</i>	2	Ectoparasite of <i>Gallus gallus domesticus</i>	
Phthiraptera		Pediculidae	<i>Pediculus humanus</i>	2	Head lice infestations	

2013). We also recorded false black widows, spiders belonging to the genus *Steatoda* Sundevall, whose bite causes steatodism, a zoonosis characterized by mild to severe regional pain, nausea, headache, general discomfort, and lethargy (Faúndez and Téllez, 2016). We also recorded *Steatoda grossa* (C. L. Koch), *S. porteri* (Simon), and *S. nobilis* (Thorell) in the Limarí basin, with *S. nobilis* being the first record of this species in the Coquimbo Region (Table 2).

The order Acari, represented by the brown dog tick *Rhipicephalus sanguineus* (Latreille) (Ixodidae), was recorded along the entire Limarí basin. Tick specimens were collected from dogs (*Canis familiaris* Linnaeus) and were associated with

dryland areas, although adult specimens have also been collected from goats (*Capra hircus* Linnaeus) (González-Acuña *et al.*, 2006). This species is univoltine and is active during the spring-summer. Diapause typically occurs during the adult stage and, secondarily, during the nymphal stage (Table 2).

Regarding Insecta, the presence of *Triatoma infestans* (Klug) and *Mepraia spinolai* (Porter) (Hemiptera: Reduviidae) in dryland areas of the Limarí basin suggests the existence of foci of American trypanosomiasis (Chagas disease). This disease poses a risk to the human population and is one of the more prevalent zoonotic diseases in the Norte Chico of Chile (Frias *et al.*, 1998; Ortiz

*et al.*, 2016). In this respect, Chacón *et al.* (2016) indicated that the most frequent feeding source used by *Trypanosoma cruzi* was *Phyllotis darwini* (Waterhouse), followed by *Octodon degus* (Molina), *Oryctolagus cuniculus* (Linnaeus), *Mus musculus* Linnaeus, *Gallus gallus* Linnaeus, *Thylamys elegans* Waterhouse, *Canis familiaris* Linnaeus, *Felis catus* Linnaeus and *Capra hircus* Linnaeus. All these taxa are distributed along the entire Limarí basin.

Another insect of medical-veterinary importance recorded in the study area was *Pediculus humanus* Haeckel (Phthiraptera: Pediculidae), an ectoparasite of humans that causes head lice infestation (Rosso *et al.*, 2003). Finally, *Ceratophyllus gallinae* (Schrank) (Siphonaptera: Ceratophyllidae) was recorded from poultry (*Gallus gallus domesticus* Linnaeus) (Table 2).

The main conclusions are the following. The richness of arthropods of forestry and medical-veterinary importance in the Limarí basin included mainly insects. The elements that were of forestry importance included insect species that were widely distributed in forests with native and introduced tree species and consisted of xylophagous generalist species that attack both live and dead wood. These species are a direct threat to local crops of introduced tree species, such as *Eucalyptus* spp., as well as the houses present in the study area. Some elements of

medical-veterinary importance included spider species that are widely distributed in the country, such as those of the genera *Loxosceles*, *Latrodectus*, *Sicarius*, and *Steatoda*, all of which can cause necrotic and complex clinical symptoms in humans as a result of the neurotoxins contained in the venom. *Triatoma infestans* (Klug) and *Mepraia spinolai* (Porter) represent a threat to public health because they are potential foci of American trypanosomiasis whose reservoirs can be both the native and introduced species that are widely distributed in this basin. We hope that this information may be useful to characterize the biological vulnerabilities of the Limarí basin, particularly for the highly diverse, widely distributed taxa with potential implications for forestry and public health.

### Acknowledgments

Our acknowledgments to Adiel R. Cayo (Servicio Agrícola y Ganadero, División de Protección Agrícola y Forestal) for allowing us access to data from SAG. Also, to Mario Elgueta (MNNC) and Danilo Cepeda (MEUC) for providing facilities to examine the collections, and two reviewers for suggestions for improving this paper. This study was funded by the DIDULS PR17121/VACDDI001 projects of Universidad de La Serena, La Serena, Chile (JPA).

### Resumen

**J. Pizarro-Araya, F.M. Alfaro, R. A. Muñoz-Rivera, J.E. Barriga-Tuñón, y L. Letelier. 2019. Artrópodos de importancia forestal y médico-veterinaria en la cuenca del Limarí (Región de Coquimbo, Chile). Cien. Inv. Agr. 46(1): 40-49.** El valle del Río Limarí, en la Región de Coquimbo, es un importante foco de producción agrícola en los valles transversales del Norte Chico. En las últimas décadas, la constante expansión de los cultivos agrícolas hacia zonas de secano ha permitido la introducción y establecimiento de potenciales plagas, como los artrópodos, que pueden afectar las producciones forestales y constituir elementos zoonóticos. Se analizó la importancia forestal y médico-veterinaria de los artrópodos de la cuenca del Limarí. Mediante la revisión de bases de datos históricas, colecciones y literatura disponible, se registró un total de 10 familias, 39 géneros y 51 especies de artrópodos de importancia forestal, de las cuales el 43,1% fueron de importancia cuarentenaria. Entre los elementos xilófagos de importancia cuarentenaria para EE.UU. destacaron los registros de *Cryptotermes brevis* (Kalotermitidae), *Neoterius mystax* (Bostrichidae), *Tyndaris planata* (Buprestidae), *Rhyphenes*



*humeralis* (Curculionidae) and *Phoracantha recurva* (Cerambycidae). Otros insectos de importancia forestal reportados fueron *Micrapate scabrata* y *Polycaon chilensis* (Bostrichidae). Por su parte, los elementos de importancia médico-veterinario estuvieron representados por 11 familias, 14 géneros y 18 especies, de las cuales 9 especies correspondieron a arácnidos y 9 a insectos. Dentro de los arácnidos destacaron los géneros *Loxosceles* (Sicariidae), *Latrodectus*, *Steatoda* (Theridiidae) and *Rhipicephalus* (Ixodidae), mientras que dentro de los insectos las más importantes fueron *Triatoma* y *Mepraia* (Reduviidae), *Pediculus* (Pediculidae), y *Ceratophyllus* (Ceratophyllidae). Se espera que la información del presente estudio sirva de base para desarrollar programas de monitoreo y control de potenciales plagas forestales, así como también entender los potenciales riesgos de elementos zoonóticos con implicancias para la salud pública.

**Palabras clave:** Artrópodos, cultivos agrícolas, Norte Chico, Valle del Limarí, zonas áridas.

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