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A new species of *Megasoma* Kirby (Coleoptera: Scarabaeidae: Dynastinae) from Sinaloa, Mexico

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Abstract

A new species, *Megasoma nogueirai* **sp. nov.,** from tropical subdeciduous forests at 290–820 m of altitude in Sinaloa, northwestern Mexico, is described and illustrated. Differences with *M. elephas* (F.) and *M. occidentalis* Bolívar, Jiménez and Martínez, are outlined.

Key words: Coleoptera: Dynastinae, Dynastini, *Megasoma*, taxonomy, Mexico

Introduction

The genus *Megasoma* Kirby is formed by 14 species clearly defined by sound morphological characters and precise geographic and ecological distributions (Table 1) (Endrödi 1941,1977; Hardy 1972; Lachaume 1985; Morón and Gómez-Anaya 2002) . In addition, the polemic *Megasoma janus* Felsche, has been cited as valid species or as subspecies of *M. actaeon* (L.) (Endrödi 1977; Lachaume 1985; Silvestre and Arnaud 2002). Mainly supported by differences in the shape of male horns and geographic distribution, six subspecies of *M. elephas* (Fab.), *M. joergenseni* Bruch, *M. janus* and *M. gyas* Herbst were also described (Fischer 1968, Silvestre and Arnaud 2002, Nagai 2003). Recent collection trips in the state of Sinaloa, Mexico, provided specimens of an undescribed species of *Megasoma*.

Illustrations were made with a digital camera (Sony Mavica CD500) and a scanning electron microscope (Jeol JSM-5600 LV). Measurements were obtained using an electronic digital caliper (0–100 mm). Specimens are deposited in the collections of the Canadian Museum of Nature, Ottawa (CMNC), Instituto de Biología, Universidad Nacional Autonoma de Mexico, Mexico City (IBUNAM), Instituto de Ecología, A.C Xalapa (IEXA), The Natural History Museum, London (BMNH), Muséum national d'Histoire

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naturelle, Paris (MNHN), University of Nebraska State Museum (UNSM), Zoologische Museum der Humboldt University, Berlin (ZMHU), M.A. Morón, Xalapa (MXAL), G. Nogueira, Guadalajara, Mexico (GNGC), and D. Curoe, Mexico City (DCC).

TABLE 1. Distribution of species and subspecies of *Megasoma*

M. actaeon (Linné 1758)	Panama to Bolivia
M. anubis Chevrolat 1836	Parana to Rio Grande do Sul, Brazil
M. cedrosa Hardy 1972	Northern Baja California, Mexico
M. elephas (Fabricius 1775)	Veracruz, Mexico to Panama
M. e. iijimai Nagai 2003	Colombia and Venezuela
M. gyas (Herbst 1775)	Minas Gerais to Sao Paulo, Brazil
M. g. rumbucheri Fischer 1968	Guyana to NE Brazil
M. g. porioni Nagai 2003	Bahia, Brazil
M. janus Felsche 1906	S. Bolivia, Paraguay, N. Argentina and S. Brazil
M. j. ramirezorum Silvestre et Arnaud 2002	Southern Colombia and Ecuador
M. j. fujitai Nagai 2003	Mato Grosso, Brazil
M. joergenseni Bruch 1910	Northern Argentina
M. j. penyai Nagai 2003	Chaco, Paraguay
M. lecontei Hardy 1972	Sierra Laguna, Baja California Sur, Mexico
M. mars Reiche 1852	Upper amazonic basin
M. nogueirai sp. nov.	Sinaloa, Mexico
M. occidentalis Bolívar, Jiménez et Martínez 1963	Nayarit to Oaxaca, Mexico
M. pachecoi Cartwright 1963	Southern Sonora, Mexico
M. punctulatus Cartwright 1952	Arizona, U.S.A.
M. sleeperi Hardy 1972	Southern California, U.S.A.
M. thersites LeConte 1861	Southern Baja California Sur, Mexico
M. vogti Cartwright 1963	S. Texas to Nuevo León and Tamaulipas, Mexico

Megasoma nogueirai Morón, sp. nov.

(Figs. 1–9)

Diagnosis. This species is distinguished from other *Megasoma* species by the following combination of characters: body length 52.7–74.0 mm; dorsally with dense yellowish brown vestiture of short setae; male with long frontal horn strongly curved upward, widely bifurcate at apex; male with antero-lateral acuminate horns curving inward; female with arrow-shaped smooth area near center of pronotal disc, extended along midline as prominent carina fused to posterior margin.

Description. **Holotype. Male**: Length from clypeus to pygidium 70.0 mm; humeral width 35.1 mm. Color shiny black with dense yellowish brown vestiture of short setae covering pronotum, elytra and pygidium (Fig. 1); most of head with dense reddish yellow, short setae.

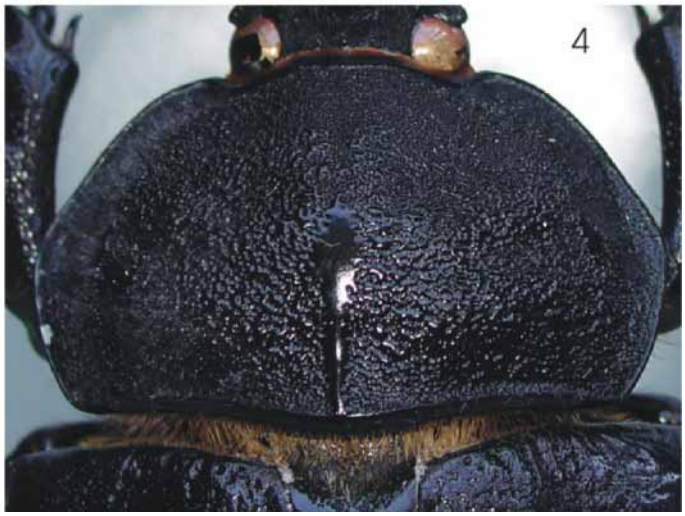
Head: frons with long horn (25 mm) projecting forward and strongly curving upward, about 1.25 times longer than pronotum; apex of horn widely bifurcate, 7.0 mm between apices; dorsal surface of horn near base with large, erect, forward-curving projection with rounded apex (Fig. 3). Clypeus broadly truncate, each lateral angle with large, forward

projecting tooth, broad space between teeth slightly concave; surface rugopunctate. Interocular width equals 2.4X the transverse eye diameter. Antennal club 1.2X longer than preceding segments 2–7. Mandibles with two apical, long teeth. *Pronotum*: Anterior angles each with a stout, long, curving inward, acuminate horn projecting forward at about 40º from midline (Fig. 1), distance between apices of horns 31.0 mm. Disc near center with prominent boss (Fig. 3), surface partially obscured by vestiture, but apex of boss widely glabrous along midline toward basal margin. *Elytra*: Surface deeply, densely punctulate, partially obscured by dense vestiture. *Pygidium*: disc surface strongly convex, densely punctulate, obscured by vestiture. *Legs*: foretibia strongly curved, longer than tarsi, with three teeth laterally, basal tooth widely distant from other teeth; all teeth short, sharply pointed. Apex of hind tibia with two stout teeth on external border. Apex of first tarsomere on hind tarsus triangularly elongated into short tooth. *Venter*: with dense yellowish brown vestiture of short setae; prosternal process short, truncate, subtrapezoidal. *Parameres* (Figs. 5–6): elongated, apex broadly rounded, slightly flattened, with stout setae along the inner border; phallobase rounded and prominent.

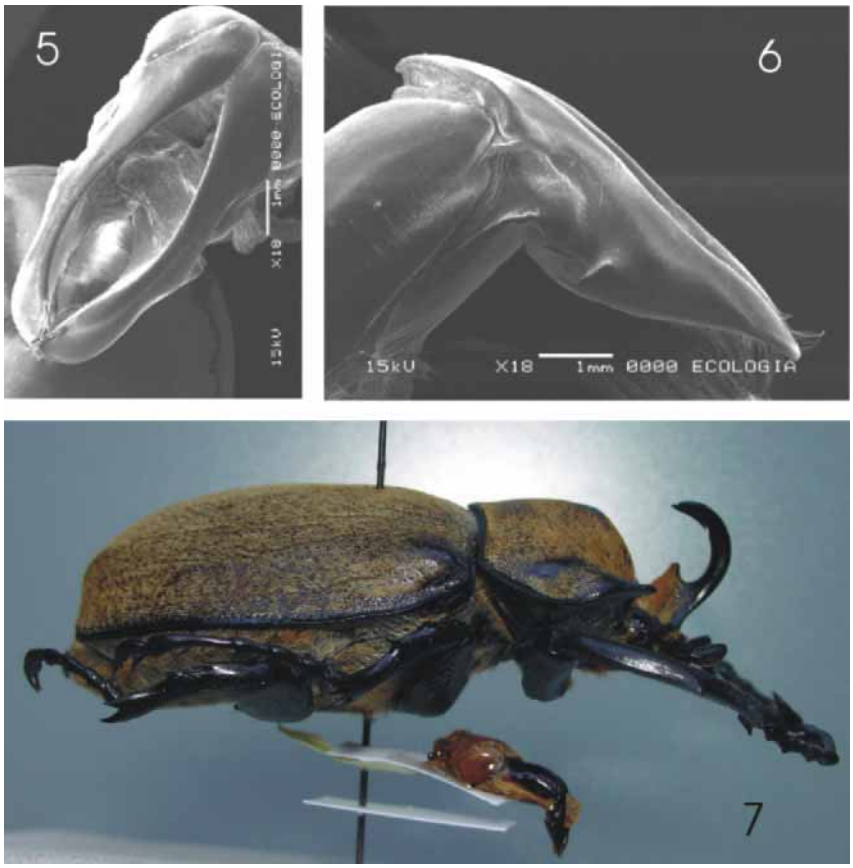
FIGURES 1–2. *Megasoma nogueirai* Morón. 1—Dorsal view of holotype; 2—Dorsal view of allotype. Scale bar 1 cm.

Allotype: Length 69.2 mm; humeral width 35.7 mm. Color shiny black with dense yellowish brown vestiture of short setae covering only posterior 3/5 of elytra and pygidium (Fig. 2). *Head:* frons with one stout, acute, large tubercle on the middle of fronto-cly-

peal suture. Clypeus broadly truncate, each lateral angle with large, upward projecting tooth, broad space between teeth nearly flat, surface rugopunctate. Interocular width equals 2.5 transverse eye diameter. Antennal club 1.2 times longer than preceding segments 2–7. Mandibles with two apical, long teeth. *Pronotum*: widely convex, coarsely rugose, with scattered, microscopic setae toward lateral sides and near posterior margin. An arrow-shaped smooth area is located near the center of pronotal disc, extended along basal half of midline as a smooth carina fused with the posterior margin (Fig. 4). *Elytra*: anterior 2/5 of surface glabrous, rugopunctate; posterior 3/5 of surface obscured by dense vestiture. *Pygidium:* surface in basal half strongly convex, with dense vestiture of long yellow setae; surface in apical half strongly concave, with scattered erect yellow setae. *Legs:* foretibia nearly straight, shorter than tarsi, with three teeth laterally, basal tooth strongly removed from other teeth; all teeth wide, sharply pointed. Apex of hind tibia with two wide, stout teeth on external border. Apex of first tarsomere on hind tarsus elongated into long spine. *Venter*: sternites widely glabrous along midline. *Genital plates*: ventral plates with the apex widely rounded, nearly truncated, covered with numerous slender short setae.



FIGURES 3–4. *Megasoma nogueirai* Morón. 3—Lateral view of holotype; 4—Close up of allotype pronotum. Scale bar 1 cm (Fig. 3); 5 mm (Fig. 4).



FIGURES 5–7. *Megasoma nogueirai* Morón. 5—Parameres, distal view; 6—Parameres, lateral view; 7—Lateral view of minor male paratype. Scale bar 1 cm.

Variation. Males (13 paratypes): body length 59.0–74.0 mm; humeral width 28.9–38.7 mm; head horn length 13.1–29.3 mm; distance between apices of head horn 6.2–8.7 mm, distance between apices of antero-lateral horns of pronotum 27.3–39.1 mm (Figs. 7–9). Females (8 paratypes): body length 52.7–63.6 mm; humeral width 25.0–31.5 mm. Dorsal vestiture more or less dense by abrassion. Inward curving of antero-lateral pronotal horns of males with slight variation in the degree of curvature Apex of pronotal horns sharply pointed is some males, slightly obtuse in others.

Material examined (23 specimens). Holotype male MEXICO: Sinaloa, carr. Durango - Mazatlán, Copala, 600 m, 7 October 1993, Col. G. Nogueira (MXAL). Allotype: Sinaloa, Copala, 620 m, 15 October 2004, Col. G. Nogueira (MXAL). Paratypes. Same data as allotype: 1 male; Sinaloa, Copala, 600 m, 7 October 1995, Col. G. Nogueira (2 males); 630 m, 16 October 2004 (3 males, 2 females); 550 m, 17 October 2004 (1 female); Pánuco, 715 m, 15 October 2004 (3 males, 1 female); Chupaderos, 400 m, 5 November 1996, Col. G. Nogueira (1 male); Chupaderos, 330 m, 16 October 2004 (1 male); Piedra Blanca, 290 m, 13 October 2004, Col. G. Nogueira (1 male, 1 female); Las Juntas, 550 m, 15 October 2004, Col. G. Nogueira (1 male, 1 female); Las Guásimas, 320 m, 17 October

2004, Col. G. Nogueira (1 female); El Cantil, 820 m, 14 October 2004, G. Nogueira (1 female)(deposited in CMNC, IBUNAM, IEXA, MNHN, MXAL, UNSM, ZMHU, GNGC, DCC).

FIGURES 8–9. *Megasoma nogueirai* Morón. 8—Dorsal view of major male paratype; 9—Dorsal view of minor male paratype. Scale bar 1 cm.

Etymology. This species is named after Guillermo Nogueira, collector of the new species, in recognition of his great contribution to the knowledge of the scarab beetle fauna of Mexico, and the continuous collection of fine samples of many interesting species during more than 15 years.

Habitat. Tropical deciduous and subdeciduous forests located between 290–820 m of altitude. These forests are located inside the Prioritary Terrestrial Region "Rio Presidio" (CONABIO- RPT-55) known by its richness of plants, birds and butterflies (Arriaga 2000). All specimens were attracted to mercury vapor or white fluorescent lights during October.

Geographic distribution. This species is known only from Pacific slopes of Sierra Madre Occidental in the southern part of the state of Sinaloa, México (23º 10'–23º 30' N; 105º 40'–106º 15' W) (Fig. 10).

Taxonomic relationships. *Megasoma nogueirai* is in the group of giant species whose males lack a horn on the pronotal midline and have a dense dorsal vestiture. This group also includes *M. elephas* (Fabricius) and *M. occidentalis* Bolívar, Jiménez and Mar-

tínez. The males of *M. nogueirai* are separated from *M. elephas* by the longer vestiture, head horn more curved upward with apex widely forked, and lateral pronotal horns clearly curved inward. The males of *M. occidentalis* have dorsal long vestiture similar to *M. nogueirai*, but the head horn is more slender, less curved, with apex less strongly forked, and the lateral pronotal horns are directed outward. Females of *M. occidentalis* and *M. elephas* do not possess complete carina on the rear half of the pronotal midline.

FIGURE 10. Distribution of *Megasoma elephas* (■); *M. occidentalis* (▲), and *M. nogueirai* (●) in Mexico.

The morphometric growth rates in the males of these species are clearly different as is supported by significative differences in the squared Mahalanobis distances (Table 2). These distances were obtained from the discriminant canonical analysis of five variables selected from three samples of 39 males of *M. elephas* from southeastern Mexico, 104 males of *M. occidentalis* from Nayarit to Oaxaca,Mexico, and 14 males of *M. nogueirai* from Sinaloa, Mexico. As was proposed by Morón and Gómez-Anaya (2002) variables used were: TBL, total body length (from clypeus to pygidium); HW, humeral width; DAPH, distance between the apices of anterolateral pronotal horns; CHL, cephalic horn length; and DACH, distance between apices of the forked cephalic horn (Table 2). Mahalanobis distances indicate that *M. nogueirai* are more closely related to *M. elephas* than either is to *M. occidentalis*.

Remarks. A female specimen of *M. occidentalis* collected in Mazatlan, Sinaloa during September 1943 (Bolívar *et al.*1963) may represent either the northern extension of the population of such species or perhaps may represent *M. nogueirai*. Unfortunately such specimen was not found in collections, and probably is lost. However, the new species was not obtained at localities below 290 m of altitude, or near the beaches of Sinaloa. *Megasoma occidentalis* was collected at localities in Nayarit, Jalisco, Colima, Michoacan, Guer-

rero and Oaxaca (Fig. 10), from sea level to 1,050 m of altitude. To date, no specimens of *Megasoma* have been collected between Villa Union, Sinaloa and San Blas, Nayarit, an area of nearly 200 km of coastal plains with large areas occupied by lagoons, marshes and mangrove swamps (G. Nogueira, unpublished data).

TABLE 2. Morphometric data of three species of *Megasoma* (see text for definitions).

Univariate Analysis							Squared Mahalanobis Distances			
	Means			Standard Deviations						
Variable	*elephas*	*occid.*	*nogue*	*elephas*	*occid.*	*nogue*		*elephas*	*occid.*	*nogue.*
TBL	78.79	66.94	69.17	8.02	6.90	4.37	*elephas*	0.00		
HW	40.61	32.48	34.86	4.60	3.78	2.86	*occidentalis*	14.92	0.00	
DAPH	37.61	33.45	33.58	6.22	5.63	3.59	*nogueirai*	4.22	10.47	0.00
CHL	33.71	28.08	24.81	7.88	7.90	5.35				
DACH	6.42	5.09	7.48	1.99	0.92	0.76				

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