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## THE SCARAB BEETLES (COLEOPTERA : SCARABAEIDAE) OF PARQUE BICENTENARIO, EL SALVADOR

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## **The Scarab Beetles (Coleoptera: Scarabaeidae) of Parque Bicentenario, El Salvador**

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## THE SCARAB BEETLES (COLEOPTERA: SCARABAEIDAE) OF PARQUE BICENTENARIO, EL SALVADOR

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### ABSTRACT

Parque Bicentenario in the Área Natural Protegida El Espino-Bosque Los Pericos, considered the “last green lung of San Salvador”, is the most important forested area in central El Salvador. We performed a survey to provide the first inventory of scarab beetles (Scarabaeidae) of the park. Collections were conducted monthly for one year (August 2018–July 2019) by using baited pitfall, aerial, and ultraviolet light traps. Four subfamilies, nine tribes, 14 genera, 20 species (8% of the total richness of the family in El Salvador), and 1,584 individuals were captured. The most abundantly collected species in the park were the scarabaeines *Onthophagus batesi* Howden and Cartwright, *Onthophagus belorhinus* (Bates), *Dichotomius centralis* (Harold), *Coprophanaeus corythus* (Harold), *Dichotomius yucatanus* (Bates), and *Coprophanaeus boucardi* (Nevinson).

Keywords: biodiversity, conservation area, *Onthophagus*, *Dichotomius*, new department records

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### INTRODUCTION

El Salvador is the smallest country (21,041 km<sup>2</sup>) in Central America and the second most densely populated (6 million inhabitants) and deforested (14% vegetative cover remaining) in Latin America (Crespin and Simonetti 2016; Dull 2008; Zarzalejos 2018). The country has usually been little sampled for insects, mostly due to deforestation for agriculture and major disturbance of its forests, a situation that made the territory unfavored by naturalists throughout its history

(e.g., Godman 1915; Kaimowitz 1996; Terborgh 1999). However, some coleopterists have collected in the country (e.g., Howden and Peck 1972; Ratcliffe and Cave 2006). Only two Coleoptera families have updated checklists for the country: Chrysomelidae with 420 species (Van Roie *et al.* 2019) and Staphylinidae with 96 species (Pablo-Cea *et al.* 2021). The only subfamily of Scarabaeidae that has been systematically studied in El Salvador is Dynastinae, with 65 species (Ratcliffe and Cave 2006). The other subfamilies have received little attention and present many

gaps in the knowledge of the distribution of their species, including those widely studied in America (e.g., Pablo-Cea and Alfaro 2020).

Historically, an important natural area in El Salvador was the extinct Finca El Espino, considered “the last green lung of San Salvador” due to the ecosystem services it offers to the urban areas of Antiguo Cuscatlán, Santa Tecla, and the “gran San Salvador” (Martínez 2004). The farm was part of a coffee plantation complex that was formerly a settlement of indigenous people before the arrival of the Spanish. In 1980, it was expropriated by the Government of El Salvador in the “Reforma Agraria”, when it had an area of 8.04 km<sup>2</sup> (Martínez 2004; Velis-Polío 2012). Since 1986, illegal actions gradually led to the complex’s fragmentation (Martínez 2004). Currently, a 0.9-km<sup>2</sup> remnant of the farm constitutes Parque Bicentenario in the Área Natural Protegida El Espino-Bosque Los Pericos (SalvaNATURA 2012). Despite the area’s ecological destruction, remnants of biological diversity are still conserved there. The place is of interest to bird watchers, where at least 106 species are known (Andino and Galán 2011), as well as ten species of amphibians, 11 species of reptiles (Henríquez 2011),

and 25 species of mammals (Rodríguez 2011), making it the most important forested patch in the vicinity of San Salvador. Despite its importance, no beetle-related studies have been conducted at the site; thus, no Scarabaeidae have been documented in the park (Sorto 2011). The objective of our study was to inventory the fauna of Scarabaeidae in Parque Bicentenario for one year.

## MATERIAL AND METHODS

**Study Area.** Parque Bicentenario (13.69469°N, 89.25055°W) overlaps the shared border between the departments of San Salvador and La Libertad (Fig. 1). It lies within the Área Natural Protegida El Espino-Bosque Los Pericos, the largest green area in the zone, located on the slopes of Volcán de San Salvador and embedded in the coastal mountains (Andino and Galán 2011; Daugherty 1969; SalvaNATURA 2012). The park is within a mosaic of urban structures and coffee production areas (both abandoned and active) (SalvaNATURA 2012). Approximately 100 families inhabit the park, who have lived there for an average of 40 years (Diario Co Latino 2021). The vegetation is a mixture of

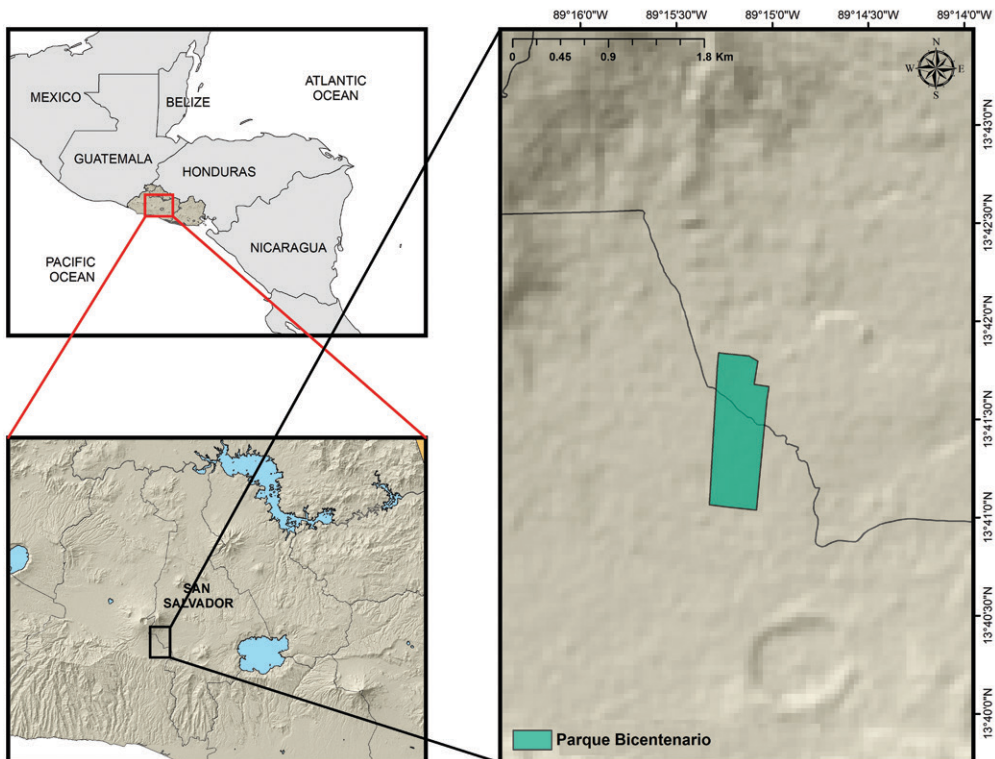
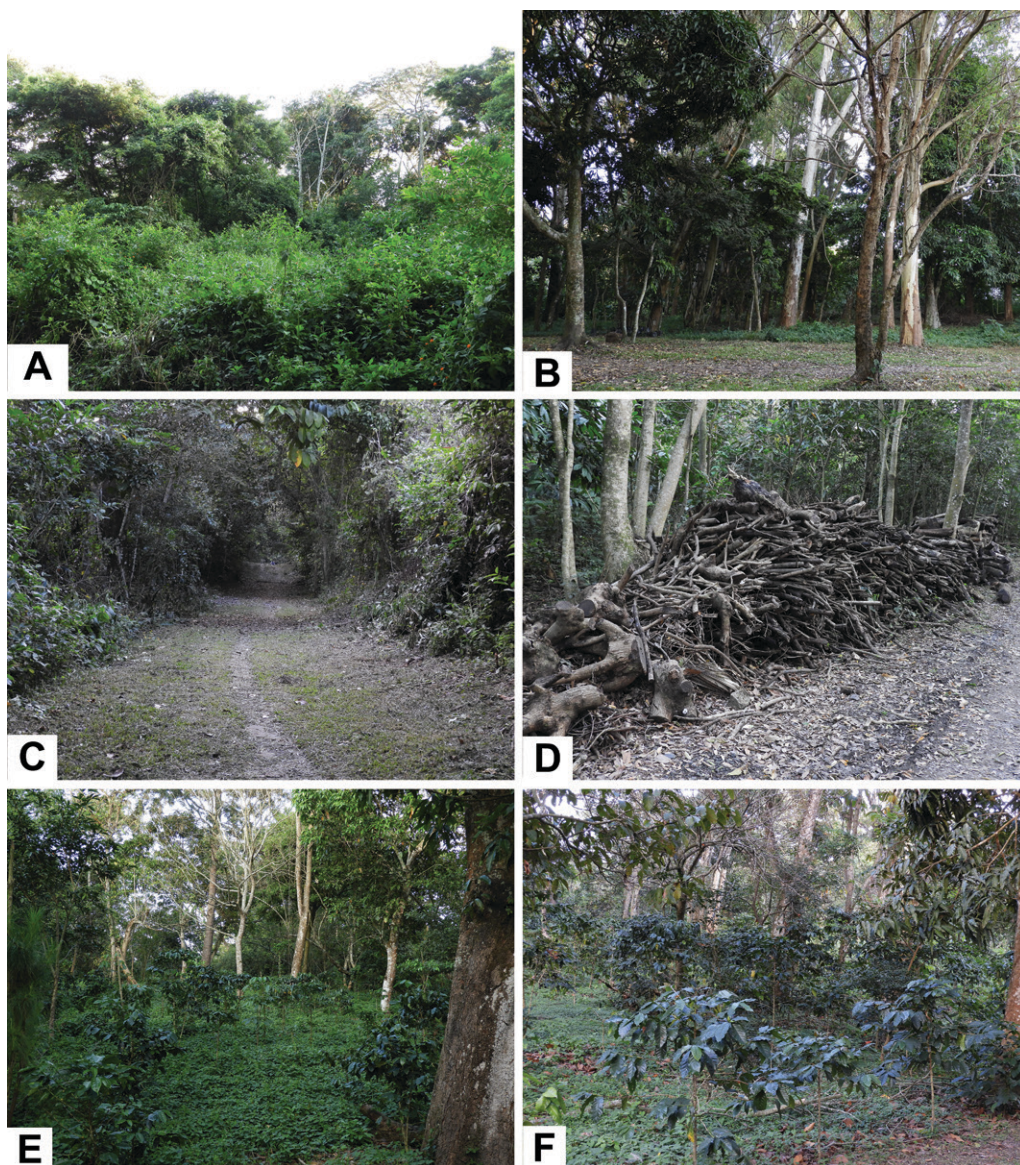


Fig. 1. Location of Parque Bicentenario straddling the border between the departments of La Libertad and San Salvador in El Salvador.

shaded coffee trees and open deforested areas with grasses, herbaceous species, and pioneer species in secondary successions (Fig. 2). Fragments of subtropical rainforests are present in the zone (Romero 2013; SalvaNATURA 2012). Native tree species are dominant (411 species), yet there are many introduced species (123 species), of which 39 are invasive due to their dispersal capacity within the park (Linares 2011). Among the most dominant species in the area are *Damburneya martinicensis* (Mez) Trofimov (Lauraceae), *Inga edulis* Mart. (Fabaceae),

*Persea americana* Mill. (Lauraceae), and *Spathodea campanulata* Beauv. (Bignoniaceae) (Linares 2011).

**Beetle Sampling.** Monthly sampling from August 2018 to July 2019 was performed at 800–900 m elevation under permit MARN-AIMA-DEV-GSV-070-2018 from the Ministerio de Medio Ambiente y Recursos Naturales of El Salvador. Three types of traps were set along two linear transects separated by 50 m (Larsen and Forsyth 2005). The location of the traps did not change during the study. Thirty in-ground pitfall traps consisted of a 5-L



**Fig. 2.** Habitats of Parque Bicentenario. A) General aspect of the vegetation, B–C) Collection sites, D) Firewood collected for use by families living in the park, E–F) Coffee trees.

plastic container buried in the ground, above which was placed a plastic 100-ml container with holes and containing 60 g of bait (10 traps per bait type). The baits were fresh human dung, rotten squid carrion (48 h of putrefaction), and fermented fruit (banana, papaya, and pineapple fermented for 48 h with yeast and dark beer). Ten baited aerial traps were installed at 5–10 m above ground with the same bait types as used in pitfall traps. Captures in the traps were harvested 48 h after baiting once per month. In addition, an ultraviolet light trap was activated one night per month, from 6:00pm to 11:00pm. The trap consisted of two ultraviolet fluorescent bulbs in front of two vertical white sheets (Aguilar-Julio 2010).

Beetles were preserved in 70% alcohol and transferred to the laboratory of the School of Biology of the Universidad de El Salvador for mounting and labeling. Identification of the specimens was performed with taxonomic guides, generic revisions, and catalogs (Edmonds 1994; Edmonds and Zidek 2010; Filippini *et al.* 2015; Kohlmann and Solís 1997, 2001; Morón 1986; Ratcliffe 2019; Ratcliffe and Cave 2006). Classification follows Bouchard *et al.* (2011). The specimens will be deposited in the collection of the Museo de Historia Natural de El Salvador in San Salvador and the collection of the Instituto de Ecología, Xalapa, Mexico.

## RESULTS

We collected four subfamilies, nine tribes, 14 genera, 20 species (8% of the total richness of Scarabaeidae in El Salvador), and 1,584 individuals. Eight species are reported for the first time from the departments of San Salvador and La Libertad.

Species capture abundance data are summarized in Table 1. Greatest species richness occurred between April and October, whereas greatest abundance was captured between May and September (months of rainy season in El Salvador). The most abundant species in the park were (in descending order) *Onthophagus batesi* Howden and Cartwright, *Onthophagus belorhinus* (Bates), *Dichotomius centralis* (Harold), *Coprophanaeus corythus* (Harold), *Dichotomius yucatanus* (Bates), and *Coprophanaeus boucardi* (Nevinson) (Fig. 3).

## SCARABAEINAE

### Coprini

1. *Copris costaricensis* Gahan, 1894 occurs from Mexico to Panama (Fuentes 2009; Schoolmeesters 2020). In El Salvador, the species was only known from Tonacatepeque (department San Salvador) and Parque Nacional El Imposible (department Ahuachapán) (Fuentes 2009; Pablo-Cea *et al.* 2020). This is the first record in the department of La Libertad.

2. *Dichotomius annae* Kohlmann and Solís, 1997 is distributed from Mexico to Panama (Schoolmeesters 2020). In El Salvador, it is widely distributed in the country and associated with open areas. However, it can be found within forests but in low numbers (Horgan 2008; Kohlmann and Solís 1997; Pablo-Cea *et al.* 2020). It is one of the largest scarab beetles in the park.
3. *Dichotomius centralis* (Harold, 1869) is distributed from Guatemala to Costa Rica (Schoolmeesters 2020). It is widely distributed in El Salvador (Fuentes 1998, 2009; Horgan 2001, 2002, 2008; Kohlmann and Solís 1997; Pablo-Cea *et al.* 2020). The species is one of the most common dung beetles in or near the urban areas of El Salvador. It was the third most abundantly collected species in the park.
4. *Dichotomius yucatanus* (Bates, 1887) is distributed from Mexico to Colombia (Fuentes 1998; Schoolmeesters 2020). The species is distributed in west and central El Salvador (Fuentes 1998; Horgan 2008; Pablo-Cea *et al.* 2020). It was the fifth most abundantly captured species in the park.

### Onthophagini

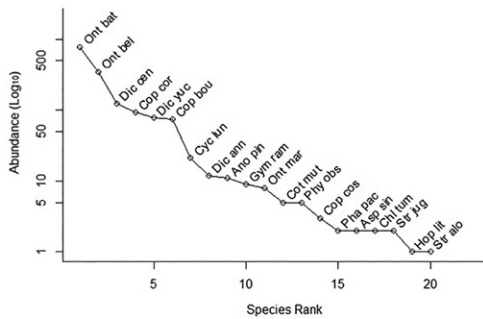
5. *Onthophagus batesi* Howden and Cartwright, 1963 occurs from the USA to Colombia (Schoolmeesters 2020). The species is widely distributed in El Salvador (Fuentes 2009; Horgan 2001, 2002, 2008; Howden and Cartwright 1963; Pablo-Cea *et al.* 2020; Pulido-Herrera and Zunino 2007). *Onthophagus batesi* is a common species within the urban areas of El Salvador. It was the dominant species collected in the park.
6. *Onthophagus belorhinus* (Bates, 1887) is distributed from Mexico to Ecuador (Schoolmeesters 2020). In El Salvador, the only previous record of the species is from Parque Nacional El Imposible (Pablo-Cea *et al.* 2020). This is the first record in the departments La Libertad and San Salvador.
7. *Onthophagus marginicollis* Harold, 1880 is distributed from Mexico to Peru, Cuba, and Guyana (Schoolmeesters 2020). It is distributed in limited areas of El Salvador in the departments La Libertad, La Paz, and Morazán (Fuentes 1998; Horgan 2001, 2002, 2008; Pulido-Herrera and Zunino 2007). This represents the first record in the department of San Salvador.

### Phanaeini

8. *Coprophanaeus boucardi* (Nevinson, 1891) is distributed from El Salvador to Costa Rica

**Table 1.** Abundance (per month and trap type) of scarab beetle species captured in Parque Bicentenario Park from August 2018 to July 2019. Pit = Pitfall trap; Aer = Aerial trap; Lig = Light trap; Tot = Total.

	Months												Traps			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Pit	Aer	Lig	Tot
<b>Scarabaeinae</b>																
<b>Copriini</b>																
<i>Copris costaricensis</i>	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	3
<i>Dichotomis annae</i>	0	0	0	1	1	3	3	1	1	0	2	0	12	0	0	12
<i>Dichotomis centralis</i>	0	0	0	5	3	18	11	47	28	3	10	0	125	0	0	125
<i>Dichotomis yucatanus</i>	0	0	0	4	6	15	19	16	10	1	7	0	78	0	0	78
<b>Onthophagini</b>																
<i>Onthophagus batesi</i>	22	11	0	25	174	146	140	93	78	33	45	13	780	0	0	780
<i>Onthophagus belorhinus</i>	8	13	10	5	2	38	59	54	68	38	35	20	350	0	0	350
<i>Onthophagus marginicollis</i>	2	2	1	2	1	0	0	0	0	0	0	0	8	0	0	8
<b>Phanaeini</b>																
<i>Coprophanaeus boucardi</i>	0	0	1	5	13	16	11	12	13	3	0	0	74	0	0	74
<i>Coprophanaeus corythus</i>	0	0	0	7	18	12	16	17	21	1	1	0	93	0	0	93
<i>Phanaeus pacificus</i>	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
<b>Melolonthinae</b>																
<b>Melolonthini</b>																
<i>Chlaenobia tumulosa</i>	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	2
<i>Phyllophaga obsoleta</i>	0	1	0	2	2	0	0	0	0	0	0	0	0	0	5	5
<b>Rutelinae</b>																
<b>Anomalini</b>																
<i>Anomala pincelada</i>	0	0	0	4	6	0	0	1	0	0	0	0	0	0	0	11
<b>Dynastinae</b>																
<b>Cyclocephalini</b>																
<i>Aspidolea singularis</i>	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	2
<i>Cyclocephala tumulata</i>	0	0	0	0	2	3	1	4	3	5	1	2	0	0	0	21
<b>Oryctini</b>																
<i>Strategus aloeus</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1
<i>Strategus jugurtha</i>	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	2
<b>Cetoniinae</b>																
<b>Cetoniini</b>																
<i>Cotinis mutabilis</i>	0	0	0	0	0	1	1	0	1	2	0	0	0	5	5	5
<b>Gymnetini</b>																
<i>Gymnetis ramulosa</i>	0	0	0	0	5	3	1	0	0	0	0	0	0	9	9	9
<i>Hoplopyga liturata</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
<b>Total</b>	<b>32</b>	<b>27</b>	<b>12</b>	<b>62</b>	<b>237</b>	<b>255</b>	<b>262</b>	<b>246</b>	<b>228</b>	<b>87</b>	<b>101</b>	<b>35</b>	<b>1,523</b>	<b>15</b>	<b>26</b>	<b>1,584</b>



**Fig. 3.** Rank-abundance ( $\log_{10}$  transformed) of the species of Scarabaeidae captured in Parque Bicentenario, El Salvador. Ont bat = *Onthophagus batesi*; Ont bel = *Onthophagus belorhinus*; Dic cen = *Dichotomius centralis*; Cop cor = *Coprophanæus corythus*; Dic yuc = *Dichotomius yucatanus*; Cop bou = *Coprophanæus boucardi*; Cyc lun = *Cyclocephala lunulata*; Dic ann = *Dichotomius annae*; Ano pin = *Anomala pincelada*; Gym ram = *Gymnetis ramulosa*; Ont mar = *Onthophagus marginicollis*; Cot mut = *Cotinis mutabilis*; Phy obs = *Phyllophaga obsoleta*; Cop cos = *Copris costaricensis*; Pha pac = *Phanaeus pacificus*; Asp sin = *Aspidolea singularis*; Chl tum = *Chlaenobia tumulosa*; Str jug = *Strategus jugurtha*; Hop lit = *Hoplopyga liturata*; Str alo = *Strategus aloeus*.

(Schoolmeesters 2020). In El Salvador, the species is only known from Santa Tecla (department La Libertad) and Lago de Ilopango and San Salvador (department of San Salvador) (Edmonds and Zidek 2010).

9. *Coprophanæus corythus* (Harold, 1863) occurs from Mexico to Venezuela (Fuentes 1998; Schoolmeesters 2020). In El Salvador, this species is only known in sporadically distributed forested areas (Fuentes 1998; Horgan 2001, 2008; Pablo-Cea *et al.* 2020). Parque Bicentenario is the only known place in the country where *C. boucardi* and *C. corythus* are sympatric. This is the first record of the species in the department of San Salvador.
10. *Phanaeus (Notiophanaeus) pacificus* Moctezuma and Halffter, 2021 is recorded from Mexico, Guatemala, and El Salvador (Moctezuma and Halffter 2021). In El Salvador, it can be found in forested areas as well open areas (Edmonds 1994; Fuentes 1998; Horgan 2001, 2008; Pablo-Cea *et al.* 2020). The species is apparently rare in Parque Bicentenario; only two minor males were captured.

#### MELOLONTHINAE Rhizotrogini

11. *Chlaenobia tumulosa* (Bates, 1888) is distributed from Mexico to Costa Rica (Evans and

Smith 2009; Rivera-Gasperín and Morón 2017). The species was previously known in El Salvador from two national parks: Parque Nacional Montecristo (department Santa Ana) (Serrano-Chicas 2019) and Parque Nacional El Imposible (Pablo-Cea 2021). This is the first record of the species in the departments La Libertad and San Salvador.

12. *Phyllophaga (Phytalus) obsoleta* (Blanchard, 1851) is distributed from the USA to Venezuela (Schoolmeesters 2020). In El Salvador, it is distributed in the western and central departments (Evans 2003; Morón 2006; Serrano-Chicas 2019).

#### RUTELINAE Anomalini

13. *Anomala pincelada* Filippini, Galante, and Micó, 2015 was previously known only from Costa Rica (Filippini *et al.* 2015). In El Salvador, the species has been collected from two national parks: Parque Nacional Montecristo (Serrano-Chicas 2019) and Parque Nacional El Imposible (Pablo-Cea 2021). This is the first record in the departments La Libertad and San Salvador.

#### DYNASTINAE Cyclocephalini

14. *Aspidolea singularis* Bates, 1888 is distributed from Mexico to Argentina and Trinidad and Tobago (Schoolmeesters 2020). In El Salvador, the species is only known from the western and central departments (Ratcliffe and Cave 2006; Serrano-Chicas 2019). This is the first record of the species in the department of San Salvador.
15. *Cyclocephala lunulata* Burmeister, 1847 occurs from the southern USA to Uruguay and Trinidad and Tobago (Schoolmeesters 2020). This species is widely distributed in El Salvador (Ratcliffe and Cave 2006; Serrano-Chicas 2019).

#### Oryctini

16. *Strategus aloeus* (Linnaeus, 1758) is distributed from the USA to Bolivia and Trinidad and Tobago (Schoolmeesters 2020). In El Salvador, the species is broadly distributed and common (Ratcliffe and Cave 2006), but only one specimen was captured in Parque Bicentenario.
17. *Strategus jugurtha* Burmeister, 1847 occurs from Mexico to Peru (Schoolmeesters 2020). Like *S. aloeus*, the species is broadly distributed throughout the country (Ratcliffe and Cave 2006).



CETONIINAE  
Cetoniini

18. *Cotinis mutabilis* Gory and Percheron, 1883 is distributed from the USA to Costa Rica (Schoolmeesters 2020; Solís 2004). The species is widely distributed in El Salvador, but there are surprisingly few literature records and specimens in entomological collections. The only known records are in the western and central departments.

Gymnetini

19. *Gymnetis ramulosa* Bates, 1872 occurs from Mexico to Colombia (Ratcliffe 2018). Like *C. mutabilis*, this species is widely distributed in El Salvador, but there are surprisingly few literature records.

20. *Hoplopyga liturata* (Olivier, 1789) ranges from Mexico to Peru. The species was previously known only from Los Planes de Renderos (department San Salvador) (Shaughney and Ratcliffe 2015) and Parque Nacional El Imposible (Pablo-Cea 2021).

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