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**A revision of the Chilean tribe Lichniini Burmeister, 1844  
(Coleoptera: Scarabaeidae: Melolonthinae)**

SHAUNA JOY HAWKINS



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## A revision of the Chilean tribe Lichniini Burmeister, 1844 (Coleoptera: Scarabaeidae: Melolonthinae)

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### Table of contents

Abstract .....	4
Introduction .....	5
Materials and methods .....	6
Natural history .....	9
Taxonomic history .....	11
Classification status .....	13
Tribe Lichniini Burmeister, 1844 .....	15
Checklist of the Lichniini (Scarabaeidae: Melolonthinae) .....	16
Key to genera and species of Lichniini .....	17
Genus <i>Lichnia</i> Erichson, 1835 .....	17
<i>Lichnia gallardoii</i> Gutiérrez, 1943 .....	22
<i>Lichnia limbata</i> Erichson, 1835 .....	26
Genus <i>Arctodium</i> Burmeister, 1844 .....	31
<i>Arctodium discolor</i> (Erichson, 1835) .....	34
<i>Arctodium mahdii</i> Hawkins, new species .....	37
<i>Arctodium planum</i> (Blanchard, 1850) .....	46
<i>Arctodium vulpinum</i> (Erichson, 1835) .....	51
Acknowledgments .....	60
Literature cited .....	60

## Abstract

The tribe Lichniini (Coleoptera: Scarabaeidae: Melolonthinae), which includes two genera and six species, is revised. A key to species, descriptions of genera and species, a checklist, distributional and temporal data, and designation of lectotypes and neotypes are given. The genus *Lichnia* Erichson, 1835 includes two species: *L. gallardoi* Gutiérrez, 1941 and *L. limbata* Erichson, 1835 (lectotype designated). The genus *Arctodidium* Burmeister, 1844 includes four species: *A. discolor* (Erichson, 1835) (neotype designated), *A. mahdii* **new species**, *A. planum* (Blanchard, 1850) (lectotype designated), and *A. vulpinum* (Erichson, 1835) (lectotype designated). The following nomenclatural changes are made: Lichniini is transferred from Glaphyridae to Melolonthinae (Scarabaeoidea: Scarabaeidae) and the spelling is emended from "Lichnini" to "Lichniini"; *Dasychaeta* Erichson, 1847 is a new junior synonym of *Lichnia*; *Dasychaeta lateralis* Erichson, 1847 (neotype designated) is a new junior synonym of *L. limbata*; *Lichnia porteri* Gutiérrez, 1941 (neotype designated) is a new junior synonym of *L. gallardoi*; *Cratoscelis aterrима* Blanchard, 1850 (lectotype designated) is a new junior synonym of *A. vulpinum*; *Cratoscelis canicapilla* Philippi & Philippi, 1864 (lectotype designated) is a new junior synonym of *A. planum*; *Cratoscelis gayana* Blanchard, 1850 (lectotype designated) is a new junior synonym of *A. vulpinum*; *Cratoscelis striolata* Redtenbacher, 1868 (lectotype designated) is a new junior synonym of *A. vulpinum*; *Cratoscelis villosa* Blanchard, 1850 (lectotype designated) is a new junior synonym of *A. vulpinum*; and *Cratoscelis* Erichson, 1835 is a junior homonym of *Cratoscelis* Lucas, 1834 (Araneae: Sicariidae) and a synonym of *Arctodidium* Burmeister, 1844.

## Resumen

La tribu Lichniini que incluye dos géneros y seis especies es revisada, se incluye una clave para las especies, descripciones de los géneros y especies, una lista taxonómica, datos de distribución y temporales y se designan lectotipos y neotipos. El género *Lichnia* Erichson, 1835 incluye dos especies: *L. gallardoi* Gutiérrez, 1941 y *L. limbata* Erichson, 1835 (lectotipo designado). El género *Arctodidium* Burmeister, 1844 incluye cuatro especies: *A. discolor* (Erichson, 1835) (neotipo designado), *A. mahdii* **especie nueva**, *A. planum* (Blanchard, 1850) (lectotipo designado), y *A. vulpinum* (Erichson, 1835) (lectotipo designado). Se realizaron los siguientes cambios nomenclaturales: Lichniini es transferida de Glaphyridae a Melolonthinae (Scarabaeoidea: Scarabaeidae) y el nombre "Lichnini" es corregido y se escribe "Lichniini"; *Dasychaeta* Erichson, 1847 es un sinónimo junior de *Lichnia*; *Dasychaeta lateralis* Erichson, 1847 (neotipo designado) es un sinónimo junior de *L. limbata*; *Lichnia porteri* Gutiérrez, 1941 (neotipo designado) es un sinónimo junior de *L. gallardoi*; *Cratoscelis aterrима* Blanchard, 1850 (lectotipo designado) es un sinónimo junior de *A. vulpinum*; *Cratoscelis canicapilla* Philippi & Philippi, 1864 (lectotipo designado) es un sinónimo junior de *A. planum*; *Cratoscelis gayana* Blanchard, 1850 (lectotipo designado) es un sinónimo junior de *A. vulpinum*; *Cratoscelis striolata* Redtenbacher, 1868 (lectotipo designado) es un sinónimo junior de *A. vulpinum*; *Cratoscelis villosa* Blanchard, 1850 (lectotipo designado) es un sinónimo junior de *A. vulpinum*; y *Cratoscelis* Erichson, 1835 es un homónimo junior de *Cratoscelis* Lucas, 1834 (Araneae: Sicariidae) y un sinónimo de *Arctodidium* Burmeister, 1844.

**Key words:** scarab beetle, identification, taxonomy, Lichniini, Chile, *Arctodidium*, *Lichnia*, *Dasychaeta*

## Introduction

The tribe Lichniini (Coleoptera: Scarabaeoidea: Scarabaeidae: Melolonthinae) includes two genera and six species whose adults visit flowers in sandy areas of central Chile. The tribe is characterized by a hairy appearance, strongly deflexed head, elongated galeae (Figs. 5a–b, 7a–b), and short elytra that expose the pygidium. They range in length from 4.0–12.5 mm.

Since their description, species in the tribe Lichniini have been classified in the family Glaphyridae that was, until now, thought to be an amphitropical taxon (Carlson 2002). Chapin (1938) separated the Glaphyridae into two tribes: the Lichnini, consisting of species from central Chile, and the Glaphyrini, which is widely distributed in the Holarctic and consists of five genera and about 70 species. The placement of the Glaphyridae within the Scarabaeoidea has been controversial. For example, the monophyly of the Chilean taxa together with the Holarctic taxa has been questioned by some authors (Machatschke 1959, Ritcher 1969) yet they continued to place them together.

As a group, the Chilean bumblebee scarabs are poorly known taxonomically. Authors that most contributed to our understanding of the Lichniini were Wilhelm F. Erichson (1835) and Émile Blanchard (1850). Following the contributions of these two authors, the species of Lichniini were mentioned in numerous checklists (Harold 1869, Philippi 1887, Germain 1911, Arrow 1912, Blackwelder 1944), but no overall synopsis has been done and there is no key to the species.

In the early to mid-1800s, much of southern South America was not easily accessible. The early authors of species of Lichniini based their descriptions on the few specimens they had on hand in European museums. In recent years, southern South America has become more accessible, and more collecting has been done. Specimens in this tribe have long remained unidentified or misidentified because of the lack of a comprehensive revision.

Morphological knowledge is vital to addressing placement of the tribe Lichniini in relation to other species of Glaphyridae and within the Scarabaeoidea. Proper delineation of species will allow studies of the ecological role of Chilean bumblebee scarabs in pollination and of character evolution, such as convergent evolution of bee mimicry in flower-visiting insects. Central Chile is a global hotspot for endemism and biodiversity (Wilson 1992), and the tribe Lichniini exemplifies this. Proper analyses of the Chilean species will contribute to the understanding of southern hemisphere faunal patterns and give insight about the geological past of southern South America. The tribe Lichniini is revised here and includes a key, catalog, descriptions, and distribution maps. It also includes one new species, six new synonymies, as well as lectotype designations for eight species, and neotype designations for three species.

**Materials and methods***Specimens examined*

A total of 2,266 specimens were examined during this revision. Specimens were obtained from or deposited in 27 institutions and private collections worldwide as listed below. Acronyms for the loaning institutions follow the format of Evenhuis & Samuelson (2005). In cases of private collections for which no acronym exists, initials of the collector were used to create an acronym.

- ABTS Andrew B. T. Smith Collection, Ottawa, Canada (Andrew B. T. Smith).  
AMNH American Museum of Natural History, New York, NY, U.S.A. (Lee Herman).  
BMNH The Natural History Museum, London, England (Malcolm Kerley).  
CASC California Academy of Sciences, San Francisco, CA, U.S.A. (Roberta Brett).  
CMNC Canadian Museum of Nature, Ottawa, Canada (François Génier).  
CNCI Canadian National Collection of Insects, Ottawa, Canada (Anthony Davies, Serge Laplante).  
EMUS Utah State University, Logan, UT, U.S.A. (Colin Brammer).  
FSCA Florida State Collection of Arthropods, Gainesville, FL, U.S.A. (Mike Thomas, Paul Skelley).  
FMNH Field Museum of Natural History, Chicago, IL, U.S.A. (Al Newton).  
HAHC Henry and Anne Howden Collection, Ottawa, Canada (Henry Howden).  
INHS Illinois Natural History Survey, Champaign, IL, U.S.A. (Colin Favret).  
JEBC Juan Enrique Barriga Collection, Cautin, Chile (Juan Barriga).  
JMEC José Mondaca E. Collection, Santiago, Chile (José Mondaca).  
KSUC Kansas State University Collection, Manhattan, KS, U.S.A. (Ralph Charlton).  
LACM Museum of Natural History of Los Angeles County, CA, U.S.A. (Brian Brown).  
LEMQ Lyman Entomological Museum, McGill University, Ste-Anne-de-Bellevue, Canada (Stéphanie Boucher, Terry Wheeler).  
MCZC Museum of Comparative Zoology, Harvard University, Cambridge, MA, U.S.A. (Philip Perkins).  
MNHN Muséum National d'Histoire Naturelle, Paris, France (Thierry Deuve).  
MNNC Museo Nacional de Historia Natural, Santiago, Chile (Mario Elgueta).  
NMWH Naturhistorisches Museum Wien, Vienna, Austria (Heinrich Schnmann).  
TAMU Texas A & M University, College Station, TX, U.S.A. (Ed Riley).  
UCCS Museo de Zoología, Universidad de Concepción, Concepción, Chile (Jorge N. Artigas, Viviane Jerez).  
UMRM Wilbur R. Enns Entomology Museum, University of Missouri, Columbia, MO, U.S.A. (Robert Sites).  
UNSM University of Nebraska State Museum, Lincoln, NE, U.S.A. (Federico Ocampo).  
USNM United States National Museum of Natural History, Washington, D.C., U.S.A.

- (Housed at UNSM, Federico Ocampo).
- VMDC V. Manuel Diéguez Collection Santiago, Chile (Manuel Diéguez).
- ZMHB Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (Joachim Willers, Johannes Frisch).
- ZSMC Zoologische Staatssammlung München, Munich, Germany (Martin Baehr).

### *Species concept*

The Phylogenetic Species Concept outlined by Wheeler & Platnick (2000) is used to delineate species in this work. According to this concept, a species is “the smallest aggregation of sexual populations or asexual lineages diagnosable by a unique combination of character states.” Intraspecific variation occurs in any taxonomic group, but combinations of characters that are consistently expressed form the basis for robust species hypotheses.

### *Database*

A specimen-level database was created for all specimens examined in this study. It can be accessed at the University of Nebraska State Museum website ([www.museum.unl.edu/research/entomology/db/scarabdb.htm](http://www.museum.unl.edu/research/entomology/db/scarabdb.htm)). Each specimen has a unique voucher number that corresponds to specimen numbers in the database. The number can be found on the determination labels for each specimen.

### *Type specimens*

In this work, lectotypes are designated to preserve the stability of names by selecting one specimen as the name-bearing type of the taxon when the original author did not do so. Lectotype specimens are designated for the following taxa: *Cratoscelis canicapilla* Philippi & Philippi, *C. gayana* Blanchard, *C. plana* Blanchard, *C. striolata* Redtenbacher, *C. villosa* Blanchard, *C. vulpina* Erichson, *Lichnia immarginata* Blanchard, and *L. limbata* Erichson. Depository institutions and descriptions of labels are included in the descriptions of each species.

In some cases, original type specimens for Lichniini are missing. Neotypes were designated to link published names to actual specimens in accordance with the International Code of Zoological Nomenclature (75.3) (International Commission on Zoological Nomenclature 1999). Specimens were chosen that matched the original descriptions as much as possible, were in good condition, or (when possible) were determined by the original author. The institution where the specimen is deposited, as well as a label description and data associated with the specimen, are noted under the description for each species. Neotypes were designated for *Lichnia porteri* Gutiérrez, *Cratoscelis discolor* Erichson, and *Dasychaeta lateralis* Erichson.

Labels on type specimens are white and rectangular with black ink unless stated otherwise. Slashes are used to denote line breaks on labels.

*Dissections*

Mouthparts, hind wings, and genitalia were dissected from exemplar specimens after immersing them in hot water for several minutes to soften them. The mentum, maxilla, mandible, and labrum were extracted using forceps and insect pins and card-mounted with water-soluble glue and pinned beneath the specimen. The left hindwing was dissected, card-mounted separately, and placed beneath the specimen. To examine the parameres, male genitalia were extracted through the genital opening with an insect pin. Parameres of *Lichniini* are covered with a membranous sac that needed to be removed with forceps and insect pins to allow examination. The parameres were then glued to the end of a point with white glue and placed beneath the specimen.

*Locality data*

Locality data are given for each species of *Lichniini*. At the time of publication Chile is divided into 13 political regions that are designated by a name and a Roman numeral assigned from north to south (a Chilean convention). The capital city of Santiago and its surroundings is simply called the "Region Metropolitana de Santiago." While these divisions are purely political, they are used for convenience to show the distribution of species of *Lichniini*. After each region subheading, the label localities are listed in alphabetical order. The number of specimens follows each region and locality in parentheses.

*Character examination*

Morphological characters form the basis of this work. Because larvae of *Lichniini* are not known, descriptions are based on adult specimens only. Species descriptions are based on characters of the mouthparts, head, pronotum, elytra, pygidium, legs, and parameres. Specimens were examined using a dissecting microscope (6.3 to 40.0 X) and fiber optic lights. The following standards were used for generic and species descriptions.

*Measurements:* Minimum and maximum measurement for length and width are given for each species. To avoid irregularities caused by the strongly deflexed head in most *Lichniini*, length measurements were taken from the anterior margin of the prothorax to the apex of the pygidium. Elytral width and length measurements were taken from the widest and longest regions of the elytra. Measurements were taken using an ocular micrometer.

*Color:* Colors are based on dried, pinned specimens. Specimens may change color after death, due to age or killing agent used. Color refers to that of magnified specimens under light. Color names were used that should be easily understood by the entomological community. Because the color tan could be subject to individual interpretation, I define it here as the equivalent of sayal brown in Ridgway (1912).

*Punctures:* Punctures are considered *sparse* if separated by five or more puncture diameters, *moderately dense* if separated from one another by about three puncture



diameters, and *dense* if confluent or separated by less than two puncture diameters. Punctures are considered *small* if the diameter is less than 0.001 mm; *moderately large* if the diameter is from 0.001 to 0.080 mm, and *large* if the diameter is larger than 0.080 mm. An ocular micrometer was used to measure puncture size.

*Setae*: Setae are considered *dense* if they completely cover and obscure the body surface, *moderate* if they completely cover the body but the surface is visible, and *sparse* if they do not cover the body surface and the surface is clearly visible. Setae are considered *short* if they are less than 0.2 mm in length, *moderately long* if between 0.2 mm and 0.4 mm, and *long* if greater than 0.4 mm. An ocular micrometer was used to measure length.

*Spines and spurs*: Because spine and spur length are compared in some species (Figs. 8a–d), it is necessary to differentiate between the two. A spine is a “more or less thornlike process or outgrowth of the cuticula not separated from it by a joint,” whereas a spur is a “thick cuticular appendage or spine connected to the body wall by a joint, generally on the tibia” (Nichols 1989).

### Natural history

Species of Lichniini are found on blooms of flowers in central Chile from Region IV (Coquimbo) to Region IX (La Araucania). The distribution of Lichniini is localized due to barriers to dispersal on all sides of central Chile: the Atacama Desert to the north, the Pacific Ocean to the west, the Andes Mountains to the east, and a glacial climate to the south. Despite its small area, central Chile has provided an isolated habitat for the evolution of a large number of species of endemic flora and fauna and is considered to be a global biodiversity hotspot (Wilson 1992). Historically, central Chile is thought to have been a refugium during three or four Quaternary glacial periods where speciation events occurred due to glacial tongues that may have acted as isolating barriers (Heusser 1966, Vuilleumier 1971). Because there are few character differences from one species of Lichniini to the next, I hypothesize that speciation events separating the groups may be recent.

The larvae of Lichniini are unknown. However, adaptations for digging in adult females suggest that eggs are likely laid in the soil. The foretibiae of female Lichniini are expanded and fossorial, whereas those of males are slender and do not appear to have adaptations for digging. This sexually dimorphic character is particularly pronounced in the genus *Lichnia* (Figs. 3a–b).

Males of most species of Lichniini have an elongate, inner, distal spine on each metatibia (Figs. 8a–d). I observed males using these spines like hooks to immobilize the female during mating by pinning down her hindlegs. I observed matings taking place on flowers at mid-afternoon on a hot, sunny day.

Species of Lichniini species appear to be generalist pollinators, and none are reported as agricultural or horticultural pests. Label data and personal observations aided by plant identifications at the Museo Nacional de Historia Natural in Santiago, Chile indicate that

specimens of Lichniini are collected on a variety of flowers, including cactus flowers (Cactaceae: *Echinopsis chiloensis* Friedrich and Rowley), baccharis (Asteraceae: *Baccharis* sp.), alfalfa (Fabaceae: *Medicago sativa* L.), soapbark tree (Rosaceae: *Quillaja saponaria* Molina), slipper flower (Scrophulariaceae: *Calceolaria thyrsoflora* Graham), mock heather (Asteraceae: *Happlopappus* sp.), St. Martin's flower (Alstroemeriaceae: *Alstroemeria ligtu simsii* (Sprengel)), St. John's wort (Clusiaceae: *Hypericum perforatum* L.), roses (Roseaceae: *Rosa* sp.), and hairy catsear (Asteraceae: *Hypochaeris radiacata* L.). Because there is no trend in evolutionary relatedness of these hosts, or in flower shape, size, or color, I conclude that Lichniini likely feed on whatever flowers are available to them, switching to different flowers as they go in and out of bloom.

More northern species, such as *Lichnia gallardoi* (Fig. 10), are collected earliest in the season, mostly in October, because the northern climate becomes hotter and flowers bloom earlier. In species from more southern localities, such as *Arctodium discolor* (Fig. 11), more specimens are collected later in the season, with many individuals still active through February. This difference in flower blooming seasons from north to south may have served as a temporal barrier resulting in speciation over time.

Species of Lichniini are well-adapted for flower feeding and pollination. All species of Lichniini are almost entirely covered with setae on all parts of the body that aid in transfer of pollen. The setose, elongated galeae, or outer lobes of the maxillae, are also characteristic of all species of Lichniini. The galeae are particularly elongated in the genus *Lichnia*, reaching 1/3 to 3/4 the body length of the insect (Fig. 7b). These long, thin galeae are easily inserted deep into flowers, and the setae (Figs. 5a–b) that run along the shaft of the galea trap pollen and/or nectar. Curtis (1845) likened these structures to the proboscis of moths, but Lichniini galeae do not coil up when at rest but are held extended underneath the body. The labium has a groove that receives the galea, with setae directed inwards that act like a brush to remove the pollen for consumption.

While most specimens of Lichniini are collected with sweepnets on flowers, some collectors have found Lichniini in great numbers in yellow pan traps and in malaise traps (Mike Irwin, University of Illinois at Urbana-Champaign, personal communication, Sept. 2004). I collected *Arctodium vulpinum* (Erichson) from deep inside large cactus flowers (*Echinopsis chiloensis* Friedrich and Rowley) on the dry, sandy slopes of Cajon del Maipo, Region Metropolitana de Santiago, Chile (Fig. 13a–d). Beetles were consistently found in flowers that had not yet fully opened but had opened enough to allow the beetles to gain entry. In flowers that had opened more fully, no beetles were found. I also found specimens by knocking flowers off the cacti with the end of a sweep net and opening the flowers by hand. No specimens of Lichniini are collected in association with any other organic materials other than flowers, and they are not attracted to lights.

While the ratio of males to females collected in *Lichnia limbata*, *L. gallardoi*, and *Arctodium vulpinum* is approximately 1:1, in *A. discolor*, *A. planum*, and *A. mahdii*, no or few females have been collected. It is unknown why females of these species are less frequent in collections.

## Taxonomic history

The first mention of a taxon belonging to the tribe Lichniini was by Pierre F. M. A. Dejean (1780–1845), a French army general and one of the most well-known coleopterists of the early 19<sup>th</sup> century. Beginning in 1802, Dejean published a series of catalogs listing species in his extensive collection. In the 1833 version of his “*Catalogue des Coléoptères de la Collection de M. le Comte Dejean*,” Dejean lists the generic name *Arctodium* with *A. villosum* Dejean as the only species. He lists this same taxon again in the 1836 version of his catalog. However, in neither case did Dejean give a description, definition, or indication of *Arctodium* or *Arctodium villosum*, and therefore, both names are *nomina nuda* according to Article 12 of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999).

In 1835, Wilhelm Ferdinand Erichson (1808–1849), a medical doctor and a curator at the Museum für Naturkunde in Berlin, published the first descriptions of species of Lichniini: *Lichnia limbata*, *Cratoscelis discolor*, and *Cratoscelis vulpina*. Erichson deposited his types at ZMHB. Erichson placed these taxa in the family Glaphyridae MacLeay, 1819 (Scarabaeoidea), a group of colorful, hairy beetles that visit flowers and mimic bees. Unfortunately, Erichson was not aware that just one year earlier, in 1834, the genus name *Cratoscelis* was used by a French arachnologist, Hippolyte Lucas (1815–1899), in connection with a plate of figures of the spiders *Cratoscelis rufipes* and *Cratoscelis nigripes* (Araneae: Sicariidae). *Cratoscelis* is therefore an invalid name. Despite this fact, most subsequent authors have treated *Cratoscelis* Erichson, 1835 as a valid name.

Erichson’s new names were listed by Laporte (1840), Burmeister (1844), Blanchard (1845), and Curtis (1845) in their catalogs. The most notable of these is Hermann Burmeister (1807–1892) because he stated (1844) that the specimens to which Dejean assigned the genus name *Arctodium* were of the same genus as those called *Cratoscelis* by Erichson. Because Burmeister provides a description for *Arctodium*, and because *Cratoscelis* Erichson, 1835 is a junior homonym to *Cratoscelis* Lucas, 1834, *Arctodium* Burmeister becomes the valid name for the genus under Article 11.6.1 of the Code (International Commission on Zoological Nomenclature 1999). Burmeister also indicated that the invalid name *Arctodium villosum* Dejean was a name intended for the same species called *Cratoscelis vulpina* by Erichson.

In 1847, Erichson described a new species from Peru that he called *Dasychaeta lateralis*. However, in his “Fauna of Peru” Erichson (1847) described a number of new Peruvian beetle species that were actually from central Chile (Jameson & Smith 2002, Smith 2003). This was a common error at that time because of recent changes in political borders and regional name changes. Since no other specimens of Lichniini have been collected in Peru since Erichson’s account, *D. lateralis* is likely one of the species that was erroneously labeled.

Claude Gay (1800–1873) was a French professor and explorer of Chile from the 1820s–1840s. In his many voyages to Chile he studied the flora, fauna, geography, and geology of Chile. His collections were the beginning of the Museum of Natural History of Chile. He also collected series of Lichniini that he brought back to France and deposited in the MNHN. French entomologist and curator of the MNHN at that time, Émile Blanchard (1819–1900), described four new species of Lichniini in 1850 based on Gay's specimens: *Lichnia immarginata*, *Cratoscelis plana*, *Cratoscelis aterrима*, and *Cratoscelis gayana*. Blanchard's type specimens are still housed at the MNHN. Most are badly damaged or in fragile condition and are not labeled, except for a small green circular label with a number on the underside corresponding to an entry in a large accession book which is still available and kept on a wooden stand in the corridor of the third floor of the MNHN. But even after viewing the accession records, little more than the locality "Chili" could be ascertained for most specimens, and, therefore, little collecting data is available for Blanchard's type series.

In trying to solve a nomenclatural problem, Blanchard (1850) created another one. Blanchard noted that Dejean's species, *Arctodium villosum*, was without description and he tried to describe it to validate the name. He described it as *Cratoscelis villosa* because *Cratoscelis* was erroneously the genus name in use at the time. However, Blanchard neglected the fact that Burmeister (1844) had already synonymized *Arctodium villosum* Dejean with *Cratoscelis vulpina* Erichson, and, therefore, *Cratoscelis villosa* Blanchard is an unavailable name.

Other contributions to the Lichniini include Redtenbacher's (1868) new species, *Cratoscelis striolata* (type deposited at NHMW), and Philippi & Philippi's (1864) new species, *Cratoscelis canicapilla* (type deposited at MNNC). I have chosen to cite the author of *C. canicapilla* as Philippi & Philippi. Other authors (Harold 1869, Arrow 1912, Blackwelder 1944) cite only Philippi as the author of *C. canicapilla*. However it is unclear if this is referring to the son, Friedrich Heinrich Eunom (Federico) Philippi (1838–1910) or the father, Rudolph Amandus (Rudolfo Amando) Philippi (1808–1904). Although the name in the original description does have a "Ph." after it, there is no evidence that this indicates a description by just one or the other Philippi (Schell 2005). It is true that in other papers (Philippi 1859) "Ph." was used for R.A. Philippi and "F. Ph." was used for F.H.E. Philippi, but this was not consistently used through the years. There is also evidence that F.H.E. Philippi actually wrote the descriptions based on material identified as new species by his father, R.A. Philippi. Due to this uncertainty, I cite both authors for *C. canicapilla*.

Other checklists and catalogs listing the Lichniini include those by Solier (1851), Lacordaire (1856), Harold (1869), Germain (1911), Arrow (1912), and Blackwelder (1944). Harold (1869) stated that *Lichnia immarginata* Blanchard, 1850 was a synonym of *L. limbata* Erichson, 1835. I observed Blanchard's collection and noted that he likely based *L. immarginata* on females of *L. limbata*. Germain (1911) listed two new species in his catalog (*Cratoscelis obscura* and *Cratoscelis margine-costata*) that were without

description and are therefore *nomen nuda* according to Article 12 of the Code (International Commission on Zoological Nomenclature 1999).

Curator of the United States National Museum, Edward A. Chapin (1894–1969), was the next major contributor to the Lichniini. He designated type species for each and was the first to point out that *Arctodium* Burmeister and not *Cratoscelis* Erichson should be the valid genus name (Chapin 1938). He also divided the subfamily Glaphyrinae into two new tribes, Lichnini (sic) and Glaphyrini, with all Chilean taxa belonging to the former. Chapin (1938) erroneously used a single “i” in his original spelling, deriving his name from the use of Lichniadae by Burmeister (1844) to classify the Chilean glaphyrids. Lichniini Burmeister, 1844 is the valid name because the root name from which the tribe “ini” to form the tribal name should actually give “Lichniini,” and I here correct the spelling.

Lastly, Ramón Gutiérrez (1917–1953), who became an expert of Chilean scarabs in his short life, is the author of the two most recent (Gutiérrez 1943) new species, *Lichnia gallardoii* and *Lichnia porteri*, for which types were deposited at the MNNC.

### Classification status

The taxonomic placement of the Lichniini is a case of a perpetuated error. While Dejean (1833) did not explicitly place species currently included in the tribe Lichniini in any taxonomic group in his catalog, he placed *Arctodium* immediately following genera of Glaphyridae in his list, thus implying a relationship. Erichson (1835) followed suit when he placed the first valid species of Lichniini in the Glaphyridae.

Erichson’s three genera (*Cratoscelis*, *Dasychaeta*, and *Lichnia*) were the only taxa from South America placed in the Glaphyridae. The other five glaphyrid genera (about 70 species) are Holarctic. Chapin (1938) grouped these five genera in the tribe Glaphyrini. It is understandable why early authors would group Lichniini within the Glaphyridae. Molecular techniques and rigorous phylogenetic methods were not available at that time, and species of Lichniini show both morphological and behavioral similarities to glaphyrids. Both groups include species that are similar to each other in size and general appearance and are strong, active, diurnal fliers that visit flowers and mimic bees. Species of both Lichniini and Glaphyridae have short, dehiscent elytra that expose the pygidium, a deflexed head, dense setae covering all parts of the body, the labrum produced beyond the apex of the clypeus, and the mandibles produced beyond the apex of the labrum. However, these characters are not particularly phylogenetically informative as they are shared in various combinations with other groups of scarab beetles especially some groups of Cetoniinae and Melolonthinae.

Browne & Scholtz (1996) stated that monophyly of Glaphyridae is supported by the fact that all taxa share five apomorphic character states of the wing articulation and wing base. The same authors (Browne & Scholtz 1995) also stated that monophyly of

glaphyrids is supported by a derived mandibular structure, a single, foramen-type of tentorium, and the absence of a stridulatory apparatus on the legs of larvae. However, in both studies, only Holarctic taxa were used in the analysis, and monophyly of the world genera cannot be inferred.

Despite immediate similarities between the Lichniini and the Glaphyridae, other striking differences indicate paraphyly. Machastchke (1959) hypothesized a separate evolutionary lineage for the Chilean taxa because of their disjunct distribution with the other glaphyrid genera. Likewise, Ritcher (1969) suggested two separate lineages based on the differences in number of the spiracles. He noted that most Holarctic glaphyrids have eight pairs of functional spiracles, and Chilean lichniines have seven. Chapin (1938) noted that the abdomen of Lichniini is not inflated, and abdominal sternites are fused, whereas in Glaphyridae the abdomen is strongly inflated and the sternites are free. Species of Lichniini have nine-segmented antennae, whereas species of Glaphyridae have ten-segmented antennae. Lichniine species have elongated maxillae, and Glaphyridae have truncate maxillae. Also, glaphyrids lack the elongated galeae that are characteristic of lichniines. The form of the male genitalia of Lichniini is more typical of phytophagous scarab groups such as Melolonthinae and Rutelinae. The paired parameres are robust, there is no sclerotized genital capsule, and no medial lobe or elongate whip-like structure associated with the parameres (as there are with glaphyrids). Additionally, Lichniini share some characters with various groups of Melolonthinae such as: the labrum fused to, and on the same plane as the clypeus; antennae 9-segmented, antennal club shape elongate (not cupuliform as in many glaphyrids); pygidium flat, perpendicular to body (elongate, parallel to body, and strongly protruding in glaphyrids); abdominal sternites fused; mesotarsomere 1 and metatarsomere 1 greatly elongate relative to other tarsomeres; and metatarsus articulated between the tibial spurs.

The morphological characters discussed above provide strong evidence that the old classification placing Lichniini within Glaphyridae is incorrect. In addition to this, molecular phylogenetics hypotheses based on 18s and 28s rDNA strongly support the placement of the Chilean Lichniini within the phytophagous scarab clade among Melolonthinae lineages. Exemplar species from Glaphyridae and Lichniini cluster in two clades that are widely separated in a phylogenetic analysis that includes most families and subfamilies of Scarabaeoidea (Smith *et al.*, in press). Therefore, based on current morphological and molecular evidence, I place the tribe Lichniini in the subfamily Melolonthinae.

Because no comparative studies have been done involving comparison of Lichniini with other groups, and because no one questioned the validity of the early authors' placement of the Lichniini within the Glaphyridae, the Lichniini erroneously remained with the Glaphyridae for 170 years. There is no evidence thus far to suggest that the Holarctic glaphyrid genera are not monophyletic, and so they should remain together in the family Glaphyridae.

The similarities between Glaphyridae and Lichniini are likely due to convergent evolution for adaptations to a similar habitat and pollen-feeding lifestyle. A densely setose body and Batesian mimicry of bees are characters that are adaptive in many flower-visiting organisms. Most glaphyrids have a close resemblance to a variety of flower-visiting Hymenoptera. Some are metallic blue or green like wasps, and others, such as several species in the genus *Lichnanthe*, have a black and yellow banding pattern that closely mimics bumblebees. This is adaptive because *Lichnanthe* is under strong predation pressure from birds (Paul Robbins, Cornell University, personal communication, Nov. 2004), and resembling a stinging insect could decrease predation. In fact, many flower-visiting organisms mimic bees. Examples include bee flies (Bombyliidae), hover flies (Syrphidae), some robber flies (Asilidae), and the snowberry clearwing moth (*Hemaris diffinis* (Boisduval): Sphingidae). Bee mimicry is therefore a common adaptation in flower-visiting insects, and I conclude that the Glaphyridae and Lichniini evolved convergently leading them to be placed erroneously into the same family.

#### **Tribe Lichniini Burmeister, 1844**

Lichniadae Burmeister 1844: 8 (original spelling).

Type genus. *Lichnia* Erichson, 1835.

#### *Diagnosis*

Length 4.0–8.0 mm. Color of body surface variable (red, brown, black). Body surface setose; setae often dense, color variable (black, brown, gray, tan, yellow, white). Head strongly deflexed. Labrum clearly visible in dorsal view, on the same plane as clypeus, fused to clypeus; clypeolabral suture distinct. Mandibles expanded, reflexed, produced beyond apex of labrum. Maxillae with greatly elongate, setose galea. Maxillary palpi 4-segmented. Labium deeply grooved longitudinally. Labial palpi 3-segmented. Eye completely divided into dorsal and ventral sections by a complete canthus. Antennae 9-segmented with 3-segmented club. Antennal club shape elongate; never cupuliform; never with smaller, apical segments fitting into larger, basal segments. Elytra short, exposing pygidium. Pygidium flat, apex perpendicular to body, not elongate or protruding from body. Abdomen with 7 exposed, fused sternites. Pleural membrane either with 8 pairs of spiracles (*Lichnia*) or pleural membrane with 6 pairs of spiracles and tergite with 1 pair of spiracles (*Arctodium*). Legs with metatibia with apical projection variable (see Fig. 8). Mesotarsome 1 and metatarsomere 1 longer than mesotarsomere 2–4 combined and metatarsomere 2–4 combined respectively. Metatarsal articulation set so movement passes between tibial spurs, tibial spurs set widely apart with lower spur set on the rim of tibial apex and the other set within the cone of the tibial apex (in the internal apical notch). Claws simple, with weak basal lobe, capable of lateral movement. Male genitalia with robust, paired parameres; parameres approximately equal in length to phallobase; genitalia without sclerotized capsule or sclerotized whip-like structure.

**Checklist of the Lichniini (Scarabaeidae: Melolonthinae)*****Arctodium* Burmeister, 1844: 9**

Gender: neuter. Type Species: *Cratoscelis vulpina* Erichson, 1835 by subsequent designation (Chapin 1938).

*Arctodium* Dejean, 1833: 167 (*nomen nudum*)

*Cratoscelis* Erichson, 1835: 267. Gender: feminine. Type Species: *Cratoscelis vulpina* Erichson, 1835 by subsequent designation (Chapin 1938). Junior homonym of *Cratoscelis* Lucas, 1834: Plate 7 (Araneae: Sicariidae).

***Arctodium discolor* (Erichson, 1835: 269) (valid name)**

*Cratoscelis discolor* Erichson, 1835: 269 (original combination)

***Arctodium mahdii* Hawkins, 2006 new species*****Arctodium planum* (Blanchard, 1850: 52) new combination**

*Cratoscelis plana* Blanchard, 1850: 52 (original combination)

*Cratoscelis canicapilla* Philippi & Philippi, 1864: 326, **new synonymy**

***Arctodium vulpinum* (Erichson, 1835: 269) (valid name)**

*Arctodium villosum* Dejean, 1833: 167 (*nomen nudum*)

*Cratoscelis vulpina* Erichson, 1835: 269 (original combination)

*Cratoscelis aterrima* Blanchard, 1850: 53, **new synonymy**

*Cratoscelis gayana* Blanchard, 1850: 53, **new synonymy**

*Cratoscelis villosa* Blanchard, 1850: 53, **new synonymy**

*Cratoscelis striolata* Redtenbacher, 1868: 61, **new synonymy**

*Cratoscelis obscura* Germain, 1911: 68 (*nomen nudum*)

*Cratoscelis margine-costata* Germain, 1911: 68 (*nomen nudum*)

***Lichnia* Erichson, 1835: 269**

Gender: feminine. Type species: *Lichnia limbata* Erichson, 1835 by monotypy.

*Dasychaeta* Erichson, 1847: 104, **new synonymy**. Gender: feminine. Type species:

*Dasychaeta lateralis* Erichson, 1847 by monotypy.

*Lichnia* (*Neolichnia*) Gutiérrez, 1943 (*nomen nudum*)

***Lichnia gallardoi* Gutiérrez, 1943: 151 (valid name)**

*Lichnia porteri* Gutiérrez, 1943: 152, **new synonymy**

***Lichnia limbata* Erichson, 1835: 270 (valid name)**

*Dasychaeta lateralis* Erichson, 1847: 104, **new synonymy**

*Lichnia immarginata* Blanchard, 1850: 52 (junior synonymy)



### Key to genera and species of Lichniini

Males and females are distinguished in the following manner: In the genus *Lichnia*, the male protibia is slender (Fig. 3a), whereas the female protibia is broader for its entire length (Fig. 3b). In the genus *Arctodium*, the male tibial apex is modified into a long, pointed spine (Figs. 8a–c), whereas the female tibial apex forms only a short, blunt spine (Fig. 8d).

1. Galea at least 1/3 body length (Figs. 5b, 7b). Mandible rounded, without apical teeth (Fig. 6b)..... (5) *Lichnia* Erichson
- 1'. Galea length less than 1/3 body length (Figs. 5a, 7a). Mandible dentate, with 2 apical teeth (Fig. 6a) ..... (2) *Arctodium* Burmeister
2. Eye canthus with fringe of long, pale setae..... *Arctodium planum* (Blanchard)
- 2'. Eye canthus with fringe of long, dark setae ..... 3
3. Body length from apex of pronotum to apex of pygidium 5.0–6.5 mm. Male metatibia with apical spine shorter than adjacent metatibial spur (Fig. 8b).....  
.....*Arctodium mahdii* Hawkins, new species
- 3'. Body length from apex of pronotum to apex of pygidium greater than 7.0 mm. Male metatibia with apical spine subequal to or longer than adjacent metatibial spur (Figs. 8a, 8c) ..... 4
4. Elytra as long as wide. Setae of posterior leg dark brown or black, never pale.....  
..... *Arctodium discolor* (Erichson)
- 4'. Elytra longer than wide. Setae of posterior leg variable, but never black.....  
.....*Arctodium vulpinum* (Erichson)
5. Antennal club of males shorter than segments 1–6 (Fig. 4b). Occurs in Region IV (Coquimbo) (Fig. 10) ..... *Lichnia gallardoii* Gutiérrez
- 5'. Antennal club of males longer than segments 1–6 combined (Fig. 4a). Occurs in Region V (Valparaíso) to Region VII (Maule) (Fig. 10)..... *Lichnia limbata* Erichson

### Genus *Lichnia* Erichson, 1835

(Figs. 1, 3a–b, 4a–b, 5b, 6b, 7a, 9a–b, 10)

*Lichnia* Erichson 1835:269 (valid name).

*Dasychaeta* Erichson 1847:104. **New synonymy.**

### Catalog

*Lichnia*: Erichson 1835: 268–270 (original description); Laporte 1840: 155 (catalog); Burmeister 1844: 8–9 (redescription); Blanchard 1845: 210 (catalog); Curtis 1845: 456 (catalog, note on mouthparts); Erichson 1848: 718 (key, taxonomic notes); Blanchard 1850: 52 (catalog, new species description); Solier 1851: 122–124 (redescription and

diagnosis); Lacordaire 1856: 159 (taxonomic note), 161 (key), 162 (redescription); Redtenbacher 1868: 61 (catalog); Harold 1869: 1094 (catalog); Philippi 1887: 685 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Chapin 1938: 80 (catalog); Gutiérrez 1943: 146–153 (subgenera designations and new species descriptions); Blackwelder 1944: 216 (checklist); Machatschke 1959: 528–533, 540–542 (comparative notes and figures), 539 (distribution map); Medvedev 1960: 191 (taxonomic notes); Ritcher 1969: 875, 876, 878 (comments on spiracles); Iablokoff-Khnzorian 1977: 174, 175 (taxonomic notes); Nel & Scholtz 1990: 11 (note on distribution); Browne & Scholtz 1996: 30 (note on distribution and taxonomic placement); Scholtz 1990: 1052 (notes on morphology); Carlson 2001 (online taxonomic information); Hawkins 2004 (online catalog).

*Dasychaeta*: Erichson 1847: 104 (original description); Erichson 1848: 718 (key, taxonomic notes); Lacordaire 1856: 159 (taxonomic note), 161 (key), 162 (comparison with *Lichnia*); Harold 1869: 1093 (catalog); Chapin 1938: 80 (catalog); Gutiérrez 1943: 146, 147 (taxonomic notes); Blackwelder 1944: 216 (checklist); Machatschke 1959: 528, 529, 540–542, 544 (comparative notes and figures), 539 (distribution map); Medvedev 1960: 191 (taxonomic notes); Ritcher 1969: 876 (taxonomic note); Carlson 2001 (online taxonomic information); Hawkins 2004 (online catalog).

#### *Type species*

*Lichnia limbata* Erichson, 1835 by monotypy.

#### *Etymology*

The origin of the name *Lichnia* is unknown, but it possibly comes from the Greek *lichnos*, which means dainty (Brown 1956). The gender is feminine.

#### *Description*

Male. Length 4.0–8.0 mm; width 2.5–5.0 mm. *Color*: Head, pronotum, venter, and legs black; elytral disc testaceous, margin dark brown to black. *Head*: Head strongly deflexed. Frons slightly concave. Surface setosely punctate; punctures and setae variable. Labrum clearly visible in dorsal view, exposed part 2/3 as long as clypeus. Mandibles protruding anteriorly beyond labrum; apices rounded (Fig. 6b), strongly reflexed. Maxilla with galea 1/3 to 3/4 body length (Figs. 5b, 7b), setose; setae curved, short, dense, forming row, pale yellow to light tan. Maxillary palpi with short, black setae at apex of all segments except last, 4-segmented: segment 1 small, 1/2 length of 2; 2–3 cylindrical, subequal in length to each other; 4 fusiform. Labium deeply grooved longitudinally. Labial palpi with short, black setae at apex of all segments except last, 3-segmented: segments 1–2 conical, 3 fusiform. Eye divided completely into dorsal and ventral sections by canthus; canthus densely setose, setae variable. Antenna 9-segmented. *Pronotum*: Surface setosely punctate, punctures and setae variable. Disc with weak, median, longitudinal groove. Lateral margins with poorly developed bead, weakly rounded. Posterior margin strongly

projected posteriorly at middle. *Elytron*: Length short, not covering pygidium. Surface depressed posteriorly, setosely punctate, punctures and setae variable. *Propygidium*: Surface exposed, covered with long, dense, white setae; setae overlaying basal 1/4 of pygidium, apices forming straight row. *Pygidium*: Surface slightly convex, setosely punctate, punctures and setae variable. Lateral and apical margin with bead. Apex rounded. *Venter*: Abdomen with 7 exposed segments; segments setosely punctate; punctures and setae variable. Pleural membrane with 8 spiracles. *Legs*: Surface setosely punctate, punctures and setae variable. Protibia slender, with 3 outer teeth and 1 inner, apical tooth (Fig. 3a). Protibial spur small, 3/4 length of first tarsal segment. Metafemur broadly expanded. Mesotibia and metatibia expanded apically. Meso- and metatarsomere 1 longer than 2–4, 2–4 subequal to each other, 5 subequal to 2–4. Tarsal claws simple. Unguitractor plate with sides parallel, with 2 apical setae. *Parameres*: Figs. 9a–b.

Female. Females differ from males in the following respects: length 5.1–7.4 mm; width 3.0–4.9 mm. *Color*: Head, pronotum, venter, and legs reddish brown to black; elytral disc testaceous to red, margin dark brown to black. *Pronotum*: Lateral margin strongly rounded. *Elytron*: Surface slightly convex, not depressed posteriorly. *Propygidium*: Surface setose; setae yellow to yellowish brown, covering 1/3 of pygidium, not dense, not forming straight row. *Pygidium*: Apex attenuate. *Venter*: Apex of terminal sternite of abdomen deeply emarginate. *Legs*: Metafemur slightly expanded. Protibia expanded (Fig. 3b). Metatibia with sides subparallel, not expanded apically.

#### Diagnosis

Species of *Lichnia* (Fig. 1) are differentiated from species of *Arctodium* (Fig. 2) by the elongated galea in *Lichnia* that is at least half the length of the entire body (Figs. 5b, 7b). The galea of *Arctodium* is also elongated but is less than half the body length (Figs. 5a, 7a). Also, the exposed apex of the mandible of *Lichnia* is smooth and rounded (Fig. 6b), whereas the exposed apex of the mandible of *Arctodium* is bidentate (Fig. 6a).

#### Distribution

Species in the genus *Lichnia* live in central Chile from Region IV (Coquimbo) to Region VII (Maule) (Fig. 10). They are not found above 2000 meters in elevation and are most abundantly found on a variety of flowers in dry, sandy areas at lower elevations.

#### Remarks

Gutiérrez (1943) attempted to divide *Lichnia* into two subgenera (*Lichnia* and *Neolichnia*) based on antennal length. However, he did not designate a type species for *Neolichnia* in the original publication, and it is therefore a *nomen nudum* according to Article 13 of the Code (International Commission on Zoological Nomenclature 1999). Because each subgenus would now contain only one species, it is unnecessary to use subgeneric names. For an explanation of the synonymy of *Dasychaeta* Erichson with *Lichnia* Erichson see the remarks section for *Lichnia limbata*.

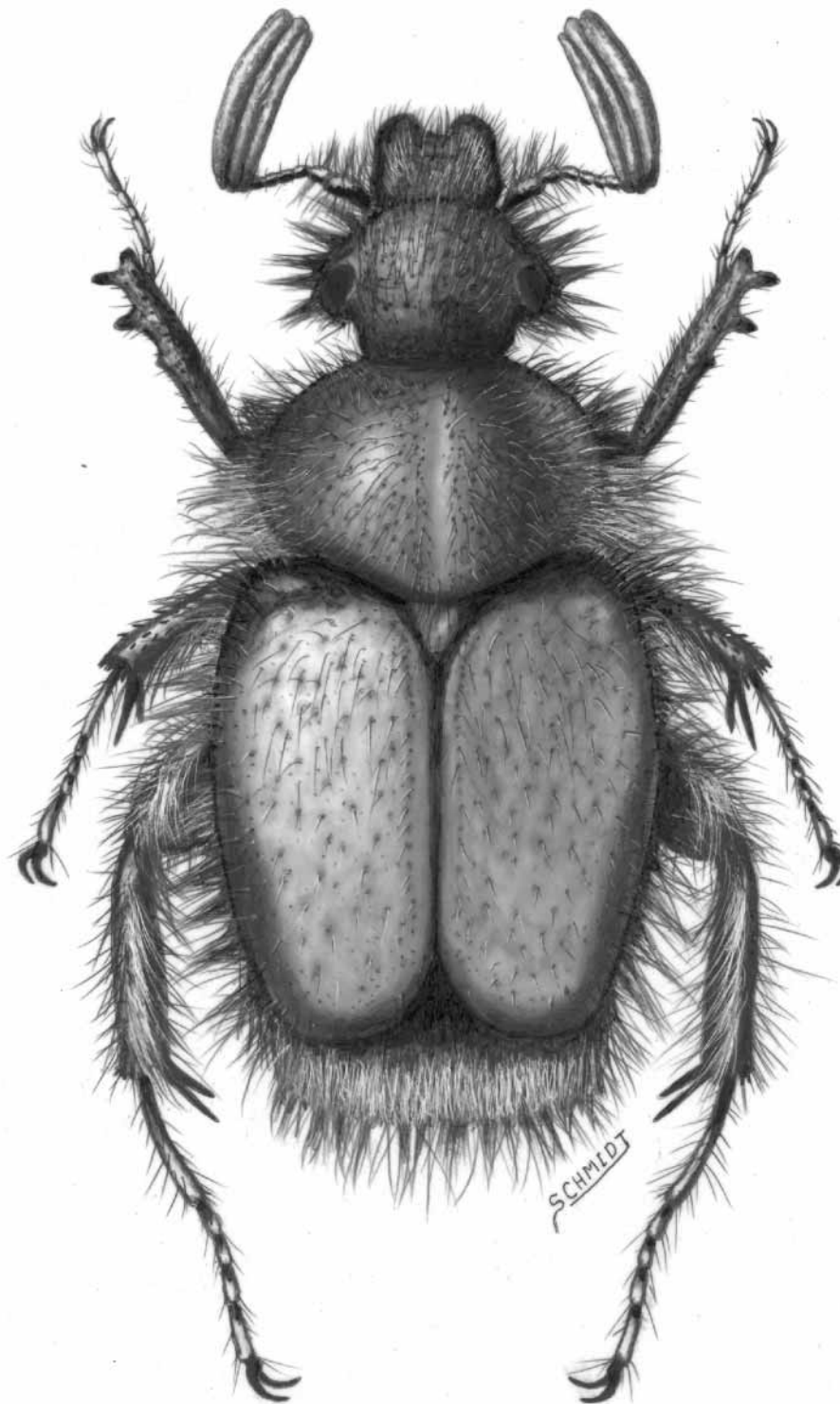
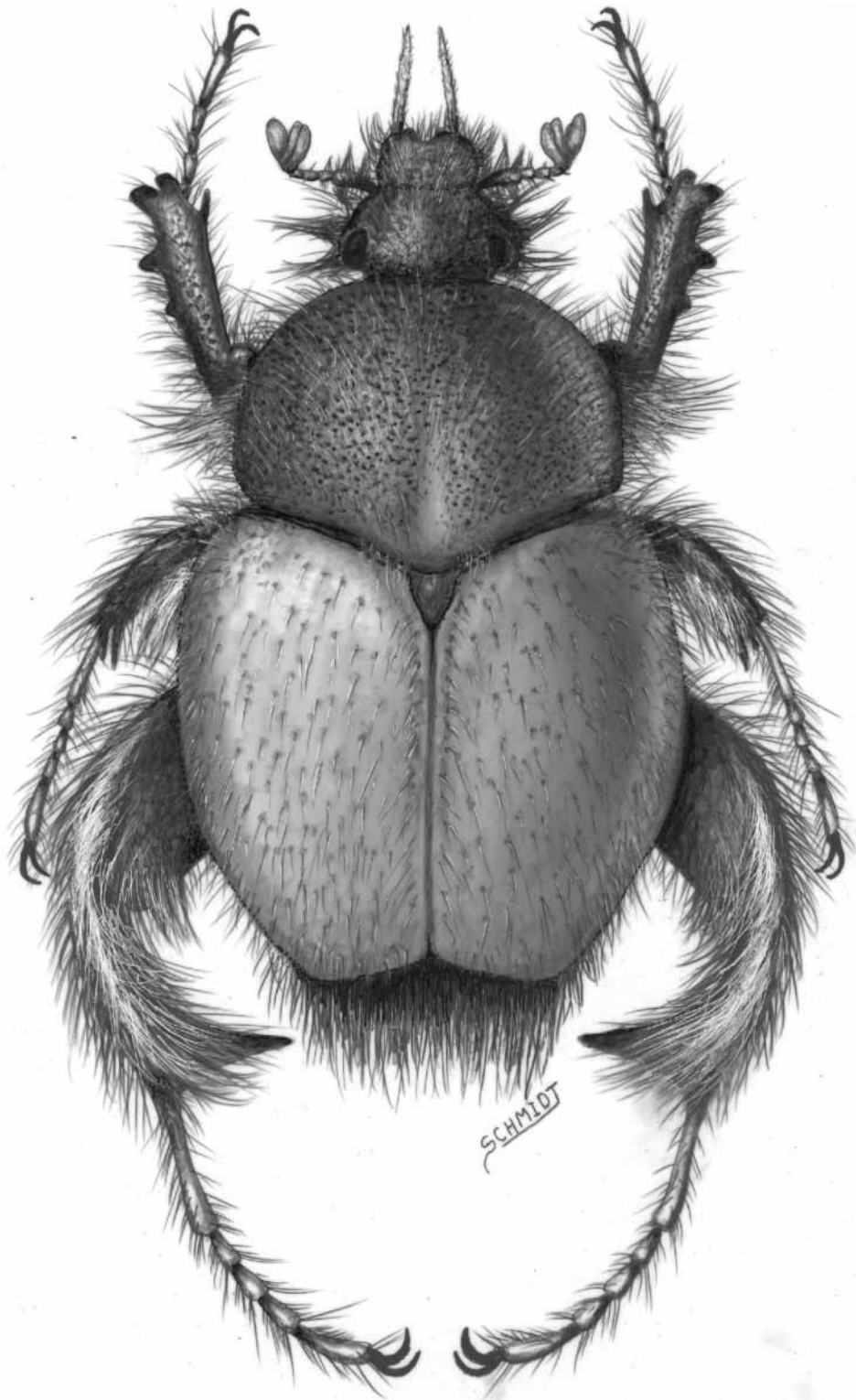


FIGURE 1. *Lichnia limbata* Erichson male.



**FIGURE 2.** *Arctodium vulpinum* (Erichson) male.

*Lichnia gallardoi* Gutiérrez, 1943

(Figs. 9a, 10)

*Lichnia gallardoi* Gutierrez 1943:151 (valid name).*Lichnia porteri* Gutierrez 1943:152. **New synonymy.***Catalog**Lichnia gallardoi*: Gutiérrez 1943:151 (original description); Hawkins 2004 (online catalog).*Lichnia porteri*: Gutiérrez 1943:152 (original description); Hawkins 2004 (online catalog).*Type specimens*

*Lichnia gallardoi* Gutiérrez, holotype male at UCCC labeled: a) "3154" (handwritten), b) "Chile 8.IX.1940/ Huetulame/ Coquimbo/ gallardo" (handwritten), c) "*Lichnia* (*Neolichnia*)/ *gallardoi* Gut./ R. Gutiérrez Det. (handwritten in red ink and typeset in black ink), d) HOLOTIPO (orange label with black border, typeset), e) "Colección/ R. Gutiérrez/ 1958" (white label with blue border, typeset in blue ink), f) "Southern Neotropical Scarabs/ database #SH75980451/ *Lichnia gallardoi* Gutiérrez ♂/ DET: S.J. Hawkins 2004" (typeset, ♂ hand-drawn). Allotype female at UCCC labeled: a) "3158" (handwritten), b) ALOTIPO (orange label with black border, typeset), c) "Chile 8.IX.1940/ Hutetulame/ Coquimbo" (handwritten), d) "Colección/ R. Gutiérrez/ 1958" (white label with blue border, typeset in blue ink), e) "Southern Neotropical Scarabs/ database #SH75980540/ *Lichnia gallardoi* Gutiérrez ♀/ DET: S.J. Hawkins 2004" (typeset, ♀ hand-drawn). There are a total of four male and two female paratypes at three institutions. Two male paratypes at UCCC labeled: a) "3156" and "3157" (handwritten), b) PARATIPO (orange label with black border, typeset), c) "Chile 8.IX.40/ Huetulame/ Coquimbo/ Gallardo" (handwritten), d) "Southern Neotropical Scarabs/ database #SH75980452/ *Lichnia gallardoi* Gutiérrez ♂/ DET: S.J. Hawkins 2004" and "Southern Neotropical Scarabs/ database #SH75980453/ *Lichnia gallardoi* Gutiérrez ♂/ DET: S.J. Hawkins 2004" (typeset, ♂ hand-drawn). One male paratype at MNHN labeled: a) "Chile/ Huetulame/ Pr. Coquimbo" (handwritten), b) "Paratipo" (handwritten), c) *Lichnia* (*Neolichnia*)/ *Gallardoi* Gut./ R. Gutiérrez Det. 46." (handwritten and typeset), d) "Southern Neotropical Scarabs/ database #SH75980777/ *Lichnia gallardoi* Gutiérrez ♂/ DET: S.J. Hawkins 2004" (typeset, ♂ hand-drawn). One male paratype (glued on card) at CMNC, labeled: a) "28.IX.940/ CHILE/ Huetulame/ Gutiérrez Coll./ Coll Martínez" (handwritten), b) "H & A HOWDEN/ COLLECTION/ Ex. A. Martínez Coll" (black border, typeset), c) "Paratype" (yellow label with double black border, typeset), d) "Paratipo" (handwritten), e) *Lichnia* (*Neolich.*)/ *Gallardoi* Gut. / ♂ R. Gutiérrez Det. 46." (handwritten and typeset), f) "CMNEN/ 2002-0063" (typeset), g) "Southern Neotropical Scarabs/ database #SH75980455/ *Lichnia gallardoi* Gutiérrez ♂/ DET: S.J. Hawkins

2004” (typeset, ♂ hand-drawn). Two female paratypes at UCCC labeled: a) “3159” and “3165” (handwritten), b) PARATIPO (orange label with black border, typeset), c) “Chile 8.IX.40/ Huetulame/ Coquimbo/ Gallardo” and “Chile 8.IX.40/ Huetulame/ Coquimbo” (handwritten), d) “Southern Neotropical Scarabs/ database #SH75980541/ *Lichnia gallardoi* Gutiérrez / ♀ DET: S.J. Hawkins 2004” and “Southern Neotropical Scarabs/ database #SH75980542/ *Lichnia gallardoi* Gutiérrez / ♀ DET: S.J. Hawkins 2004” (typeset, ♀ hand-drawn). Type locality: Huetulame, Region IV (Coquimbo), Chile. According to Gutiérrez (1943), the type series was collected on the flowers of *Senecio macropus* Greenman (Asteraceae). The location of 14 additional female paratypes from Gutiérrez’s original type series is unknown. Gutiérrez’s original description stated that the collection date of the type series was 26-IX-1940, but the collection date on most of the specimen labels is 8-IX-1940. However, because all other label data matches Gutiérrez’s original description, I consider the series labeled as 8-IX-1940 to be part of the type series.

*Lichnia porteri* Gutiérrez, neotype male (glued on card) at CMNC labeled: a) “Chile X.40/ Hurtado/ Coquimbo ” (handwritten), b) “H & A HOWDEN/ COLLECTION/ Ex. A. Martínez Coll” (black border, typeset), c) “Paratype” (yellow label with double black border, typeset), d) *Lichnia* (*Neolich/ nia*) *porteri* Gut./ ♂ R. Gutiérrez Det. 49.” (handwritten in red ink and typeset in black ink), f) “CMNEN/ 2002-0064” (typeset), g) “Southern Neotropical Scarabs/ database #SH75980642/ *Lichnia gallardoi* Gutiérrez ♂/ DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Lichnia gallardoi*/ Gutiérrez/ NEOTYPE ♂/ S.J. Hawkins” (red label, typeset). Neotype here designated. The neotype was chosen from among the paratypes in the original type series. The location of two additional males (including the holotype male) and one additional female (the allotype female) from Gutiérrez’s original type series is unknown. Gutiérrez deposited these specimens in his personal collection, which was later transferred to the UCCC (Smith 2003). Because I was unable to locate the holotype or allotype at UCCC or in any other collection from which I borrowed specimens, I consider them both lost. Type locality: Hurtado (Ovalle), Region IV (Coquimbo), Chile. There are a total of nine female paratypes from two institutions. Seven female paratypes at UCCC labeled: a) “3162,” “3163,” “3164,” “3166,” “3168,” “3169,” and “3170” (handwritten), b) PARATIPO (orange label with black border, typeset), c) “Chile 8.IX.40/ Huetulame/ Coquimbo/ Gallardo” (handwritten), d) “Colección/ R. Gutiérrez/ 1958” (white label with blue border, typeset in blue ink), e) “Southern Neotropical Scarabs/ database, #SH75980634, #SH75980635, #SH75980636, #SH75980637, #SH75980638, #SH75980639, #SH75980640/ *Lichnia gallardoi* Gutiérrez ♀/ DET: S.J. Hawkins 2004” (typeset, ♀ hand-drawn). One female paratype (glued on card) at CMNC, labeled: a) “28.IX.940/ CHILE/ Huetulame/ Gutiérrez-leg./ Coll Martínez” (handwritten), b) “H & A HOWDEN/ COLLECTION/ Ex. A. Martínez Coll” (black border, typeset), c) “Paratype” (yellow label with double black border, typeset), d) “Paratipo” (handwritten), e) *Lichnia* (*Neolichnia*) *porteri* Gut./ R. Gutiérrez Det. 46.” (handwritten and typeset), e) “CMNEN/ 2002-0062”

(typeset), f) "Southern Neotropical Scarabs/ database #SH75980641/ *Lichnia gallardoii* Gutiérrez ♀/ DET: S.J. Hawkins 2004" (typeset, ♀ hand-drawn). One female paratype at UCCC labeled: a) "3161" (handwritten), b) PARATIPO (orange label with black border, typeset), c) "Chile Porter/ Hurtado/ Coquimbo" (handwritten), d) "Colección/ R. Gutiérrez/ 1958" (white label with blue border, typeset in blue ink), e) "Southern Neotropical Scarabs/ database #SH75980543/ *Lichnia gallardoii* Gutiérrez ♀/ DET: S.J. Hawkins 2004" (typeset, ♀ hand-drawn).

#### Description

Male. Length 5.6–7.6 mm; width 3.5–4.7 mm. *Color*: Head, pronotum, venter, and legs black; elytral disc testaceous, margin dark brown to black. *Head*: Surface punctate; punctures small, dense, setose; setae long, moderately dense to dense, white. Clypeus with surface flat, punctate; punctures small, dense, setose; setae short, half as long as clypeal setae, dense, white or black; apex truncate. Labrum with surface punctate; punctures small, dense, setose; setae short, half as long as clypeal setae, dense, white or black; apex rounded with minute, recurved tooth at middle. Mandible on external surface with moderately long, dense, black setae. Labial margins with moderately long, dense, black setae. Eye canthus setose; setae long, dense, black. Antenna with pedicel setose, elongate, segment 2 globular, 3–6 subequal in length, 7–9 lamellate; club small, subequal in length to segments 3–6 (Fig. 4b). *Pronotum*: Surface punctate; punctures small, moderately dense, with long, moderately dense to dense, white setae. Anterior margin setose; setae short, dense, yellow. Lateral margins slightly rounded, setose; setae long, dense, white. Posterior margin setose; setae long, dense, white. *Scutellum*: Surface setose; setae long, dense, white. *Elytron*: Surface depressed posteriorly, punctate; punctures small, moderately dense medially, dense laterally; surface with both stout, black and slender, white setae. *Propygidium*: Surface exposed, covered with long, dense, white setae; setae overlaying basal 1/4 of pygidium, apices forming straight row. *Pygidium*: Surface slightly convex, setose; setae long, dense, black. *Venter*: Thorax punctate; punctures small, dense, with both black and white setae. Mes- and metepisternum setose; setae long, dense, white. Abdominal segments densely setose on lateral margin, sparsely setose medially; setae long, white. Terminal abdominal segment setose on apical half; setae long, dense, black. Margin of apex sinuate. *Legs*: Surface setose; setae long, moderately dense, both black and white. Protibia slender, with 3 outer teeth and 1 inner apical tooth (Fig. 3a). *Parameres*: Fig. 9a.

Female. Females differ from males in the following respects: length 5.7–7.4 mm; width 3.6–4.9 mm. *Color*: Head, pronotum, venter, and legs reddish brown to black; elytral disc testaceous to red, margin dark brown to black. *Head*: Clypeal apex weakly rounded, without apical tooth. *Pronotum*: Lateral margin broadly rounded. *Elytron*: Surface not depressed posteriorly. *Propygidium*: Surface setose; setae yellow to yellowish brown, covering 1/3 of pygidium, not dense and not forming a straight row. *Pygidium*: Apex



attenuate. *Venter*: Apex of terminal sternite of abdomen deeply emarginate. *Legs*: Protibia expanded (Fig. 3b).

#### *Diagnosis*

*Lichnia gallardoi* resembles *Lichnia limbata*. Males of *L. gallardoi* are easily diagnosed by a shorter antennal club (Fig. 4b) and the presence of a clypeal tooth (males of *L. limbata* have a longer antennal club [Fig. 4a] and lack a clypeal tooth). The clypeal tooth may be worn down and not visible in many specimens. When using male antennal characters to distinguish *L. gallardoi* from *L. limbata*, it must first be determined that the specimens are males by comparing the protibia, which is slender in males (Fig. 3a) and expanded along the entire length in females (Fig. 3b). Otherwise, males of *L. gallardoi* can be mistaken for females of *L. limbata* because both have short antennae (Fig. 4b). On average, both sexes of *L. gallardoi* are slightly larger than those of *L. limbata*. With the exception of size, females of these two species are indistinguishable and must be identified based on association with males and geographic location. The distribution of *L. limbata* is Region V (Valparaíso) to Region VII (Maule), whereas *L. gallardoi* is found further north in Region IV (Coquimbo) (Fig. 10).

#### *Remarks*

Gutiérrez (1943) differentiated *L. porteri* from *L. gallardoi* based on characters such as color of setae and bristles and size difference. After studying a larger series (248 specimens) than Gutiérrez had access to, I conclude that these characters represent variation within a single species. Following Article 24.2 of the Code (International Commission on Zoological Nomenclature 1999), I, as first revisor, designate *L. gallardoi* as the valid name for the species because this name is most commonly used in collections and it better promotes stability. Consequently, *L. porteri* is here designated as a junior synonym of *L. gallardoi*.

#### *Distribution*

Central Chile in Region IV (Coquimbo) (Fig. 10).

#### *Locality data*

248 specimens were examined from ABTS, CASC, CMNC, CNCI, EMUS, FMNH, JEBC, JMEC, LACM, MNHN, MNNC, UCCC, UMRM, USNM, VMDC.

CHILE. REGION IV (COQUIMBO) (199): Canela Baja (4), Condoriaco (2), Costa Las Cardas (8), El Molle (4), El Tofo (1), Guanaqueros (1), Huentelauquén (2), Hurtado (2), Illapel (48), La Serena (2), Limari (4), Los Hornitos (27), Los Mantos (1), Los Molles (1), Mincha (21), Ovalle (2), Parque Nacional Fray Jorge (30), Puerto Oscuro (5), Quebrada El Arrayan (2), Rio Limari (5), San Lorenzo (4), Socos (1), Tongoy (6), Vicuna (1), no data (15). NO DATA (49).

*Temporal data*

January (7), August (2), September (16), October (125), November (43), December (6).

***Lichnia limbata* Erichson, 1835**

(Figs. 1, 3a–b, 4a–b, 5b, 6b, 7b, 9b, 10)

*Lichnia limbata* Erichson 1835: 270 (valid name).

*Dasychaeta lateralis* Erichson 1847: 104. **New synonymy.**

*Lichnia immarginata* Blanchard 1850: 52 (junior synonym).

*Lichnia inmarginata* Blanchard 1850 (*lapsus calami*, Gutiérrez 1943: 149).

*Catalog*

*Lichnia limbata*: Erichson 1835: 270, Plate 3, Fig. 6 (original description); Laporte 1840: 155 (catalog); Burmeister 1844: 9 (comments on morphology); Curtis 1845: 456 (catalog, comment on mouthparts); Blanchard 1850: 52 (catalog); Solier 1851: 123, Plate 17, Figs. 11–12 (redescription and illustrations); Lacordaire 1856: 162 (note); Redtenbacher 1868: 61 (catalog); Harold 1869: 1094 (catalog); Philippi 1887: 685 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Chapin 1938: 80 (taxonomic notes); Gutiérrez 1943: 149 (redescription); Blackwelder 1944: 216 (checklist); Machatschke 1959: 530, 532, 533 (illustrations); Hawkins 2004 (online catalog).

*Dasychaeta lateralis*: Erichson 1847: 104 (original description); Lacordaire 1856: 162 (checklist, taxonomic notes); Harold 1869: 1093 (catalog); Arrow 1912: 6 (catalog); Chapin 1938: 81 (taxonomic note); Gutiérrez 1943: 147 (taxonomic note); Blackwelder 1944: 216 (checklist); Hawkins 2004 (online catalog).

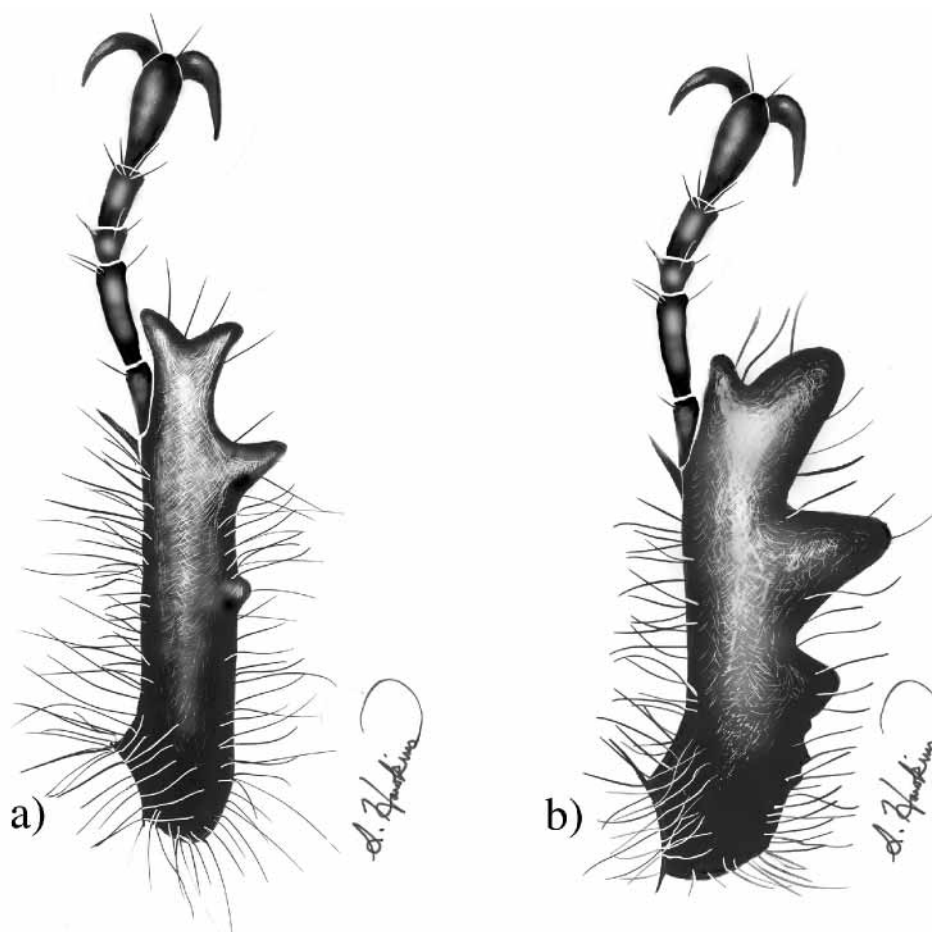
*Lichnia immarginata*: Blanchard 1850: 52 (original description); Harold 1869: 1094 (placed in synonymy with *L. limbata*); Philippi 1887: 685 (catalog listing as synonym of *L. limbata*); Germain 1911: 68 (catalog listing as synonym of *L. limbata*); Arrow 1912: 6 (catalog listing as synonym of *L. limbata*); Hawkins 2004 (online catalog listing as synonym of *L. limbata*).

*Lichnia inmarginata*: Gutiérrez 1943: 149 (*lapsus calami* in catalog).

*Type specimens*

*Lichnia limbata* Erichson, male lectotype at ZMHB labeled: a) “Valparai/ so. M.” (handwritten), b) “Southern Neotropical Scarabs/ database #SH75980171/ *Lichnia limbata* Erichson ♂/ DET: S.J. Hawkins 2004” (typeset, ♂ hand-drawn), c) “*Lichnia limbata* Erichson/ LECTOTYPE ♂/ S.J. Hawkins” (red label, typeset). Lectotype here designated. One female paralectotype (glued on card) at ZMHB labeled: a) “Valparai/ so. M.” (handwritten), b) “*Lichnia lim/ bata* Er. M.” (handwritten), c) “*limbata* Er./ *Lichnia*” (large white label, handwritten), d) “*L./ limbata*/ Er. M./ Chile.” (large, light green, square label,

handwritten), e) “Southern Neotropical Scarabs/ database #SH75980000/ *Lichnia limbata* Erichson ♀/ DET: S.J. Hawkins 2004” (typeset, ♀ hand-drawn), f) “*Lichnia limbata* Erichson/ PARALECTOTYPE ♀ S.J. Hawkins” (yellow label, typeset). Erichson (1835) did not indicate how many specimens were in the type series. The location and existence of other paralectotypes is unknown. Type locality: Valparaíso, Region V (Valparaíso), Chile.

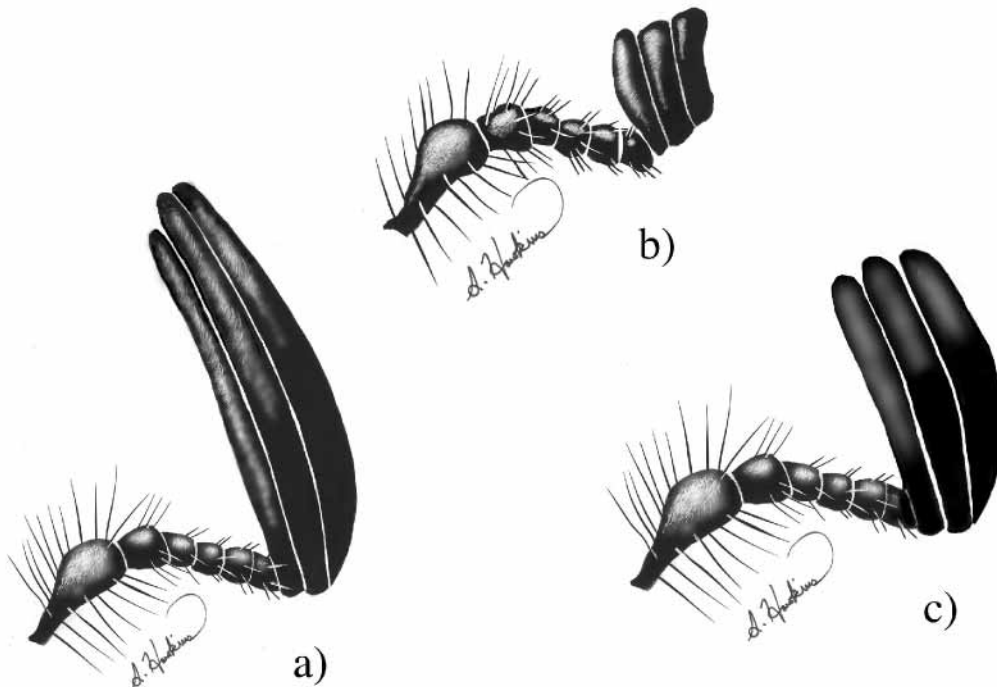


**FIGURES 3a–b.** Dorsal view of foreleg of *Lichnia limbata* showing sexual dimorphism in male (a) and female (b).

*Dasychaeta lateralis* Erichson, neotype male at USNM labeled: a) Valparaiso/ Chile/ XI. 1976 (typeset), b) “Southern Neotropical Scarabs/ database #SH75980122/ *Lichnia limbata* Erichson ♂/ DET: S.J. Hawkins 2004” (typeset, ♂ hand-drawn), c) *Dasychaeta lateralis*/ Erichson/ NEOTYPE ♂/ S.J. Hawkins” (red label, typeset). Neotype here designated. Type locality: Valparaíso, Region V (Valparaíso), Chile. Original type missing from ZMHB (see remarks).

*Lichnia immarginata* Blanchard, lectotype female at MNHN labeled: a) “4196 36”

(round green label, handwritten on underside), b) “*Lichnia immarginata*/ type Bl.” (handwritten), c) “*L. immarginata*/ Cat. Mus./ Chili/ M. Gay” (large green label, handwritten), d) “Southern Neotropical Scarabs/ database #SH75980771/ *Lichnia limbata* Erichson ♀/ DET: S.J. Hawkins 2004” (typeset, ♀ hand-drawn), e) “*Lichnia immarginata*/ Blanchard/ LECTOTYPE ♀/ S.J. Hawkins” (red label, typeset). Lectotype here designated. Two female paralectotypes at MNHN labeled: a) “15/ 43” (round green label, handwritten on underside), b) “Southern Neotropical Scarabs/ database #SH75980773/ *Lichnia limbata* Erichson ♀/ DET: S.J. Hawkins 2004” and “Southern Neotropical Scarabs/ database #SH75980774/ *Lichnia limbata* Erichson ♀/ DET: S.J. Hawkins 2004” (typeset, ♀ hand-drawn), c) “*Lichnia immarginata*/ Blanchard/ PARALECTOTYPE ♀/ S.J. Hawkins” (yellow label, typeset). Blanchard (1850) did not indicate how many specimens were in the type series. The location and existence of other paralectotypes is unknown. Blanchard (1850) described *L. immarginata* based on females of *L. limbata*. Type locality: Chile.



**FIGURES 4a–c.** Dorsal view of antenna showing length of club. a) *Lichnia limbata* male; b) *L. limbata* female; c) *Arctodidium mahdii* male.

#### Description

Male. Length 4.5–6.0 mm; width 3.0–4.0 mm. *Color*: Head, pronotum, venter, and legs black; elytral disc testaceous, margin dark brown to black. *Head*: Surface punctate; punctures small, dense, setose; setae long, moderately dense to dense, white. Clypeus with surface flat, punctate; punctures small, dense, setose; setae short, half as long as clypeal

setae, dense, white or black; apex truncate. Labrum with surface punctate; punctures small, dense, setose; setae short, half as long as clypeal setae, dense, white or black; apex rounded without tooth. Clypeal apex slightly rounded. Labrum with surface punctate; punctures small, dense, setose; setae short, half as long as clypeal setae, dense, white or black. Mandible on external surface with moderately long, dense, black setae. Labial margins with moderately long, dense, black setae. Eye canthus setose; setae long, dense, black. Antenna with pedicel setose, elongate, segment 2 globular, 3–6 subequal in length, 7–9 lamellate; club slightly longer than segments 1–6 (Fig. 4a). *Pronotum*: Surface punctate; punctures small, moderately dense, with long, moderately dense to dense, white setae. Anterior margin setose; setae short, dense, yellow. Lateral margins slightly rounded, setose; setae long, dense, white. Posterior margin setose; setae long, dense, white. *Scutellum*: Surface setose; setae long, moderately dense, white. *Elytron*: Surface depressed posteriorly, punctate; punctures small, moderately dense medially, dense laterally, with both stout, black and slender, white setae. *Propygidium*: Surface exposed, covered with long, dense, white setae; setae overlaying basal 1/4 of pygidium, apices of setae forming straight row. *Pygidium*: Surface slightly convex, setose; setae long, dense, black. Apex rounded. *Venter*: Thorax punctate, punctures small, dense, with both black and white setae. Mes- and metepisternum setose; setae long, dense, white. Abdomen with 7 segments exposed, segments densely setose on lateral margin, sparsely setose medially; setae long, white. Margin of apex sinuate. Terminal abdominal segment setose on apical half; setae long, dense, black. *Legs*: Surface setose; setae long, moderately dense, both black and white. Protibia slender, with 3 outer teeth and 1 inner apical tooth (Fig. 3a). Metatibia expanded apically. *Parameres*: Fig. 9b.

Female. Females differ from males in the following respects: length 5.1–6.5 mm; width 3.0–4.2 mm. *Color*: Head, pronotum, venter, and legs reddish brown to black; elytral disc testaceous to red, margin dark brown to black. *Head*: Antennal club short, subequal in length to segments 3–6 (Fig. 4b). *Pronotum*: Lateral margin rounded. *Elytron*: Surface not depressed posteriorly. *Propygidium*: Surface setose; setae yellow to yellowish brown, covering 1/3 of pygidium, not dense and not forming straight row. *Pygidium*: Apex attenuate. *Venter*: Apex of terminal sternite of abdomen deeply emarginate. *Legs*: Protibia expanded (Fig. 3b). Metatibia subparallel, not expanded apically.

#### Diagnosis

*Lichnia limbata* (Fig. 1) resembles *L. gallardoi*. However, *L. limbata* is distinguished by a long antennal club (Fig. 4a) and the absence of a clypeal tooth in males (the antennal club is short (Fig. 4b) and a clypeal tooth is present in males of *L. gallardoi*). In both sexes, *L. limbata* is slightly smaller than *L. gallardoi*. Aside from size, females of these two species are indistinguishable and must be identified based on association with males and geographical location. The distribution of *L. limbata* is from Region V (Valparaíso) to Region VII (Maule), whereas *L. gallardoi* is found further north in Region IV (Coquimbo) (Fig. 10).

*Remarks*

Most specimens of *L. limbata* have been collected in dry, sandy areas around Valparaíso and Santiago, and the distributional records become fewer to the south. Many specimens were collected using sweep nets on flowers, but some were caught in malaise traps and pan traps.

Erichson (1847) stated that the original type of *Dasychaeta lateralis* was from Peru. However, Erichson described a number of new beetle species in “The Fauna of Peru” (1847) that were actually from central Chile (Jameson & Smith 2002, Smith 2003). This was a common error at that time because of recent changes in political borders and regional name changes. Because no specimens of any species of Lichniini have subsequently been found in Peru, I believe that *D. lateralis* is one of the species that was erroneously labeled. Erichson was likely observing a specimen of *L. limbata* Erichson from central Chile. He perhaps classified the mislabeled specimen as a new genus because of its locality despite the fact it resembled *L. limbata*. Erichson stated that the two species are indistinguishable except for a shorter lobe on the mandibles and a shorter eye canthus on *D. lateralis*. Because these characters are variable in *L. limbata*, I believe that *D. lateralis* is conspecific with *L. limbata*, and I have placed the name in synonymy. No specimens of *D. lateralis* are known, and according to accession records at ZMHB, Erichson described the species solely from the holotype. Dr. Johannes Frisch and Joachim Willers at the ZMHB have reported that the *D. lateralis* type specimen has been missing since at least 1999, and I did not locate it in any of the other museums that I visited or from which I borrowed specimens. For these reasons, I designate a neotype to stabilize the nomenclature.

*Distribution*

Central Chile from Region V (Valparaíso) to Region VII (Maule) (Fig. 10).

*Locality data*

538 specimens were examined from ABTS, BMNH, CASC, CMNC, CNCI, EMUS, FMNH, FSCA, INHS, JMEC, KSUC, LACM, LEMQ, MCZC, MNHN, MNNC, UCCC, UMRM, USNM, VMDC, ZMHB, ZSMC.

CHILE. REGION V (VALPARAÍSO) (212): Algarrobo (15), Cuesta Chacabuco (41), Cuesta El Melón (38), El Quisco (11), Las Chilcas (1), Limache (7), Llay-Llay (3), Llo-Lleo (4), Palma de Ocoa (40), Penuelas (2), Quillota (7), Valparaíso (42), no data (1). REGION METROPOLITANA DE SANTIAGO (195): Cajon del Maipo (1), Caleu (3), Cuesta Barriga (5), Curacavi (1), El Noviciado (32), El Portezuelo (22), Fundo El Manzano (1), La Africana (2), La Obra (4), Laguna Carén (6), Lampa (4), Leyda (8), Maipo (1), Pudahuel (54), Quebrada de La Plata (1), Renca (10), San Bernardo (4), Santiago (20), Tiltil (10), no data (6). REGION VI (O’HIGGINS) (15): El Arbol (7), El Manzano (2), Pencahue (4), Las Nieves (1), Rancagua (1). REGION VII (MAULE) (19): Curicó (1), Rio Cipreses (18). NO DATA (97).

*Temporal data*

January (8), September (4), October (157), November (230), December (12).

**Genus *Arctodium* Burmeister, 1844**

(Figs. 2, 4c, 5a, 6a, 7a, 8a–d, 9c, 11, 12)

*Arctodium* Dejean 1833: 167 (*nomen nudum*).

*Cratoscelis* Erichson 1835: 267 (synonym).

*Arctodium* Burmeister 1844: 9 (valid name).

*Catalog*

*Arctodium*: Dejean 1833: 167 (first usage); Dejean 1836: 186 (catalog); Lacordaire 1856: 161 (listed as a synonym of *Cratoscelis*), 162 (catalog); Harold 1869: 1094 (catalog); Chapin 1938: 80 (catalog listing as invalid name); Hawkins 2004 (online catalog listing as invalid name).

*Cratoscelis*: Erichson 1835: 267–269 (original description); Laporte 1840: 154, 155 (catalog); Blanchard 1845: 210 (catalog); Curtis 1845: 455 (catalog, notes on mouthparts); Blanchard 1850: 52, 53 (catalog, new species descriptions); Erichson 1848: 718 (key, taxonomic notes); Solier 1851: 119–122 (redescription and diagnoses); Lacordaire 1856: 159 (taxonomic notes), 161 (redescription), 162 (comparison with *Lichnia*); Philippi & Philippi 1864: 326 (comparison of species, new species description); Redtenbacher 1868: 61 (catalog, new species description); Harold 1869: 1094 (catalog); Philippi 1887: 685 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Chapin 1938: 80 (name invalidated because it is a homonym, type species designation); Gutiérrez 1943: 146 (taxonomic note); Blackwelder 1944: 216 (checklist); Machatschke 1959: 528–532, 540–542, 544 (comparative notes and figures), 539 (distribution map); Medvedev 1960: 191 (taxonomic notes); Ritcher 1969: 875, 876, 878 (comment on spiracles); Iablokoff-Khnzorian 1977: 174, 175 (taxonomic notes); Nel & Scholtz 1990: 11 (note on distribution); Scholtz 1990: 1052 (morphological notes); Browne & Scholtz 1996: 30 (note on distribution and taxonomic placement); Hawkins 2004 (online catalog listing as synonym).

*Arctodium*: Burmeister, 1844: 9–10 (first usage of name with available species names); Chapin 1938: 81 (stated name as replacement for *Cratoscelis*, type species designation); Gutiérrez 1943: 146, 147, 151 (taxonomic notes); Carlson 2001 (online taxonomic information); Hawkins 2004 (online catalog).

*Type species*

*Cratoscelis vulpina* Erichson, 1835 by subsequent designation (Chapin 1938).

*Etymology*

The name *Arctodium* likely comes from the Latin word *arctos*, meaning bear or bear-like (Brown 1956). The gender is neuter.

*Description*

Male. Length 4.5–12.5 mm; width 3.0–8.0 mm. *Color*: Head, pronotum, and scutellum black; venter, elytra, legs, pygidium, and setae variable. *Head*: Head strongly deflexed. Frons slightly concave. Surface setosely punctate; punctures and setae variable. Labrum clearly visible in dorsal view, exposed part in dorsal view  $\frac{2}{3}$  as long as clypeus. Mandibles protruding anteriorly beyond labrum; apices with 2 apical teeth, strongly reflexed (Fig. 6a). Maxilla with moderately long galea (Figs. 5a, 7a), galea  $\frac{1}{2}$  to subequal in length to head (including mouthparts), setose; setae curved, short, dense, forming row, pale yellow to light tan. Maxillary palpi 4-segmented; segment 1 small,  $\frac{1}{2}$  length of 2, 2–3 cylindrical, equal in length, 4 fusiform. Labium deeply grooved longitudinally. Labial palpi 3-segmented: segments 1–2 conical, 3 fusiform. Eye completely divided into dorsal and ventral sections by canthus. Antenna 9-segmented. *Pronotum*: Surface setosely punctate, punctures and setae variable. Disc with weak, median, longitudinal groove. Lateral margins with poorly developed bead. Posterior margin strongly projected posteriorly at middle. *Elytron*: Length short, not covering pygidium. *Propygidium*: Surface exposed, covered with long, dense, white setae; setae overlaying basal  $\frac{1}{5}$  of pygidium (covered by elytra in some specimens), apices of setae forming straight row. *Pygidium*: Lateral and apical margin with bead. Apex rounded. *Venter*: Abdomen with 7 exposed segments; segments setosely punctate, punctures and setae variable. Pleural membrane with 6 spiracles. Tergite with 1 spiracle. *Legs*: Surface setosely punctate; punctures and setae variable. Protarsomere  $1\frac{3}{4}$  length of 2, 2 long, subequal in length to 5, 3–4 short, sub-globose, subequal in length to each other; 5 twice as long as 4. Metatibial apex with 2 spurs and 1 spine; spine between 2 spurs, long, attenuate, with sharp point at apex (Figs. 8a–c). Mesotarsomere and metatarsomere 1 longer than 2–4, 2–4 subequal to each other, 5 subequal to 2–4. Tarsal claws simple. Unguitractor plate with sides parallel, with 2 apical setae. *Parameres*: Figs. 9c.

Female. Females differ from males in the following respects: length 5.0–12.0 mm; width 3.0–6.5 mm. *Legs*: Metatibial apex with 1 spine; spine short, broadly attenuate, with blunt point at apex (Fig. 8d).

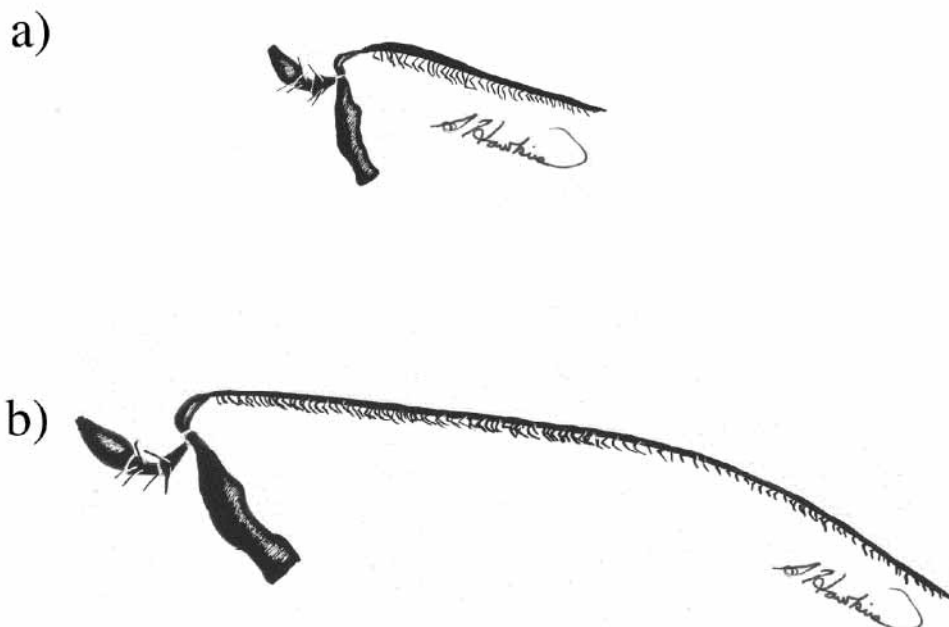
*Diagnosis*

*Arctodium* is differentiated from *Lichnia* by the shorter galea in *Arctodium* that is less than half the length of the entire body (Figs. 5a, 7a). In *Lichnia* the galea is more elongated and extends at least half the length of the entire body (Figs. 5b, 7b). Also, the mandible of *Arctodium* is toothed (Fig. 6a), whereas the mandible of *Lichnia* is smooth and rounded (Fig. 6b). The distribution range for *Arctodium* (Figs. 11, 12) extends further south than that of *Lichnia* (Fig. 10).



### Distribution

Species of *Arctodium* are found in central Chile from Region V (Valparaíso) to Region IX (La Araucanía) (Figs. 11, 12).



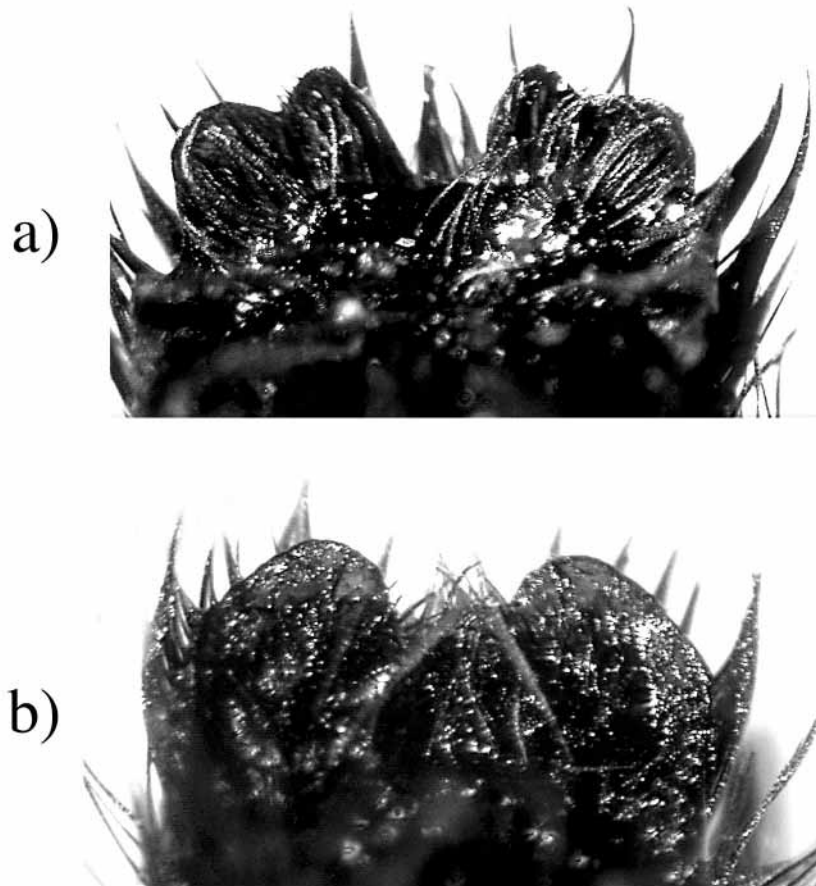
**FIGURES 5a–b.** Dorsal view of maxilla showing length of galea. a) *Arctodium discolor*; b) *Lichnia limbata*.

### Remarks

According to Chapin (1938), *Arctodium* Burmeister should replace *Cratoscelis* Erichson as the valid name of the genus. However, subsequent authors still incorrectly used *Cratoscelis* as the valid name. I agree with Chapin that *Cratoscelis* Erichson is not a valid name, because Lucas (1834) previously used the name *Cratoscelis* in connection with a plate of figures, including the spider species *Cratoscelis rufipes* Lucas and *Cratoscelis nigripes* Lucas (Araneae: Sicariidae). There is no description of these species, but the International Code of Zoological Nomenclature states (Article 12.1) that for a genus name published before 1931 to be valid, the publication must include a description, a definition, or an indication of the taxon (International Commission on Zoological Nomenclature 1999). Furthermore, the Code states (Article 12.2.7) that the publication of a genus name in conjunction with an illustration is sufficient as an indication. Therefore *Cratoscelis* Erichson, 1835 is a junior homonym of *Cratoscelis* Lucas, 1834, and *Arctodium* Burmeister should be the valid name.

*Arctodium* was proposed by Dejean (1833) in his catalog with *A. villosum* Dejean as the only species. However, there was no description, definition, or indication of *A. villosum*, and therefore the name *Arctodium* Dejean is a *nomen nudum* according to Article

12 of the Code (International Commission on Zoological Nomenclature 1999). It was Burmeister (1844) who first used the name as an invalid synonym of *Cratoscelis* Erichson in association with described species (*A. discolor* and *A. vulpina*), and it is to Burmeister (1844) that we attribute the name under Article 11.6.1 of the Code (International Commission on Zoological Nomenclature 1999).



**FIGURES 6a–b.** Dorsal view of labrum and mandibles showing form of the mandibles (a) dentate, *Arctodium vulpinum* or (b) rounded, *Lichnia limbata*.

***Arctodium discolor* (Erichson, 1835)**

(Figs. 5a, 9c, 11)

*Arctodium discolor* (Erichson 1835:269) (valid name).

*Cratoscelis discolor* Erichson 1835:269 (original combination).

*Catalog*

*Arctodium discolor*: Chapin 1938: 81 (transferred to *Arctodium* from *Cratoscelis*);  
Hawkins 2004 (online catalog).

*Cratoscelis discolor*: Erichson 1835: 269 (original description); Laporte 1840: 155 (catalog); Burmeister 1844: 10 (catalog); Blanchard 1850: 52 (catalog); Solier 1851: 121 (redescription and diagnoses); Lacordaire 1856: 162 (checklist); Harold 1869: 1094 (catalog); Philippi 1887: 685 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Blackwelder 1944: 216 (checklist); Hawkins 2004 (online catalog).

#### *Type specimens*

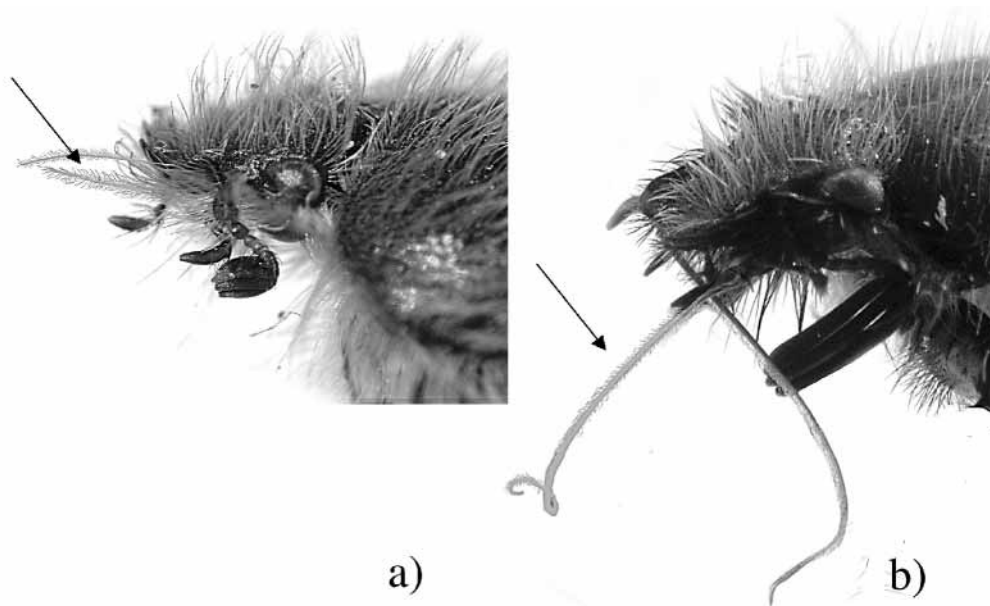
*Cratoscelis discolor* Erichson, neotype male at FMNH labeled: a) "Prov. ARAUCO/ Palo Botado/ 1-Febr. 1953/ Co. Il. L.E. Pena" (typeset), b) "FMNH, 1986/ L. Peña Coll./ Acc. # 17-422" (typeset), c) "Southern Neotropical Scarabs/ database #SH75980854/ *Arctodidium discolor* Erichson ♂/ DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), d) "*Arctodidium discolor*/ Erichson/ NEOTYPE ♂/ S.J. Hawkins" (red label, typeset). Neotype here designated. The original type was deposited at ZMHB, but Dr. Johannes Frisch and Joachim Willers were unable to find it. Likewise, Dr. Andrew Smith, who searched specifically for Lichniini types, was unable to find Erichson's *C. discolor* type at the ZMHB. Because I was unable to locate any specimens from the original type series in any other collection I visited or from which I borrowed specimens, I consider the type specimens to be lost. The total number of specimens in the original type series is unknown. Because no specimens from the original type series were located, and because the exact original type locality is unknown (Erichson gave only "Chile" as the type locality), I chose a neotype that was in good condition and matched the original species description closely. Type locality: Palo Botado, Region IX (La Araucania), Chile.

#### *Description*

Male. Length 7.0–9.5 mm; width 4.5–6.4 mm. *Color*: Head, pronotum, scutellum and pygidium black; venter and legs black (dark red to reddish black under microscope); elytra reddish brown. *Head*: Surface punctate; punctures small, dense, setose; setae long, moderately dense to dense, orange to black. Labrum with surface punctate; punctures small, dense, setose; setae short to moderately long, half as long as clypeal setae, dense, black. Mandibular external surface with short to moderately long, dense, black setae. Maxillary palpi with short, black, apical setae on all segments except last. Labial margins with moderately long, dense, black setae. Labial palpi with short, black, setae at apex of all segments except last. Eye canthus setose; setae long, dense, black. Antenna with pedicel setose, elongate, segment 2 globular, 3–6 subequal in length, 7–9 lamellate; club shorter than to subequal in length to segments 3–6 (Fig. 4b). *Pronotum*: Surface punctate; punctures small, moderately dense, with long, dense, bright orange setae. Anterior margin setose; setae short, dense, golden yellow to orange. Lateral margins setose; setae long, dense, white. Posterior margin setose; setae short to moderately long, dense, orange. *Scutellum*: Surface setose; setae moderately long, moderately dense, orange. *Elytron*: Form wide, half as wide as long. Surface depressed posteriorly, setosely punctate;

punctures small, moderately dense medially, dense laterally, with short, black setae around margins, long orange setae elsewhere. *Propygidium*: Surface exposed, covered with long, dense, white setae; setae overlaying basal 1/5 of pygidium (covered by elytra in some specimens), apices of setae forming straight row. *Pygidium*: Surface slightly concave apically, setose; setae long, dense, black. *Venter*: Thorax, mes- and metepisternum punctate; punctures small, dense, with black setae. Abdominal segments densely setose on lateral margin, sparsely setose medially; setae long, black. *Legs*: Surface setose; setae long, dense, black. Protibia slender, with 3 outer teeth and 2 inner teeth. Protibial spur small, 3/4 length of first tarsal segment. Metafemur broadly expanded. Metatibial apex with 2 spurs, 1 spine; spine between 2 spurs, longer than spurs, oblique at apex (Fig. 8c). *Parameres*: Fig. 9c.

Female. Females differ from males in the following respects: length 7.9–9.0 mm; width 4.4–5.5 mm. *Elytron*: Form moderately wide, less than half as wide as long. Surface convex, not depressed posteriorly. *Legs*: Metafemur slightly expanded. Metatibial apex with 1 spine; spine short, shorter than adjacent spurs, broadly attenuate at apex (Fig. 8d).



**FIGURES 7a–b.** Lateral view of beetles showing length of galea. a) *Arctodium vulpinum*; b) *Lichnia limbata*.

#### Diagnosis

*Arctodium discolor* is most similar to *A. vulpinum*. *Arctodium discolor* has brown elytra, black legs (dark red to reddish black under microscope) with black setae, and bright orange setae on the elytra and pronotum. *Arctodium vulpinum* has variable color of the elytra, legs, and setae but is not as in *A. discolor*. *Arctodium discolor* is also characterized by a square-like body form due to the elytra which are as wide as long when measured at

the widest and longest points. *Arctodium vulpinum* is more elongate because its elytra are longer than wide.

#### Remarks

For reasons unknown to me, very few females have been collected relative to males. Of the 163 specimens of *A. discolor* examined, only 6 were females.

#### Distribution

Central Chile in Region VIII (Biobío) and Region IX (La Araucania) (Fig. 11).

#### Locality data

164 specimens were examined from CASC, CMNC, CNCI, FMNH, HAHC, JMEC, MNHN, MNNC, UCCC, UMRM, USNM, VMDC, ZMHB.

CHILE. REGION VIII (BIOBO) (93): Caete (4), Contulmo (76), Lanahue (1), Nahuelbuta (2), Rio Cayucupil (10). REGION IX (LA ARAUCANIA) (61): Palo Botado (60), Puren (1). NO DATA (10).

#### Temporal data

January (29), February (112), December (21).

#### *Arctodium maldii* Hawkins, new species

(Figs. 4c, 8b, 12)

#### Type specimens

Male holotype, female allotype, and 271 paratypes (268 male, 3 female) in 18 institutions. Holotype male at FMNH labeled: a) "Prov. LINARES/ Cord. Parral/ Fdo. Malcho" (typeset), b) "Dic. 1956/ Coll M. Rivera" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc. # 17-422" (typeset), d) "Southern Neotropical Scarabs/ database #SH75982128/ ♂/ *Arctodium maldii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodium maldii*/ Hawkins/ HOLOTYPE ♂/ S.J. Hawkins (red label, typeset). Allotype female at FMNH labeled: a) "TREGUALEMU/ N. Costa Nuble/ 6,9 Dic-1953/ Coll: L.E. Pena" (typeset), b) "*Arctodium villosum* (Bl.)/ Det. A. Martinez 1971" (handwritten and typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), d) "Southern Neotropical Scarabs/ database #SH75982239/ ♀/ *Arctodium maldii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♀ hand-drawn), e) "*Arctodium maldii*/ Hawkins/ ALLOTYPE ♀/ S.J. Hawkins (red label, typeset). One female paratype at CASC labeled: a) "CHILE: 20 km./ E. of Temuco/ Cautin, I-8-51" (typeset), b) leg. Ross &/ Michelbacher" (typeset) c) *Lichnia*/ spec/ det. G. Frey, 1967/68/ (ohne Fühler) (typeset and handwritten in blue ink), d) "Southern Neotropical Scarabs/ database #SH75982240/ ♀/ *Arctodium maldii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♀

hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♀/ S.J. Hawkins (yellow label, typeset). Two paratype males (one at CASC, one at JMEC) labeled: a) "Chile, Malleco Prov./ Nahuelbuta Nat'l Pk./ 35 km.W Angol, II-12-/ 1967 E.I. Schlinger/ 1220m," b) "Collection of the/ California Academy/ of Science, San/ Francisco, Calif." (typeset), c) "Southern Neotropical Scarabs/ database #SH75982207, #SH75982212/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Six male paratypes (two at CNCI, three at CMNC, one at ABTS) labeled: a) "FUNDO MALCHO/ CORD. PARRAL" (typeset), b) Chile XII. 56/ Luis Pena, Coll." (typeset), c) "University/ of Missouri" (typeset, image of map of Missouri with letters M U), d) "Southern Neotropical Scarabs/ database #SH75982232-#SH75982233 (CNCI), #SH75982234 (ABTS), #SH75982235-#SH75982237 (CMNC)/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at CMNC labeled: a) Prov. NUBLE/ Fdo. Malcho/ Cord. Parral/ Dic. 1956/ Leg: M. Rivera" (typeset), b) *Arctodinium*/ sp./ Det. A. Martinez 1971" (typeset and handwritten), c) "Southern Neotropical Scarabs/ database #SH75982201 / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Two male paratypes at CMNC and one at ABTS labeled: a) "Prov. LINARES/ Cord. Parral/ Fdo. Malcho" (typeset), b) "Dic. 1957/ Coll. M. Rivera" (typeset), c) "Southern Neotropical Scarabs/ database #SH75982202 (ABTS), #SH75982203-#SH75982204 (CMNC)/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at HAHC labeled: a) "CARAMAVIDA/ Nahuelbuta (W)/ (Arauco)" (typeset), b) "1200, 1400 mt' / 1,6-Enero-1954/ Coll. L.E. Pena" (typeset), c) "H & A HOWDEN/ COLLECTION/ ex. A. Martinez coll." (typeset), d) "*Arctodinium villosum* (Bl.)/ Det. A. Martinez 1971" (typeset and handwritten), "Southern Neotropical Scarabs/ database #SH75982205/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Eight male paratypes at FMNH labeled: a) "Prov. NUBLE/ 10 km. E. Coihueco/ 27 Dic. 1967/ Coll. L.E. Pena" (typeset), b) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), c) "Southern Neotropical Scarabs/ database #SH75981973, #SH75981974, #SH759822041, #SH75982062, #SH75982071, #SH75982072, #SH75982075, #SH75982080/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) "Peillem-Pelle/ 600, 800 m/ Nahuelbuta W" (typeset), b) "(Arauco)/ 14,29 Enero-54/ Coll: L.E. Pena" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), d) "Southern Neotropical Scarabs/ database #SH75982070/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e)

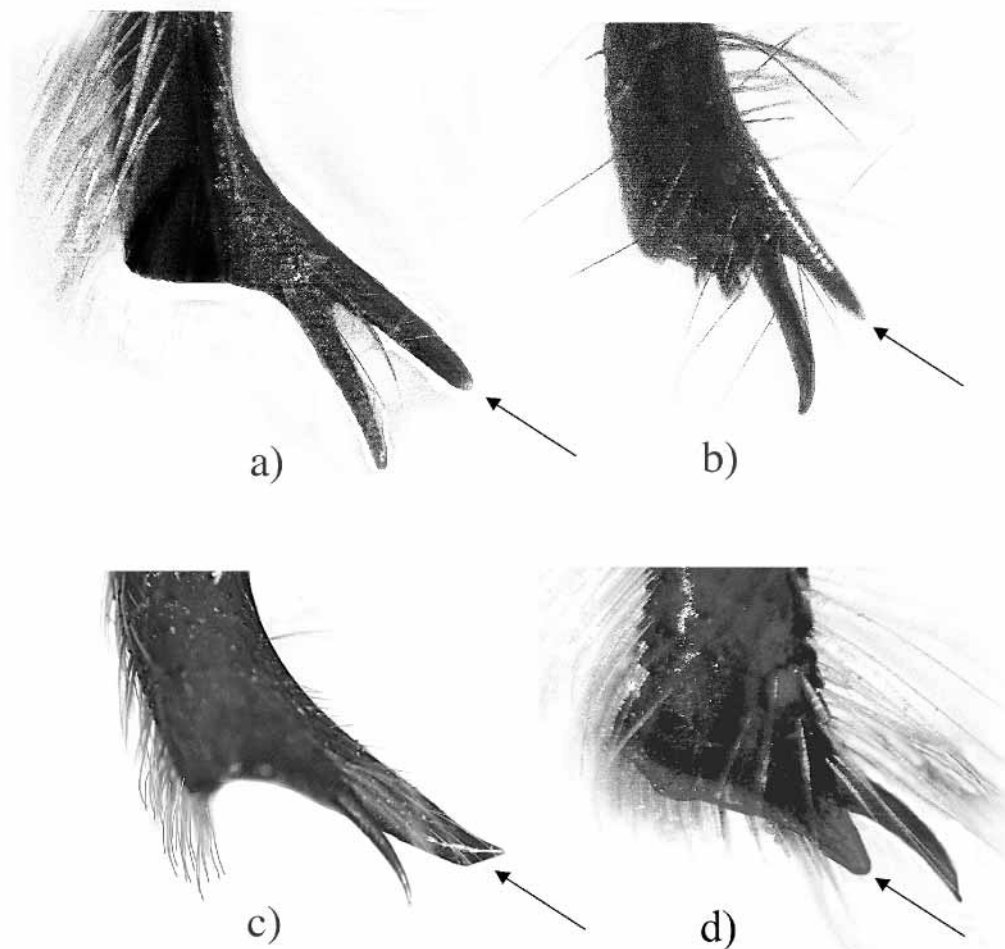
“*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) “CARAMAVIDA/ Nahuelbuta (W)/ (Arauco)” (typeset), b) “(Arauco) 750 m/ 25, 31 Dic-53/ Coll. L.E. Pena” (typeset), c) “FMNH, 1986/ L. Peña Coll./ Acc # 17-422” (typeset), d) “Southern Neotropical Scarabs/ database #SH75982063, / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) “CARAMAVIDA/ Nahuelbuta (W)” (typeset), b) “(Arauco) 750 m/ 25, 31 Dic-53/ Coll. L.E. Pena” (typeset), c) “FMNH, 1986/ L. Peña Coll./ Acc # 17-422” (typeset), d) “*Arctodinium*/ sp./ Det. A. Martinez 1971” (handwritten and typeset), “Southern Neotropical Scarabs/ database #SH75982064, / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) “CARAMAVIDA/ Nahuelbuta (W)” (typeset), b) “(Arauco) 750 m/ 25, 31 Dic-53/ Coll. L.E. Pena” (typeset), c) “FMNH, 1986/ L. Peña Coll./ Acc # 17-422” (typeset), d) “*Arctodinium villosum* (Bl.)/ Det. A. Martinez 1971” (handwritten and typeset), “Southern Neotropical Scarabs/ database #SH75982065, / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Four male paratypes at FMNH labeled: a) “CARAMAVIDA/ Nahuelbuta (W)/ (Arauco)” (typeset), b) “1200,1400 mt/ 1/6 Enero-1954/ Coll: L.E. Pena” (typeset), c) “FMNH, 1986/ L. Peña Coll./ Acc # 17-422” (typeset), d) “Southern Neotropical Scarabs/ database #SH75982066-#SH75982069, / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Four male paratypes at FMNH labeled: a) “Prov. LINARES/ Cord. Parral/ Fdo. Malcho” (typeset), b) “Dic. 1956/ Coll. M. Rivera” (typeset), c) “*Arctodinium*/ sp./ Det. A. Martinez 1971” (handwritten and typeset), d) “FMNH, 1986/ L. Peña Coll./ Acc # 17-422” (typeset), e) “Southern Neotropical Scarabs/ database #SH75981978, #SH75982082, #SH75982194, #SH75982197 / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), f) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) “Prov. LINARES/ Cord. Parral/ Fdo. Malcho” (typeset), b) “Dic. 1957/ Coll. M. Rivera” (typeset), c) “*Arctodinium*/ sp./ Det. A. Martinez 1971” (handwritten and typeset), d) “FMNH, 1986/ L. Peña Coll./ Acc # 17-422” (typeset), e) “Southern Neotropical Scarabs/ database #SH75982042 / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), f) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Five male paratypes at FMNH labeled: a) “FUNDO MALCHO/ Pre-Cord. Parral/ Octubre, 1956/ Leg. M. Rivera” (typeset), b) “FMNH, 1986/ L. Peña Coll./ Acc # 17-422” (typeset), c) “Southern Neotropical Scarabs/ database #SH75981979, #SH75982043, #SH75982044, #SH75982079, #SH75982081 / ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), d) “*Arctodinium mahdii*/

Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) "FUNDO MALCHO/ Pre-Cord. Parral/ Octubre, 1956/ Leg. M. Rivera" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), d) "Southern Neotropical Scarabs/ database #SH75982077 / ♂ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Four male paratypes at FMNH labeled: a) "FUNDO MALCHO/ Pre-Cord. Parral/ Diciembre, 1956/ Leg. M. Rivera" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), d) "Southern Neotropical Scarabs/ database #SH75982058, #SH75982059, #SH75982076, #SH75982078/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Two male paratypes at FMNH labeled: a) "FUNDO MALCHO/ Pre-Cord. Parral/ Enero, 1957/ Leg. M. Rivera" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), d) "Southern Neotropical Scarabs/ database #SH75982073, #SH75982074/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) "FUNDO MALCHO/ Pre-Cord. Parral/ Abril-1957/ Coll. L.E. Pena" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), d) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at FMNH labeled: a) "Las Trancas/ Chillan Chile/ I-III 1984/ Coll. S. Ocar" (typeset), b) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), c) "Southern Neotropical Scarabs/ database #SH75982061/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Nine male paratypes at FMNH labeled: a) "Prov. NUBLE/ Fdo. Malcho/ Cord. Parral" (typeset), b) "Dic 1956/ Leg. M. Rivera" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), d) "Southern Neotropical Scarabs/ database #SH75981975, #SH75982170, #SH75982171, #SH75982172, #SH75982174, #SH75982175, #SH75982179, #SH75982181, #SH75982182/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Nineteen male paratypes at FMNH labeled: a) "Prov. LINARES/ Cord. Parral/ Fdo. Malcho" (typeset), b) "Dic. 1957/ Coll. M. Rivera" (typeset), c) "FMNH, 1986/ L. Peña Coll./ Acc # 17-422" (typeset), e) "Southern Neotropical Scarabs/ database #SH75981954, #SH75981976, #SH75981989, #SH75981991, #SH75982054, #SH75982055, #SH75982096, #SH75982097, #SH75982099, #SH75982108, #SH75982109, #SH75982110, #SH75982111, #SH75982114, #SH75982127, #SH75982136, #SH75982144, #SH75982145, #SH75982196/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005" (typeset, ♂ hand-drawn), e) "*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One hundred forty-five male paratypes (2 at TAMU, 3 at UCCC, 3 at FSCA, 5 at UNSM, 3 at AMNH, 3 at BMNH, 3 at MNHN, 3 at ZMHB, 17 at MNNC, 22 at USNM,



80 at FMNH) labeled: a) “Prov. LINARES/ Cord. Parral/ Fdo. Malcho” (typeset), b) “Dic. 1956/ Coll. M. Rivera” (typeset), c) FMNH, 1986/ L. Peña Coll. Acc # 17-422” (typeset), d) “Southern Neotropical Scarabs/ database #SH75981950–#SH75981953, #SH75981955–#SH75981972, #SH75981977, #SH75981980–#SH75981988, #SH75981990, #SH75981992– #SH75982000, #SH75982045–#SH75982053, #SH75982056, #SH75982057, #SH75982060, #SH75982083–#SH75982095, #SH75982098, #SH75982100–#SH75982107, #SH75982112, #SH75982113, #SH75982115–#SH75982126, #SH75982129–#SH75982135, #SH75982137–#SH75982143, #SH75982146–#SH75982169, #SH75982173, #SH75982176–#SH75982178, #SH75982180, #SH75982183–#SH75982193, #SH75982195/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Two male paratypes at JMEC labeled: a) “Chile ÑUBLE/ Atacalco/ 4-XII-2003/ leg. J. Mondaca E” (typeset), b) “Southern Neotropical Scarabs/ database #SH75982214, #SH75982215/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins” (yellow label, typeset). Two male paratypes at JMEC labeled: a) “CHILE MALLECO/ P.N. Nahuelbuta/ Coimalin/ 19-I-2003/ leg. E. Benavides” (typeset), b) “Southern Neotropical Scarabs/ database #SH75982211, #SH75982213/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins” (yellow label). One male paratype at JMEC labeled: a) “CHILE MALLECO/ P.N. Nahuelbuta/ Coimalin/ 15-I-2004/ leg. E. Benavides” (typeset), b) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label). One female paratype at JEBC labeled: a) “CHILE, prov./ Melleco, Nahuelbuta/ ene 2001/ leg. J.E. Barriga” (typeset), b) “Coleccion/ J.E. BARRIGA/ CHILE 128879” (typeset), c) “Southern Neotropical Scarabs/ database #SH75982241/ ♀/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♀ hand-drawn), d) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♀/ S.J. Hawkins (yellow label). One female paratype at USNM labeled: a) “Chile/ Temuco” (typeset), b) “Dec 10, ‘50/ J. Hope” (typeset), c) “14 =/ Temuco/ Fdo Trianow/ 10-XII-50/ Coll. Hope” (handwritten), d) “Southern Neotropical Scarabs/ database #SH75982238/ ♀/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♀ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♀/ S.J. Hawkins (yellow label). Three male paratypes at VMDC labeled a) “Nahuelbuta/ Parque/ Cabreria/ 10.I.1978/ P. Cerda B” (handwritten), b) “COLL CERDA/ MNHN CHILE” (typeset), “Southern Neotropical Scarabs/ database #SH75982198, #SH75982199, #SH75982206/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label). One male paratype at VMDC labeled: a) Nuble/ Chillan/ P. Marchant/ 24.1.1989/ E. M. Roitman” (typeset), b) “COLL CERDA/ MNHN CHILE” (typeset), “Southern Neotropical Scarabs/ database #SH75982200/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005”

(typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label). Three male paratypes at MNNC labeled: a) “Chile Cautin/ Coñaripe/ 22.12.1979/ Coll. D. Jackson/ (typeset), b) “Southern Neotropical Scarabs/ database #SH75982208–#SH75982210/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label). Four male paratypes at UMRM labeled: a) “Caramavida Chile:/ Caramavida/ 1/6 Jan. 1954” (typeset), b) “Southern Neotropical Scarabs/ database #SH75982216–#SH75982219/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). One male paratype at UMRM labeled: a) “Chile: Alto Nahuelbuta/ 16 Jan. 1954/ 1000–1400M:” (typeset), b) “Southern Neotropical Scarabs/ database #SH75982220/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label). Four male paratypes at UMRM labeled: a) “Pillim Pili/ 5 Jan. 1954/ 600–800M” (typeset), b) “Southern Neotropical Scarabs/ database #SH75982221–#SH75982224/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Three male paratypes at UMRM labeled: a) “Alto Caicupil/ 7 Jan. 1954/ 1200–1300M” (typeset), b) “Southern Neotropical Scarabs/ database #SH75982225–#SH75982227/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Four male paratypes at UMRM labeled: a) “Caramavida/ Chile” (handwritten), b) “XII.25.53/ Luis Pena” (handwritten), c) “University/ of/ Missouri” (typeset, image of map of Missouri with letters U M), d) “Southern Neotropical Scarabs/ database #SH75982228–#SH75982231/ ♂/ *Arctodinium mahdii* Hawkins / DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂/ S.J. Hawkins (yellow label, typeset). Fifteen male paratypes at JMEC labeled: a) “CHILE CAUTIN PROV./ PUCÓN/ 26-XII-2005/ leg. C. Fortino” (typeset), b) “Southern Neotropical Scarabs/ database #AS2603113-AS2603127/ *Arctodinium mahdii* Hawkins ♂/ DET: A.B.T.SMITH 2006” (typeset), e) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂” (yellow label, typeset). Four male paratypes at MNNC labeled: a) “CHILE: VIII Región (BIOBÍO/ Chillán Los Lleuques/ 15 January 2005/ G Moreno” (typeset), b) “Southern Neotropical Scarabs/ database #AS2603109-AS2603112/ *Arctodinium mahdii* Hawkins ♂/ DET: A.B.T.SMITH 2006” (typeset), c) “*Arctodinium mahdii*/ Hawkins/ PARATYPE ♂” (yellow label, typeset).

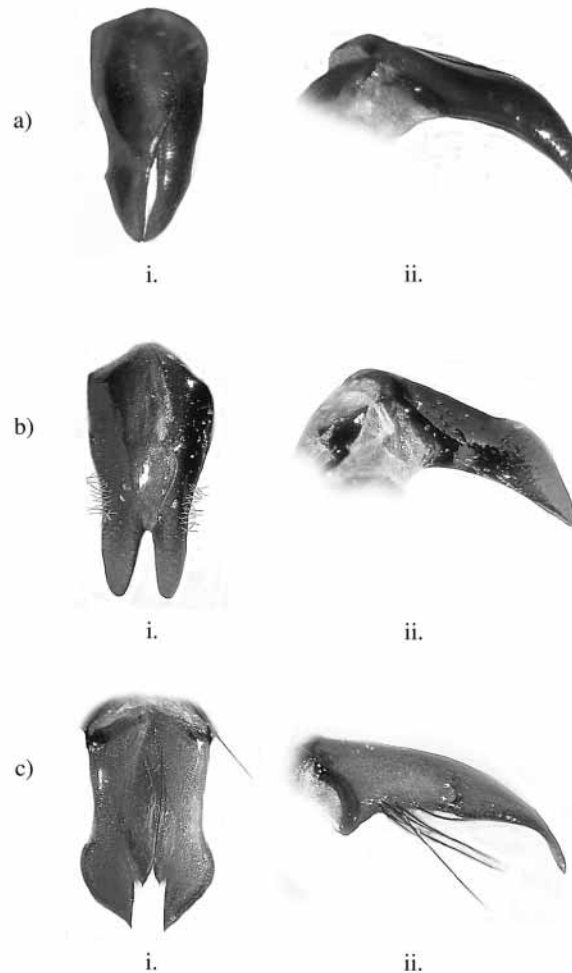


**FIGURES 8a–d.** Metatibial apex showing apical spine (arrow) and adjacent spur. a) *Arctodidium planum* male; b) *A. mahdii* male; c) *A. vulpinum* male; d) *A. vulpinum* female.

*Discription*

Holotype. Male. Length 6.5 mm, width 3.9 mm. *Color*: All body parts reddish black. *Head*: Surface punctate; punctures small, dense, setose; setae long, moderately dense, black. Labrum with surface punctate; punctures small, dense, setose; setae short, half as long as clypeal setae, dense, black. Mandibular external surface with moderately long, dense, black setae. Maxillary palpi with short, black apical setae on all segments except last. Labial margins with moderately long, dense, black setae. Labial palpi with short, black, setae at apex of all segments except last. Eye canthus setose; setae long, dense, black. Antenna with pedicel setose, elongate, segment 2 globular, 3–6 subequal in length, 7–9 lamellate; club slightly longer than segments 2–6 (Fig. 4c). *Pronotum*: Surface punctate; punctures small, moderately dense, with long, dense, black setae. Lateral margins setose; setae long, dense, black. Posterior margin setose; setae moderately long,

dense, grayish black. *Scutellum*: Surface setose; setae moderately long, moderately dense, gray. *Elytron*: Form moderately wide, less than half as wide as long. Surface slightly convex, punctate; punctures small, moderately dense medially, dense laterally, setose; setae short medially, moderately long laterally, black. *Propygidium*: Surface exposed, covered with moderately long, dense, grey setae; setae overlaying basal 1/5 of pygidium), apices of setae forming straight row. *Pygidium*: Surface slightly concave apically, setose; setae long, moderately dense, black. *Venter*: Thorax, mes- and metepisternum punctate; punctures small, sparse, with moderately long, gray setae. Abdominal segments sparsely setose; setae long, gray. *Legs*: Surface setose; setae long, dense, gray. Protibia slender, with 3 outer teeth and 1 inner tooth (Fig. 3a). Protibial spur 1.5 times length of first tarsal segment. Metafemur slightly expanded. Metatibial apex with 2 spurs, 1 spine; spine between 2 spurs, spine shorter than spurs, narrow, attenuate at apex (Fig. 8b). Parameres: Fig. 9c.



**FIGURES 9a–c.** Caudal (i) and lateral (ii) views of parameres. a) *Lichnia gallardoii*; b) *L. limbata*; c) *Arctodium discolor*.

Allotype. Female. Length 6.5 mm, width 4.2 mm. As holotype except in the following respects. *Color*: Elytra brownish orange, legs reddish brown, setae on head, clypeus, elytra, pygidium, venter, abdomen, and legs golden yellow. *Head*: Antennal club short, slightly shorter than or subequal to segments 3–6 (Fig. 4b). *Legs*: Protibia expanded (Fig. 3b). Metatibial apex with 1 spine; spine short, shorter than adjacent spurs, not narrow, broadly attenuate at apex (Fig. 8d).

Variation. Male: length 5.0–6.5 mm, width 3.4–4.2 mm. Female: length 5.2–6.5, width 3.3–4.5. Paratypes differ from the holotype and allotype in the following respects. *Color*: Elytra variable: brownish orange, reddish black, or black. Setae on head, clypeus, elytra, pygidium, venter, abdomen, and legs moderately long to long, color variable: black, dark brown, gray, or golden yellow.

#### *Etymology*

*Arctodinium mahdii* is named after my husband Mahdi, for his support and encouragement of my work on scarab beetles.

#### *Diagnosis*

*Arctodinium mahdii* is easily distinguished from all other species of *Arctodinium* because of its smaller size; it is the only species that is less than 6.5 mm long. It is also the only species of *Arctodinium* in which the spine on the metatibial apex is shorter than the adjacent spurs (Fig. 8b). In all other species of *Arctodinium*, the spine on the metatibial apex is longer than the adjacent spur (Fig. 8a, c). The male antennal club is longer in proportion to its body size (Fig. 4c) than all other species of *Arctodinium* (Fig. 4b), but it is not as long as the antennal club of males of *Lichnia limbata* (Fig. 4a). Because of its small size, *A. mahdii* may superficially resemble species of *Lichnia* if generic characters are not checked with a microscope. *Arctodinium mahdii* can be easily distinguished from either species of *Lichnia* by examining the apex of the mandibles which are rounded and without teeth in *Lichnia* (Fig. 6a) versus bidentate (Fig. 6b) in *A. mahdii*.

#### *Remarks*

While elytral and setal color are variable (see description) in *A. mahdii*, the elytra of males are more often reddish-black to black, and setae on all parts of the body are usually dark brown, black, or gray. The elytra of females are more often brownish orange, and the setae on all parts of the body are most often golden yellow with some black setae on the apex of the head, mouthparts, and eye canthus. However, the full variation of color as stated in the species description can occasionally be seen in both sexes.

*Arctodinium mahdii* has characters that show affinities with species of both *Lichnia* and *Arctodinium*. *Arctodinium mahdii* and species of *Lichnia* are similar in size. The male antennal club of *A. mahdii* is sexually dimorphic as in *L. limbata* (Figs. 4a–b), and the female protibia are expanded while the male protibia are slender as in both species of *Lichnia* (Figs. 3a–b). Also, the spine on the tibial apex of males of *A. mahdii* (Fig. 8b) is smaller

than in males of other species of *Arctodium* (Figs. 8a, c), but it is more strongly modified into a spine than in males of *Lichnia*. *Arctodium mahdii* may have an evolutionary relationship intermediate to the two genera. Because in *A. mahdii* the galea is only slightly elongate (Figs. 5a, 7a) and the apex of the mandibles are bidentate (Fig. 6a), I place this species in the genus *Arctodium*. Furthermore, despite the many morphological differences between *A. mahdii* and the other species of *Arctodium*, I have not designated it as a new genus because of the genitalia, which are remarkably similar to all other species of *Arctodium* (Fig. 9c) and different from *Lichnia* (Figs. 9a–b).

Many collections have specimens of *A. mahdii* labeled as *C. villosa* (= *A. vulpinum*), but Blanchard's type specimen of *C. villosa* does not exhibit any of the apomorphic characters of *A. mahdii*.

For unknown reasons, females are rare in collections. Of the 272 specimens examined, only four were female.

#### *Distribution*

Central Chile Region VII (Maule) to Region IX (La Araucania) (Fig. 12), especially abundant at Fundo Malcho, which used to be forested at the time when the specimens examined were collected. However, this area is now almost entirely deforested and has been developed into pine plantations (Paulsen 2005).

#### *Locality data*

274 specimens were examined from AMNH, BMNH, CASC, CMNC, CNCI, FSCA, FMNH, JEBC, JMEC, MNHN, MNNC, TAMU, UCCC, UMRM, UNSM, USNM, VMDC, ZMHB.

CHILE. REGION VII (MAULE) (201): Fundo Malcho (201). REGION VIII (BIOBÍO) (45): Alto Caicupil (3), Alto de Nahuelbuta (1), Atacalco (2), Cabreria (3), Caramavida (16), Chillan (2), Coihueco (8), Coimallin (2), Nahuelbuta (1), Peillén Pille (1), Pilim Pili (4), Temuco (1), Tregualemu (1). REGION IX (LA ARAUCANIA) (28): Angol (1), Cautin (3), Coñaripe (3), Los Lleuques (4), Nahuelbuta (1), Pucón (15), Temuco (1).

#### *Temporal data*

January (29), February (2), October (64), December (171).

#### ***Arctodium planum* (Blanchard, 1850)**

(Figs. 8a, 11)

*Arctodium planum* (Blanchard 1850: 52). **New combination.**

*Cratoscelis plana* Blanchard 1850: 52 (original combination).

*Cratoscelis canicapilla* Philippi & Philippi 1864: 326. **New synonymy.**

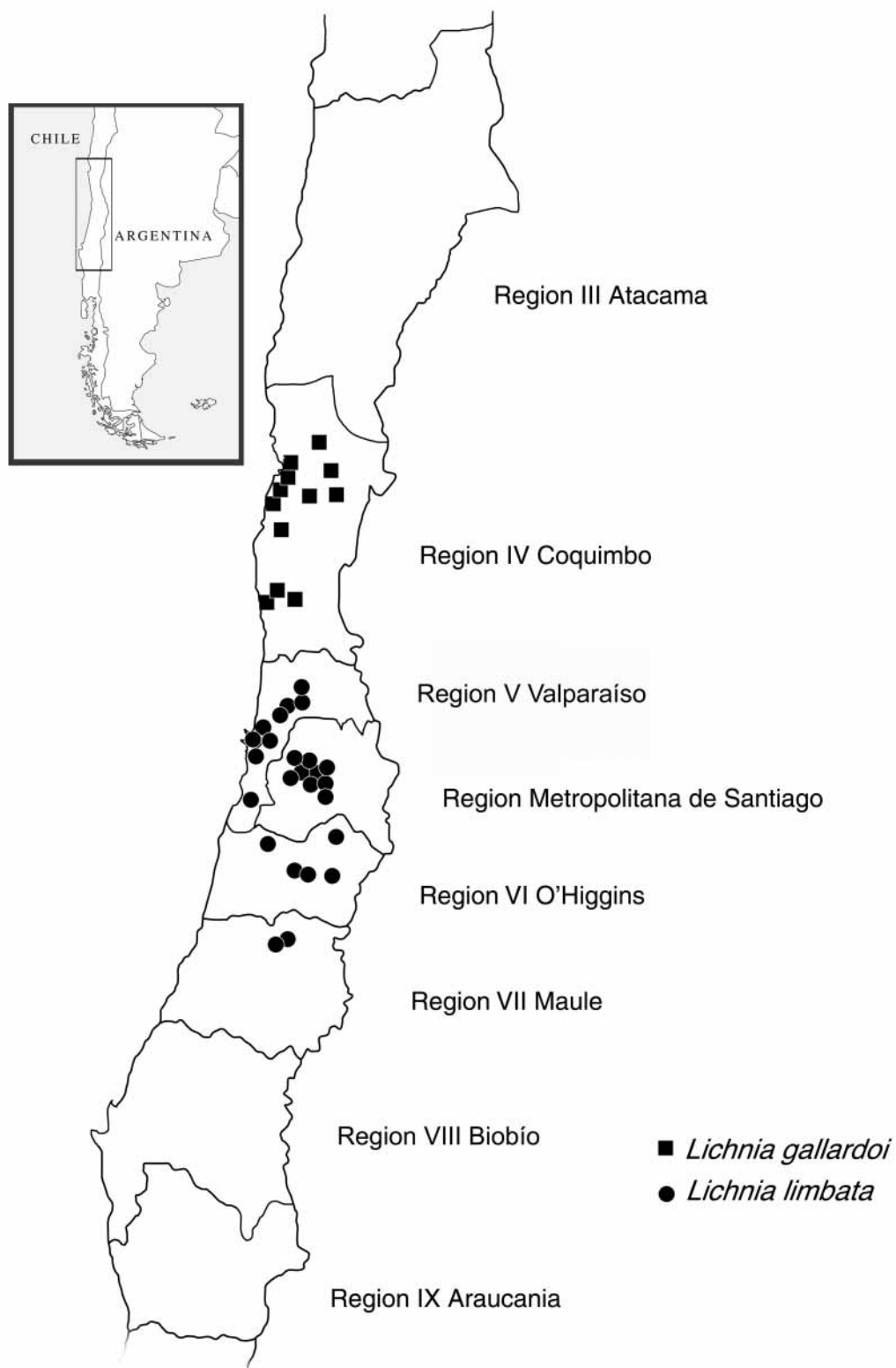
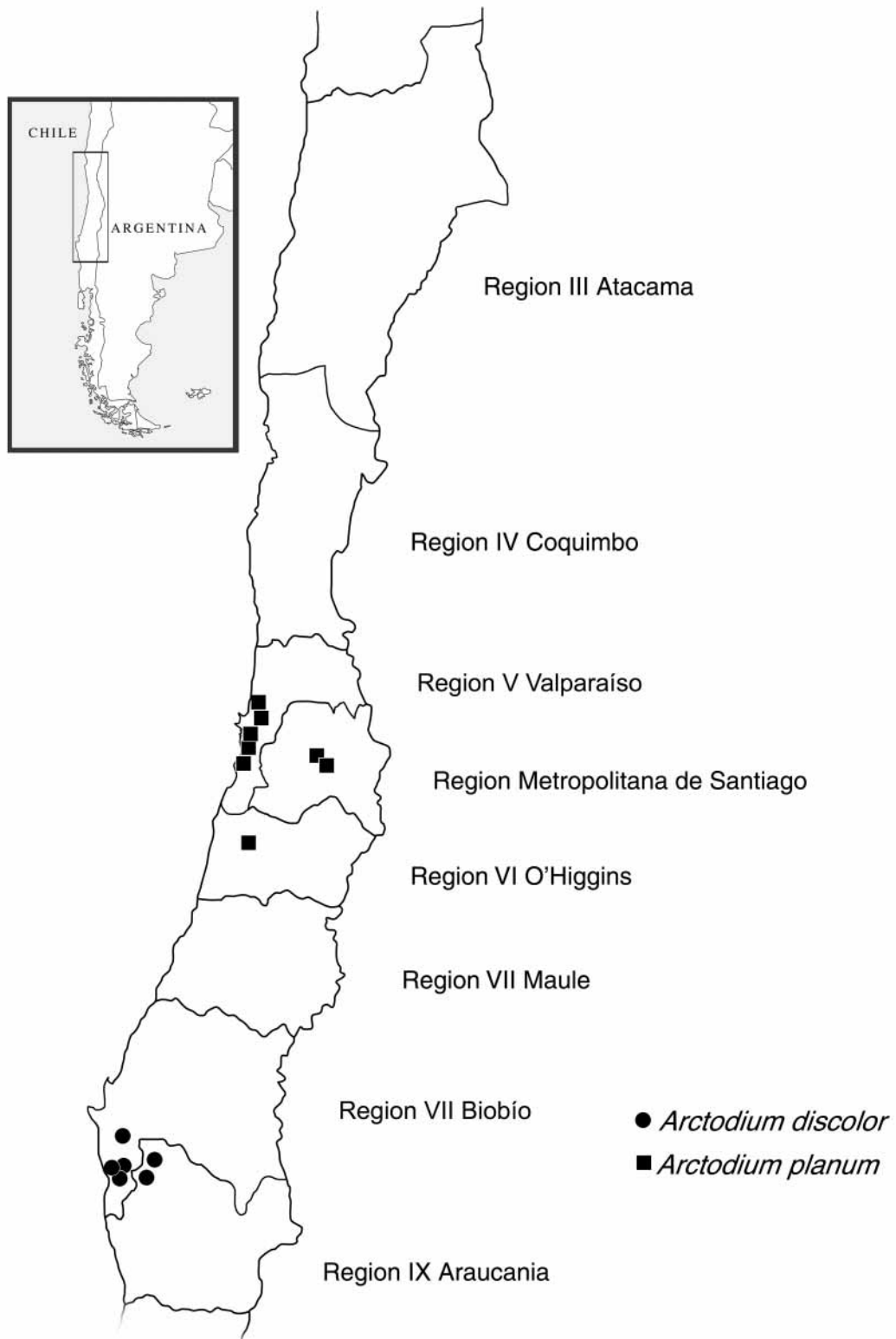


FIGURE 10. Map of central Chile showing distribution of *Lichnia gallardoi* and *L. limbata*.



**FIGURE 11.** Map of central Chile showing distribution of *Arctodium discolor* and *A. planum*.



*Catalog*

*Cratoscelis plana*: Blanchard 1850: 52 (original description); Solier 1851: 120 (redescription and diagnoses); Lacordaire 1856: 162 (checklist); Philippi & Philippi 1864: 326 (comparison with *Cratoscelis canicapilla*); Philippi 1887: 685 (catalog); Redtenbacher 1868: 61 (catalog); Harold 1869: 1094 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Blackwelder 1944: 216 (checklist); Hawkins 2004 (online catalog).

*Cratoscelis canicapilla*: Philippi & Philippi 1864: 326 (original description); Philippi 1887: 685 (catalog); Harold 1869: 1094 (catalog); Arrow 1912: 6 (catalog); Blackwelder 1944: 216 (checklist); Hawkins 2004 (online catalog).

*Type specimens*

*Cratoscelis plana* Blanchard, lectotype male at MNHM labeled: a) “M. Gay/ 18?9./ Chili” (round green label, handwritten on underside, third digit of date on line two of label is obscured by pinhole), b) “*C. plana*./ Cat. mus./ Chili/ M. Gay.” (large green label, handwritten), c) “Southern Neotropical Scarabs/ database #SH75981044/ *Arctodidium planum* Blanchard ♂/ DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), d) “*Arctodidium planum*/ Blanchard/ LECTOTYPE ♂/ S.J. Hawkins” (red label, typeset). Lectotype here designated. Blanchard (1850) stated that he based his concept of *C. plana* only on males, but he did not indicate how many specimens were in the type series. The location and existence of other paralectotypes is unknown. Type locality: Chile.

*Cratoscelis canicapilla* Philippi & Philippi, neotype male at USNM labeled: a) CHILE: Valpo./ P.N. Penuelas/ 28 Oct. 1969./ O.S. Flint Jr., b) “Southern Neotropical Scarabs/ database #SH75980999/ *Arctodidium planum* Blanchard ♂/ DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), c) *Cratoscelis canicapilla*/ Philippi and Philippi/ NEOTYPE ♂/ S.J. Hawkins” (red label, typeset). **Neotype here designated.** The original type was deposited in the MNNC. The curator, Mario Elgueta, and I searched together in the collections at the MNNC but did not find any specimens from the original type series of *C. canicapilla*. Unfortunately, many Philippi (1887) and Philippi & Philippi (1864) types in Santiago were lost or are unidentified because they were not properly labeled. No Philippi & Philippi types of Lichniini were found in any other collections I visited or from which I obtained loans. A neotype was chosen that was in condition that closely matched Philippi & Philippi’s description, and which was from the coast of Valparaíso, a typical locality for the species. See remarks for an explanation of synonymy with *A. planum*. Type locality: Parque Nacional Peñuelas, Region V (Valparaíso), Chile.

*Description*

Male. Length 6.5–9.3 mm; width 3.9–6.2 mm. *Color*: Head, pronotum, scutellum, and pygidium black; venter and legs brown; elytra brown. *Head*: Surface obscured by setae; setae long, dense, pale yellow. Labrum with surface obscured by setae; setae short to

moderately long, half as long as clypeal setae, dense, pale yellow. Mandibular external surface with short to moderately long, dense, pale yellow setae. Maxillary palpi with short, pale yellow, apical setae on all segments except last. Labial margins with moderately long, dense, pale yellow setae. Labial palpi with short, pale yellow setae at apex of all segments except last. Eye canthus setose; setae long, dense, pale yellow. Antenna with pedicel setose, elongate, segment 2 globular, 3–6 subequal in length, 7–9 lamellate; club subequal in length to segments 2–6 or to 3–6 (Fig. 4b). *Pronotum*: Surface setosely punctate, obscured by setae; setae, long, moderately dense to dense, pale yellow. Anterior margin setose; setae short, dense, pale yellow to golden yellow. Lateral margins setose; setae long, dense, white to pale yellow. Posterior margin setose; setae moderately long to long, dense, pale yellow. *Scutellum*: Surface setose; setae long, moderately dense, pale yellow. *Elytron*: Form moderately wide, less than half as wide as long. Surface strongly depressed, obscured by setae; setae long, dense laterally, moderately dense medially, pale yellow. *Propygidium*: Surface exposed, covered with long, dense, white setae; setae overlaying basal 1/5 of pygidium (covered by elytra in some specimens), apices of setae forming straight row. *Pygidium*: Surface obscured by setae; setae long, dense, pale yellow. *Venter*: Thorax, mes- and metepisternum setose; setae dense, long, pale yellow. Abdominal segments densely setose; setae long, pale yellow. *Legs*: Surface setose; setae long, dense, pale yellow. Protibia slender, with 3 outer teeth and 2 inner teeth. Protibial spur small, 3/4 length of first tarsal segment. Metafemur broadly expanded. Metatibial apex with 2 spurs, 1 spine; spine between 2 spurs, longer than spurs, narrow, attenuate at apex (Fig. 8a). *Parameres*: Fig. 9c.

Female. Females of *A. planum* are unknown.

### Diagnosis

*Arctodium planum* is characterized by its long, dense, pale yellow setae covering all parts of the body. While some specimens of *A. vulpinum* may also have pale colored setae on some parts of the body, the setae are not usually as long, dense, or pale yellow. Setae of *A. vulpinum* are typically more golden brown. Other species of *Arctodium* do not have pale setae. *Arctodium planum* is the only species that has pale colored setae on the apices of the segments of the maxillary and labial palps and a fringe of pale yellow setae along the eye canthus. All other species of Lichniini have dark colored (brown, gray, or black) setae on the mouthparts and eye canthus. *Arctodium planum* males are also characterized by the metatibial apex, which is modified into a spine that is slender and attenuate and is longer than the adjacent spurs (Fig. 8a). Males of *A. vulpinum* and *A. discolor* also have a long spine that is longer than the adjacent spurs, but the shape is different. The metatibial spine of males of *A. vulpinum* and *A. discolor* is much broader and oblique towards the apex (Figs. 8c). Males of *A. mahdii* have a metatibial spine that is shorter than the adjacent spur (Fig. 8b).

*Remarks*

While the original Philippi & Philippi type series of *Cratoscelis canicapilla* is lost (see Type Specimens section), there is evidence in the original description to indicate that *C. canicapilla* is a junior synonym of *Arctodium planum*. First, Philippi & Philippi characterize *C. canicapilla* by the pale setae covering the body and particularly by the “white lash-like hairs on the side of the head, while that of other species is black.” These pale setae are also what Blanchard (1850) used to characterize *C. plana*. Also, according to Philippi & Philippi’s description, *C. canicapilla*, like *A. planum*, is of a distinctly small size, being four German lines long (approximately 8.8 mm including the head). Furthermore, the type locality for *C. canicapilla* is Valparaíso, which is where most specimens of *A. planum* are found. All other characters used by Philippi & Philippi to describe *C. canicapilla* match characters of *A. planum*, and no characters were provided that differ from *A. planum*. I conclude that *C. canicapilla* is conspecific with *A. planum*. See the Taxonomic History section for an explanation of authorship of *C. canicapilla*.

*Distribution*

Central Chile in Region V (Valparaíso), Region VI (O’Higgins), and Region Metropolitana de Santiago (Fig. 11).

*Locality data*

99 specimens were examined from BMNH, FMNH, HAHC, JMEC, LEMQ, MNHN, MNNC, UCCC, USNM.

CHILE. REGION METROPOLITANA DE SANTIAGO (13): Leyda (1), Macul (1), Peumo (2), Pilay (8), Santiago (1). REGION V (VALPARAÍSO) (66): Algarrobo (2), El Quisco (3), LloLleo (17), Malvilla (1), Peuelas (38), Quebrada Verde (1), Rodelillo (1), San Antonio (3). REGION VI (O’HIGGINS) (2): Matanza (1), Rinconada de Idahue (1). NO DATA (18).

*Temporal data*

January (14), September (1), October (37), November (21), December (6).

***Arctodium vulpinum* (Erichson, 1835)**

(Figs. 2, 6a, 7a, 8c, 12)

*Arctodium villosum* Dejean 1833: 167 (*nomen nudum*).

*Arctodium vulpinum* (Erichson 1835: 269) (valid name).

*Cratoscelis vulpina* Erichson 1835: 269 (original combination).

*Cratoscelis aterrima* Blanchard 1850: 53. **New synonymy.**

*Cratoscelis gayana* Blanchard 1850: 53. **New synonymy.**

*Cratoscelis villosa* Blanchard 1850: 53. **New synonymy.**

*Cratoscelis striolata* Redtenbacher 1868: 61. **New synonymy.**

*Cratoscelis obscura* Germain 1911: 68 (*nomen nudum*).

*Cratoscelis margine-costata* Germain 1911: 68 (*nomen nudum*).

### Catalog

*Arctodium villosum*: Dejean 1833: 167 (first usage, without description, catalog); Dejean 1836: 186 (catalog); Burmeister 1844: 10 (catalog listing as synonym of *Cratoscelis vulpina* Erichson); Lacordaire 1856: 162 (checklist).

*Arctodium vulpinum*: Chapin 1938: 81 (transferred to *Arctodium* Burmeister from *Cratoscelis* Erichson); Hawkins 2004 (online catalog).

*Cratoscelis vulpina*: Erichson 1835: 269, Pl.3, Fig.5; Laporte 1840: 155; Burmeister 1844: 10 (redescription); Curtis 1845: 455 (catalog, note on mouthparts); Blanchard 1850: 52 (catalog); Solier 1851: 119–122, Plate 17, Fig. 10 (redescription and illustrations); Lacordaire 1856: 162 (checklist); Philippi 1887: 685 (catalog); Redtenbacher 1868: 61 (catalog); Harold 1869: 1094 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Chapin 1938: 80 (designated as type species of *Arctodium*); Blackwelder 1944: 216 (checklist); Machatschke 1959: 530, 532, 541 (illustrations); Hawkins 2004 (online catalog).

*Cratoscelis aterrima*: Blanchard 1850: 53 (original description); Solier 1851: 122 (redescription and diagnoses); Lacordaire 1856: 162 (checklist); Philippi 1887: 685 (catalog); Redtenbacher 1868: 61 (catalog); Harold 1869: 1094 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Blackwelder 1944: 216 (checklist); Machatschke 1959: 530, 532, 533 (illustrations), 539 (distribution map); Hawkins 2004 (online catalog).

*Cratoscelis gayana* Blanchard 1850: 53 (original description); Solier 1851: 121,122 (redescription and diagnosis); Lacordaire 1856: 162 (checklist); Philippi & Philippi 1864: 326 (usage, comparison with *Cratoscelis canicapilla*); Harold 1869: 1094 (catalog); Philippi 1887: 685 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Blackwelder 1944: 216 (checklist); Machatschke 1959: 530, 532, 533 (illustrations), 539 (distribution map); Hawkins 2004 (online catalog).

*Cratoscelis villosa*: Blanchard 1850: 53 (original description); Solier 1851: 121 (redescription and diagnoses); Philippi & Phillip 1864: 326 (usage, comparison with *Cratoscelis canicapilla*); Lacordaire 1856: 162 (checklist); Harold 1869: 1094 (catalog); Philippi 1887: 685 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Blackwelder 1944: 216 (checklist); Machatschke 1959: 530, 532, 533 (illustrations), 539 (distribution map); Hawkins 2004 (online catalog).

*Cratoscelis striolata*: Redtenbacher 1868: 61 (original description); Philippi 1887: 685 (catalog); Harold 1869: 1094 (catalog); Germain 1911: 68 (catalog); Arrow 1912: 6 (catalog); Blackwelder 1944: 216 (checklist); Machatschke 1959: 530, 532, 533 (illustrations), 539 (distribution map); Hawkins 2004 (online catalog).

*Cratoscelis obscura*: Germain 1911: 68 (first usage, without description, catalog); Hawkins 2004 (online catalog).

*Cratoscelis margine-costata*: Germain 1911: 68 (first usage, without description,

catalog); Hawkins 2004 (online catalog).

*Type specimens*

*Cratoscelis vulpina*, lectotype male at ZMHB labeled: a) “*vulpina* Er.” (handwritten), b) “*vulpina*/ Erichs./ Chili” (large, green, square label, handwritten), c) “Southern Neotropical Scarabs/ database #SH75981045/ *Arctodidium vulpinum* Erichson ♂/ DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), d) “*Cratoscelis vulpina*/ Erichson/ LECTOTYPE ♂/ S.J. Hawkins” (red label, typeset). Lectotype here designated. Erichson (1835) did not indicate how many specimens were in the type series. The location and existence of paralectotypes is unknown. Type locality: Chile.

*Cratoscelis aterrima* Blanchard, lectotype female at MNHM labeled: a) “7/ 49” (round green label, handwritten on underside), b) “*C. aterrima*./ Cat. mus./ Chili/ M. Gay.” (large green label, handwritten), c) “Valparaiso/ 72,” d) “Southern Neotropical Scarabs/ database #SH75982035/ *Arctodidium vulpinum* Erichson ♀/ DET: S.J. Hawkins 2005” (typeset, ♀ hand-drawn), d) “*Cratoscelis aterrima*/ Blanchard/ LECTOTYPE ♀/ S.J. Hawkins” (red label, typeset). Lectotype here designated. One female paralectotype at MNHN labeled: a) “4196/ 34” (round green label, handwritten on underside), b) “Southern Neotropical Scarabs/ database #SH7592036/ *Arctodidium vulpinum* Erichson ♀/ DET: S.J. Hawkins 2005” (typeset, ♀ hand-drawn), c) “*Cratoscelis aterrima*/ Blanchard/ PARALECTOTYPE ♀/ S.J. Hawkins (yellow label, typeset). One female paralectotype at MNHN labeled: a) “15/ 45” (round green label, handwritten on underside), “Southern Neotropical Scarabs/ database #SH7592037/ *Arctodidium vulpinum* Erichson ♀/ DET: S.J. Hawkins” (typeset, ♀ hand-drawn), c) “*Cratoscelis aterrima*/ Blanchard/ PARALECTOTYPE ♀/ S.J. Hawkins (yellow label, typeset). One female paralectotype at MNHN labeled: a) “15/ 45” (round green label, handwritten on underside), c) “*Cratoscelis* ?????” (sic) (handwriting not legible), d) “Southern Neotropical Scarabs/ database #SH7592038/ *Arctodidium vulpinum* Blanchard ♀/ DET: S.J. Hawkins 2005” (typeset, ♀ hand-drawn), e) “*Cratoscelis aterrima*/ Blanchard/ PARALECTOTYPE ♀/ S.J. Hawkins (yellow label, typeset). One male paralectotype at MNHN labeled: a) “4/ 49” (round green label, handwritten on underside), b) “Southern Neotropical Scarabs/ database #SH75982039/ *Arctodidium vulpinum* Erichson ♂/ DET: S.J. Hawkins 2005” (typeset, ♂ hand-drawn), c) “*Cratoscelis aterrima*/ Blanchard/ PARALECTOTYPE ♂/ S.J. Hawkins (yellow label, typeset). The specimens in the type series were obtained from Claude Gay. Blanchard (1850) did not indicate how many specimens were in the type series. The location and existence of other paralectotypes is unknown. See remarks section for an explanation of synonymy. Type locality: Valparaíso, Region V (Valparaíso), Chile.

*Cratoscelis gayana* Blanchard, lectotype female at MNHM labeled: a) “15/ 45” (round green label, handwritten on underside), b) “Coquimbo” (handwritten) c) “*C. gayana*/ Cat. Mus./ Chili/ M. Gay” (large green label, handwritten), d) “Southern Neotropical Scarabs/ database #SH75982032/ *Arctodidium vulpinum* Erichson ♀/ DET: S.J. Hawkins 2005”

(typeset, ♀ hand-drawn), e) “*Cratoscelis gayana*/ Blanchard/ LECTOTYPE ♀/ S.J. Hawkins” (red label, typeset). Lectotype here designated. Two female paralectotypes at MNHN labeled: a) “15/ 45” and “670/ 97” (round green label, handwritten on underside), b) “Southern Neotropical Scarabs/ database #SH75982033/ *Arctodium vulpinum* Erichson ♀/ DET: S.J. Hawkins 2005” and “Southern Neotropical Scarabs/ database #SH75982034/ *Arctodium vulpinum* Erichson ♀/ DET: S.J. Hawkins 2005” (typeset, ♀ hand-drawn), c) “*Cratoscelis gayana*/ Blanchard/ PARALECTOTYPE ♀/ S.J. Hawkins (yellow label, typeset). Blanchard (1850) did not indicate how many specimens there were in the type series. The location and existence of other paralectotypes is unknown. See remarks section for an explanation of synonymy. Type locality: Region IV (Coquimbo), Chile.

*Cratoscelis villosa* Blanchard, lectotype female at MNHM labeled: a) “3065/ 40” (round green label, handwritten on underside, b) “*C. villosa*./Dej./ Chili./ M. Gay.” (large green label, handwritten), c) “Southern Neotropical Scarabs/ database #SH75982031/ *Arctodium vulpinum* (Erichson) ♀/ DET: S.J. Hawkins 2005” (typeset, ♀ hand-drawn), d) “*Arctodium villosum*/ Blanchard/ LECTOTYPE ♀/ S.J. Hawkins” (red label, typeset). Lectotype here designated. Blanchard (1850) stated that he based his concept of *C. villosa* on females but did not indicate how many specimens were in the type series. The location and existence of other paralectotypes is unknown. See remarks section for an explanation of synonymy. Type locality: Chile.

*Cratoscelis striolata* Redtenbacher, lectotype male at NMWH labeled: a) “Zelevator/ Novara” (typeset), b) “Z” (typeset), c) “Type” (handwritten), d) “TYPUS” (red, rectangular label, typeset), e) “Striolata/ Chili. Rdt” (rectangular label with octagonal, black border, handwritten), f) “Southern Neotropical Scarabs/ database #AS2603128 / *Arctodium vulpinum* (Erichson) ♀/ DET: A.B.T. Smith 2006” (typeset), g) “*Cratoscelis striolata*/ Redtenbacher/ Shauna Hawkins/ Lectotype/ ♀” (red label with black border, handwritten). Lectotype here designated. Paralectotype male at NMWH labeled: a) “Zelevator/ Novara” (typeset), b) “Z” (typeset), c) “TYPUS” (red, rectangular label, typeset), d) “*Cratoscelis striolata*/ Type. Redtb.” (handwritten), e) “Southern Neotropical Scarabs/ database #AS2603129/ *Arctodium vulpinum* (Erichson) ♀/ DET: A.B.T. Smith 2006” (typeset), f) “*Cratoscelis striolata*/ Redtenbacher/ Shauna Hawkins/ Paralectotype ♀” (handwritten). The location and existence of other paralectotypes is unknown. See remarks section for an explanation of synonymy. Type locality: Chile.

#### Description

Male. Length 8.0–12.0 mm; width 5.0–7.6 mm. *Color*: Head, pronotum, scutellum, and pygidium black; venter and legs reddish brown to black; elytra dull brown to chestnut brown. *Head*: Surface punctate; punctures small, dense, setose; setae moderately long, moderately dense to dense, golden yellow to golden brown. Labrum with surface punctate; punctures small, dense, setose; setae short to moderately long, half as long as clypeal setae, dense, golden brown to black. Mandibular external surface with short to moderately

long, dense, black setae. Maxillary palpi with short, black, apical setae on all segments except last. Labial margins with moderately long, dense, black setae. Labial palpi with short, black setae at apex of all segments except last. Eye canthus setose; setae long, dense, black. Antenna with pedicel setose, elongate, segment 2 globular, 3–6 subequal in length, 7–9 lamellate; club subequal in length to segments 3–6 (Fig. 4b). *Pronotum*: Surface punctate; punctures small, dense, with long, dense, golden yellow to golden brown setae. Anterior margin setose; setae short, dense, golden brown. Lateral margins setose; setae long, dense, golden yellow to golden brown. Posterior margin setose; setae short to moderately long, dense, golden yellow to golden brown. *Scutellum*: Surface setose; setae moderately long, moderately dense, golden brown. *Elytron*: Form moderately wide, less than half as wide as long. Surface flat, punctate; punctures small, moderately dense medially, dense laterally, setose; setae moderately long, golden yellow to golden brown. *Propygidium*: Surface exposed, covered with long, dense, white setae; setae overlaying basal 1/5 of pygidium (covered by elytra in some specimens), apices of setae forming straight row. *Pygidium*: Surface slightly concave apically, setose; setae long, dense, golden brown, dark brown, or black. *Venter*: Thorax, mes- and metepisternum punctate; punctures small, dense, with golden brown setae. Abdominal segments densely setose on lateral margin, sparsely setose medially; setae long, golden brown. *Legs*: Surface setose, setae long, dense, golden yellow to golden brown. Protibia slender, with 3 outer teeth and 2 inner teeth. Protibial spur small, 3/4 length of first tarsal segment. Metafemur broadly expanded. Metatibial apex with 2 spurs, 1 spine; spine between 2 spurs, longer than spurs, oblique at apex (Fig. 8c). *Parameres*: Fig. 9c.

Female. Females differ from males in the following respects: length 8.5–11.7 mm; width 4.5–6.2 mm. *Color*: Elytra, venter, legs, and setae as in males or elytra, venter, legs, and setae black in black female color morph. *Elytron*: Surface convex, not flat or depressed. *Legs*: Metatibial apex with 1 spine; spine shorter than adjacent spurs, broadly attenuate at apex (Fig. 8d).

### Diagnosis

*Arctodium vulpinum* is the most widespread and common species in the tribe Lichniini. It has a broad range of variation in morphological characters that make it a difficult species to diagnose. *Arctodium vulpinum* is, on average, the largest species of Lichniini, with males 8.0–12.0 mm long and females 8.5–11.7 mm long. Because there is some overlap in size (smaller specimens of *A. vulpinum* are as small as the largest specimens of *A. discolor* or *A. planum*), the best way to distinguish small specimens is by ruling out characters defining other species: *A. vulpinum* does not have a pale fringe of setae along the eye canthus as in *A. planum*, it does not have black setae on the legs and wide elytra giving it a square-like body form as in *A. discolor*, or it is not less than 6.5 mm long as in *A. mahdii*.

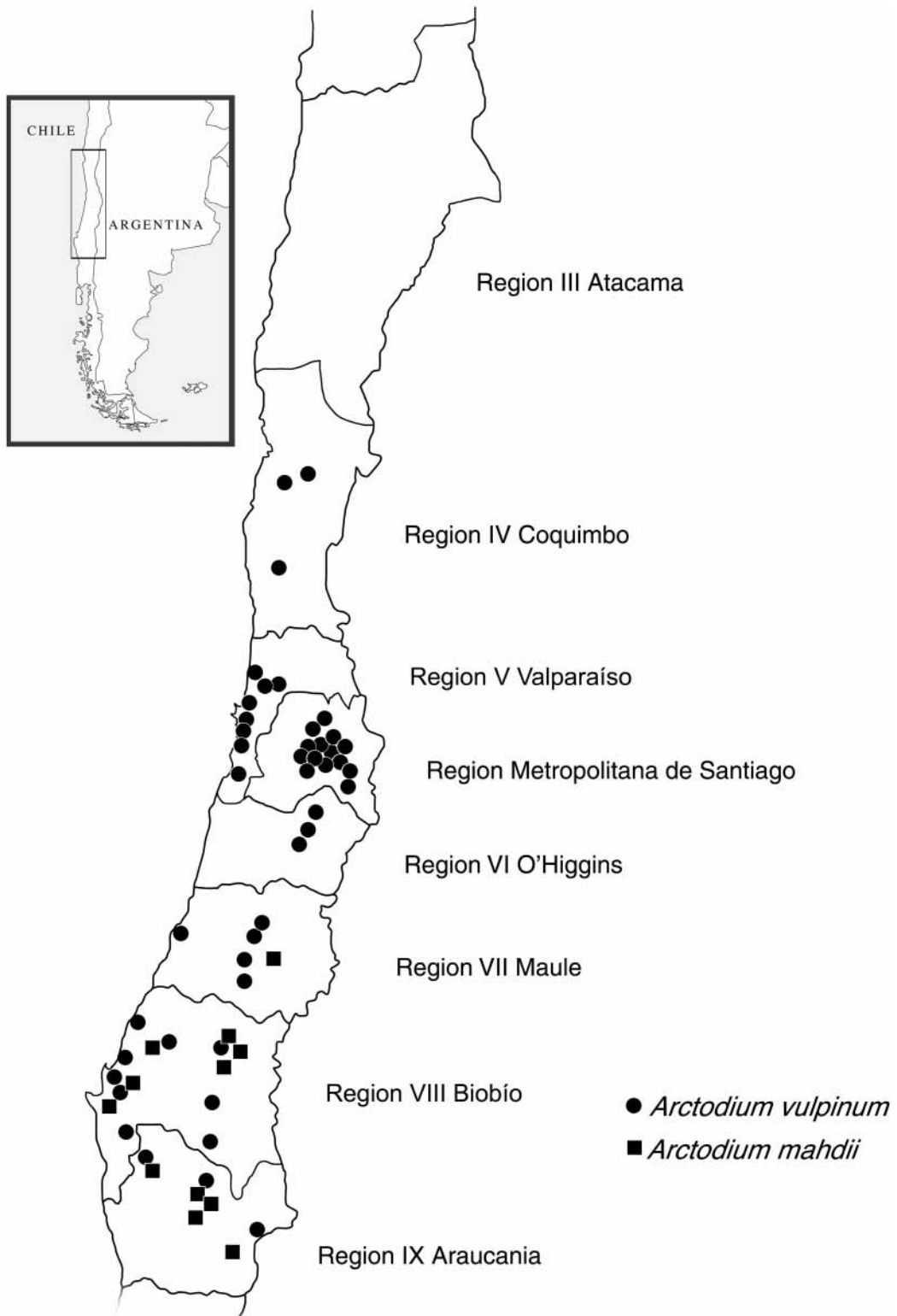


FIGURE 12. Map of central Chile showing distribution of *Arctodium vulpinum* and *A. mahdii*.



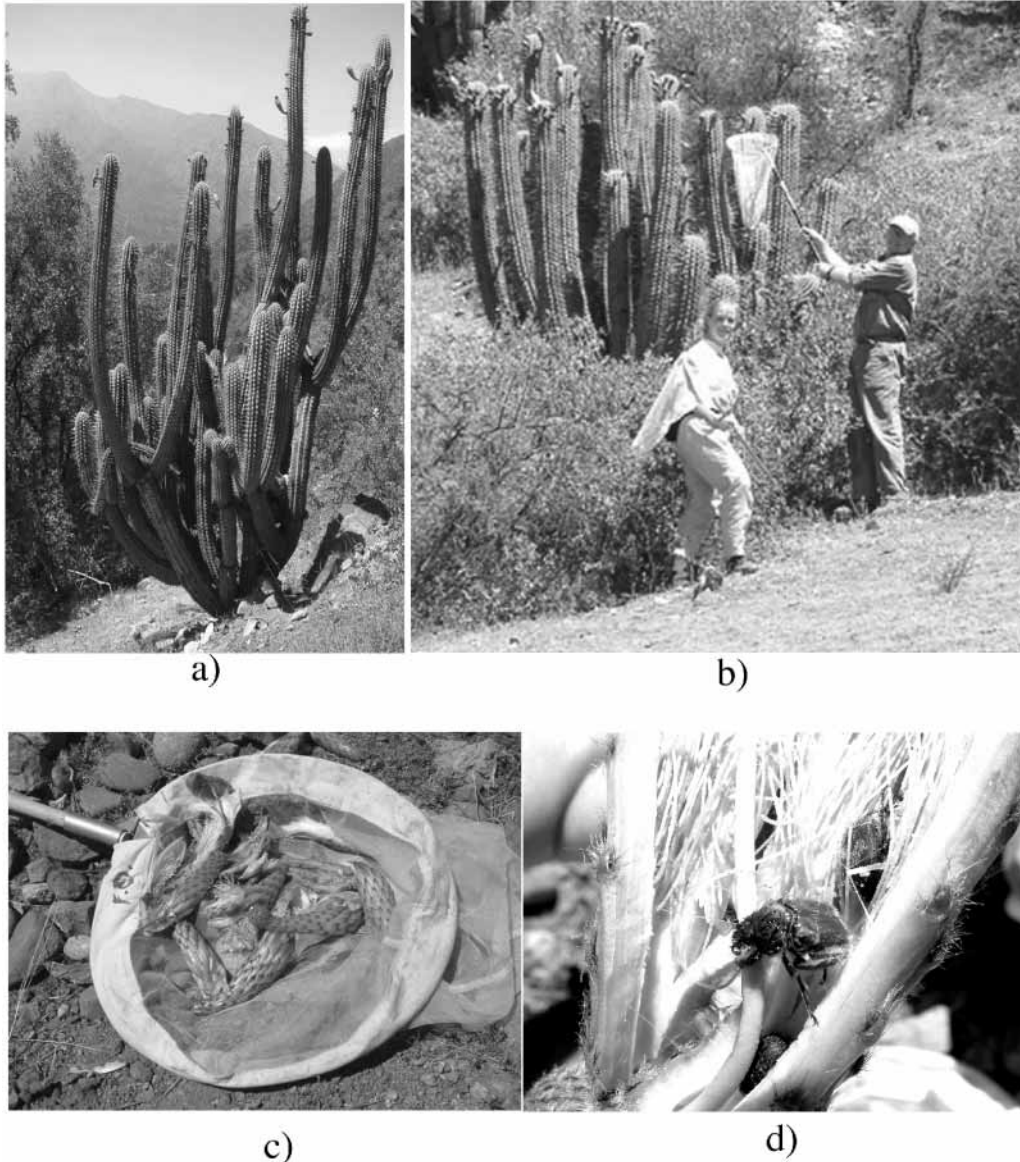
### Remarks

In Blanchard's (1850) description of *Cratoscelis aterrima*, he differentiated the species from others in the genus on the basis of the black color on all parts of the body. However, this species is based on a black color morph found in females of *A. vulpinum*. Aside from its black color, *C. aterrima* shares all other characters with *A. vulpinum*. I observed the more common brown morph males mating with black female morphs on flowers in Cajon del Maipo, Chile. In collections, series of *A. vulpinum* contain approximately one female black morph out of every eight female specimens collected. Although black color morphs have not been named as a subspecies in any publication, many collections have specimens labeled as *C. vulpina aterrima*. This is in keeping with my hypothesis that the black specimens should be classified as *A. vulpinum*, but I do not believe that black color morphs constitute a subspecies. Mayr (1963) defines a subspecies as "an aggregate of local populations of a species inhabiting a geographic subdivision of the range of the species, taxonomically separated from other populations of the species." Based on this definition, *C. aterrima* is not a subspecies because it is not an isolated subdivision of *A. vulpinum* but is found throughout the populations as a phenotypic variant.

Blanchard (1850) described *Cratoscelis gayana* based on the pattern of punctures on the elytra. According to Blanchard, the punctures of *C. gayana* form ordered, straight rows, whereas the punctures of other species of *Cratoscelis* are random. However, all species of Lichniini have at least one row of punctures that form a straight row at the inner margin of the elytra. Laterad from the inner margin of the elytra, the punctures become gradually more random. The extent to which the punctures become more random is variable from individual to individual. I have studied Blanchard's type series consisting of three females deposited in the MNHN and have noted that the rows Blanchard is referring to are not as ordered into straight lines as his description indicates, and they are not more so than in specimens of *A. vulpinum*. Furthermore, in specimens where the setae are rubbed off (from collection, rough handling, or due to the age of the specimen), as is the case with Blanchard's type series, punctures that seem to form rows seem more pronounced because the pattern of the punctures is more visible. If Blanchard was comparing specimens where the elytral setae were rubbed off with those where the setae were still intact, he might have erroneously divided the specimens into two species. Other characters Blanchard used to define *C. gayana*, such as body length, pattern and color of setae, and body shape, are consistent with characters for *A. vulpinum*. Therefore I conclude that *C. gayana* is conspecific with *A. vulpinum*.

Blanchard (1850) created the unnecessary name *Cratoscelis villosa* when trying to validate Dejean's species name *Arctodium villosum*, which was published without a description (see the Taxonomic History section). The name *A. villosum* Dejean was already synonymized with *C. vulpina* Erichson by Burmeister (1844). Because Blanchard (1850) was the first to publish a description in connection with the name *Cratoscelis*

*villosa*, it is a valid name that I here synonymize with *A. vulpinum*. I also confirmed this by studying Blanchard's single female type specimen deposited at MNHN.



**FIGURES 13a–d.** Photos from Cajon del Maipo, Chile showing: a) Host cactus (*Trichocereus* sp.) of *Arctodidium vulpinum*; b) Brett Ratcliffe and Mary Liz Jameson collecting cactus flowers containing *A. vulpinum*; c) cactus flowers in a net; d) *A. vulpinum* emerging from a peeled open cactus flower.

In Redtenbacher's (1868) description of *Cratoscelis striolatum*, all characters described are consistent with those of *A. vulpinum* in terms of length, width, color, shape, and setae. Redtenbacher claims to have studied other species of *Cratoscelis* and differentiates *C. striolatum* from other species in the genus based only on punctures,

especially of the pronotum, which he stated are dense in *C. striolatum*, with “gaps between the punctures not larger than the punctures themselves” (my translation). However, this is also true of the punctures of the pronotum of specimens of other species and a fine, line-like pattern can be observed to a varying degree in all species based on how clean the pronotum is and the quality of the light source. I conclude that *C. striolata* is conspecific with *A. vulpinum*.

While Germain’s (1911) two names, *Cratoscelis obscura* and *Cratoscelis margine-costata*, are *nomena nuda* (see Taxonomic History section), I mention them here because these names have been perpetuated in collections. Germain published these names without description in his catalog of the Coleoptera of the Museum of Chile. I have studied the Germain specimens at MNNC, and I conclude that he used the name *C. margine-costata* for brown morphs of *A. vulpinum* and *C. obscura* for black morphs of *A. vulpinum*. Germain did not describe any new species, and the names remain *nomina nuda*. Germain’s specimens correspond to numbers in his catalog: 1787 is on the label of the specimen he examined and on which he based the name *C. margine-costata*, and 1788 is on the *C. obscura* label.

#### *Distribution*

Widespread in central Chile from Region IV (Coquimbo) to Region IX (La Araucania) (Fig. 12).

#### *Locality data*

943 specimens were examined from BMNH, CASC, CMNC, CNCI, FMNH, HAHC, JEBC, JMEC, KSUC, LACM, LEMQ, MCZC, MNHN, MNNC, UCCC, UMRM, UNSM, USNM, VMDC, ZMHB, ZSMC.

CHILE. REGION IV (COQUIMBO) (77): Hurtado (1), Illapel (69), Socos (7). REGION V (VALPARAÍSO) (72): Aconcagua (7), Alfalfares (10), Algarrobo (5), Canelillos (13), Colliguay (2), El Guindal (3), El Quisco (1), El Salto (2), La Campana (2), Las Peñas (1), Limache (6), Llo-Lleo (2), Punta Horcón (1), Rodelillo (1), Vina del Mar (2), Zapallar (3), no data (11). REGION METROPOLITANA DE SANTIAGO (467): Alhue (1), Bella Vista (1), Cajon del Maipo (42), Cerro Manquehue (2), Chacabuco (12), Conchali (1), Cordillera El Tollo (3), Cuesta Barriga (5), El Canelo (40), El Clarillo (1), El Ingenio (1), El Manzano (25), El Noviciado (2), El Peumo (27), El Portezuelo (1), El Principal (4), El Tabo (3), Farellones (2), Florida (2), La Africana (15), La Obra (19), Laguna Carén (6), Lampa (6), Lo Marin (1), Macul (3), Maipu (30), Peñalolén (3), Pudahuel (63), Quebrada de San Ramon (29), Renca (13), Rio Clarillo (3), Rio Colorado (2), Rio Maipo (10), San Bernardo (16), San José de Maipo (5), Santiago (31), Talagante (4), Tiltill (4), Valle Ramon (33), Vizcachas (11). REGION VI (O’HIGGINS) (10): Las Nieves (1), Parral (5), Rancagua (2), Tanumé (1), Termas de Cauquenes (1). REGION VII (MAULE) (24): Constitucion (6), Curicó (1), Fundo Tregualemu (1), La Jaula (1), Pelluhue (1), Peunte Malcho (3), Rio de los Cipreses (5), San Clemente (3), Talca (3).

REGION VIII (BIOBÍO) (38): Chillan (1), Cobquecura (1), Concepción (21), Contulmo (7), El Salto del Laja (1), Mulchen (3), Nahuelbuta (1), Quilaco (1), Talcahuano (1), Temuco (1). REGION IX (LA ARAUCANIA) (4): Angol (1), Horcones (2), Icalma (1), Victoria (1). NO DATA (250).

#### *Temporal data*

January (98), February (22), October (140), November (268), December (243).

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