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Distribution and biology of the rare scarab beetle *Megatharsis buckleyi*
Waterhouse, 1891 (Coleoptera: Scarabaeinae: Phanaeini)

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Abstract. *Megatharsis buckleyi* Waterhouse, 1891 is newly recorded from Brazil, extending its distributional range beyond Ecuador and Peru. A further new provincial record from Ecuador is presented in detail, and the species' distribution and habitat is discussed. Color variation within the species, with a possible geographic correlation, is reported here for the first time.

Abstrato. A ocorrência de *Megatharsis buckleyi* Waterhouse, 1891 é registrada pela primeira vez para o Brasil, implicando um grande aumento na sua área de distribuição, além do Equador e do Peru. O registro da espécie para a província equatoriana de Orellana é registrada pela primeira vez. Finalmente, discute-se a distribuição geográfica e de hábitat da espécie, e sua variação de cor que parece ter um componente geográfico.

Resumen. *Megatharsis buckleyi* Waterhouse, 1891 presenta un nuevo registro para Brazil, extendiéndose su rango de distribución hacia Ecuador y Perú. Se presenta un nuevo registro provincial para Ecuador, con detalle de la distribución de la especie y su hábitat. Por primera vez, se reportan la variación de color por las especies, y una posible correlación geográfica.

Key words / Palavras-chaves / Palabras claves. Dung beetle, Brazil, Peru, Ecuador, Neotropical, South America, Amazonia, Rondônia, Orellana, Payamino, new country record, new provincial record, color variation.

Introduction

The monobasic phanaeine genus *Megatharsis* Waterhouse contains the Neotropical species *Megatharsis buckleyi* Waterhouse, 1891. For a long time, this scarab was known only from Ecuador (Arnaud 2002), although recently it has also been collected in Peru (Larsen et al. 2006). Edmonds (1972) described in detail the unique morphological characters distinguishing this species from its closest relatives. Morphological phylogenetic reconstructions have suggested that *Megatharsis* belongs to a monophyletic assemblage containing the most derived phanaeine genera (*Dendropaemon* Perty, *Tetramereia* Klages, *Homalotarsus* Janssens and *Megatharsis*) (Philips et al. 2004), whose constituent species, as far as is known, have unusual and atypical ecologies for Scarabaeinae dung beetles. Several of these (some *Dendropaemon* spp. and *Tetramereia convexa* (Harold)) are myrmecophilous, having been collected in association with attine ant nests (Vaz-de-Mello et al. 1998). Myrmecophily is an example of extreme resource specialization among dung beetles. However, no such biological information is available specifically for *Megatharsis buckleyi*, because most known preserved specimens have imprecise collecting data or were collected in flight intercept traps (FIT) or by chance. By all accounts, most species in the aforementioned genera, including *M. buckleyi* are rare insects, seldom found even in large institutional collec-

tions. This note aims to summarize and consolidate all distributional and biological data known to date for this species.

Materials and Methods

Specimens of *M. buckleyi* housed in several institutional and private collections, and their corresponding data, were studied. Some reliably identified specimens were unable to be personally studied by the authors during the time available. However, in these cases, their detailed label data were generously made available by those responsible for the specimens. Data from each individual label are presented below, each label separated by a slash “/”. All known published records are also cited here. An attempt was made to locate all localities as precisely as possible using a variety of maps and online sources. Where possible, coordinates for collecting localities have been given, and the data are summarized in a distribution map. The dorsal coloration of each specimen studied was recorded and an attempt at interpreting any variation was made based on geographic separation and on the variation of other species of Phanaeini.

Results

Specimens examined are deposited in the institutional and private collections indicated by the following acronyms:

BMNH – The Natural History Museum, London, UK
 CPFA – Collection F. Arnaud, Saintry-sur-Seine, France
 FVMC – Fernando Z. Vaz-de-Mello collection, Universidade Federal de Mato Grosso, Cuiabá, MT, Brazil
 MECN – Museo Ecuatoriano de Ciencias Naturales, Quito, Ecuador
 MGCB – Michael P.T. Gillett Collection, Birmingham, UK
 NMNH – National Museum of Natural History, Smithsonian Institution, Washington, DC, USA
 WECM – W. D. Edmonds Collection, Marfa, Texas, USA

Specimens marked with an asterisk * were not personally studied by the authors, although their detailed data was made available for study.

ECUADOR

Holotype female (BMNH): Chiquinda, 80.14/ Type/ *Megatharsis buckleyi* (Type) Waterh. Attached to the specimen pin is a card mount containing the dissected mouthparts. A second clear plastic mount contains the preserved genitalia and the following handwritten label: *Megatharsis buckleyi* Wat. (female symbol), Holotypus, Canada balsam, M. Zunino '83. The holotype is a metallic green specimen, shown in figure 1-4.

1 female specimen (BMNH): Equateur, Macas, P. Arnaud; 1.82/ (female symbol) / BM 1986-394/ *Megatharsis buckleyi* Waterhouse, 1891, det. CPDT Gillett, 2007. This is a metallic green specimen resembling the holotype closely and is shown in figure 5.

1 specimen (WECM): Ecuador: Depto. Morona-Santiago, Macas v-60, J. Foerster. This is a metallic green specimen.

1 specimen (MECN): Ecuador: Morona-Santiago, Macas, 2°18'17.56"S; 78°06'53.51"W, 1021 m, secondary rainforest corresponding to evergreen lowland forest formation. Captured flying. No date. This is a greenish-blue specimen, shown in figure 6.

1 specimen (MGCB): Ecuador (Orellana), Payamino Research Station, 0°29'36.01"S; 77°17'29.15"W, 400 m tropical secondary rainforest, Flight intercept trap, 03. viii. 2008, leg. CPDT Gillett/ *Megatharsis buckleyi* Waterhouse, 1891, det. CPDT Gillett, 2007. This is a metallic green specimen. **NEW PROVINCIAL RECORD.**

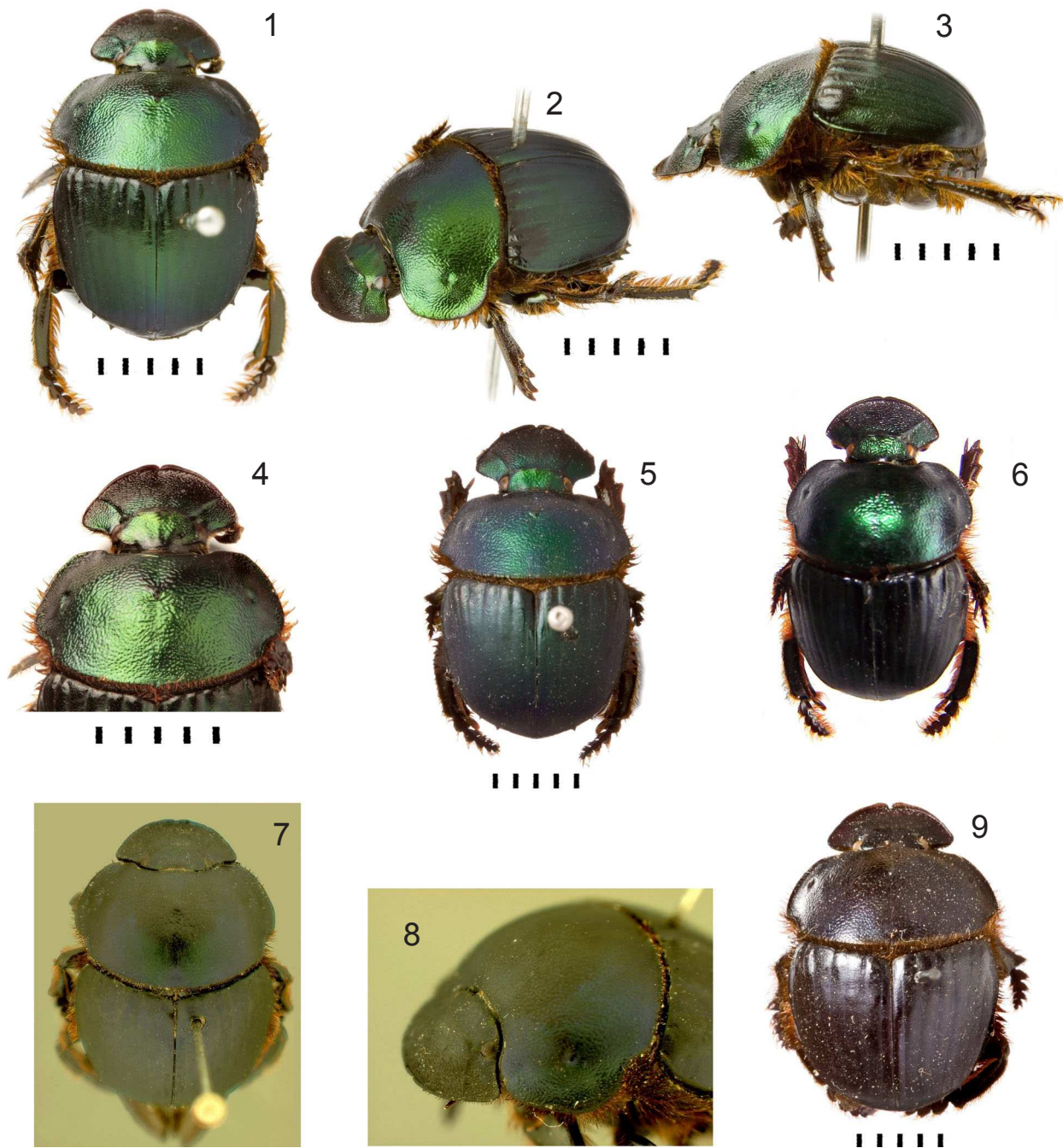


Figure 1-9. *Megatharsis buckleyi*. Unless noted, scale in millimetres. 1-4) Holotype female in the BMNH. Photographs by Harry Taylor (The Natural History Museum photographic unit). 1) Dorsal view. 2) Oblique view. 3) Lateral view. 4) Close-up of head and pronotum. 5) Female collected in Macas, Morona-Santiago, Ecuador (BMNH). Photograph by Harry Taylor. 6) Specimen collected in Macas, Ecuador (MECN). Photograph by Santiago Villamarin. 7-8) Specimen collected in Peru: Depto. Madre de Dios, Río Madre de Dios, CICRA Biological Station, Río Los Amigos. T. Larsen (NMNH). Length 13.1mm. Photographs by Trond Larsen. 7) Dorsal view. 8) Oblique close-up of head and pronotum. 9) Specimen collected in 'Abuna', Rondônia, Brazil (BMNH). Photograph by Harry Taylor.

1 specimen (CPFA): Ecuador: Oriente, Tapizal, Sept. 1957*. This is a metallic green specimen.

4 specimens (CPFA): Ecuador: Env. Macas, Macas – Puyo Road, 15 km North, 1100 m alt., crildé net, Feb. 2000. * These specimens are metallic green-blue.

1 specimen (FVMC): Ecuador, Macas, VI-1960 *. The specimen has the elytra dull with a bright blue sericeous color, pronotum very dark blue-green, with two small centrally connected dark spots. The clypeus is black and the frons is the same color as the pronotum.

PERU

1 specimen (USNM): Peru: Depto. Madre de Dios, Río Madre de Dios, CICRA Biological Station, Río Los Amigos, 1° flood plain, 250 m, FIT, iv-23/24-2000, 12°34'10.0" S; 70°06'01.4" W, T. Larsen. This is a dark specimen with few metallic reflections, shown in figures 7 and 8.

1 specimen (USNM): Peru: Depto. Madre de Dios, Río Patuyacu, Oculito Biological Station, 1° tierra firme, 12°39'00" S; 68°55'33" W, 230 m, July 1997, hand collected on leaf, N. Quinte. This is a dark specimen with few metallic reflections.

1 specimen (CPFA): Iquitos (?), no date*. This is a metallic greenish-blue specimen. The locality is uncertain.

BRAZIL

1 specimen (BMNH): Rio Madeira, Abuna, Brazil, Mann & Baker/ Brazil, Stanford Exped., 1913-56/ *Megatharsis Buckleyi*, Wat., G.J. Arrow det./ *Megatharsis buckleyi* Waterhouse, 1891, det. CPDT Gillett, 2007. This is a black specimen with only a vestige of dark blue metallic coloration and is shown in figure 9. The elytra are dull and the pronotum is moderately shining. **NEW COUNTRY RECORD.**

Records from the literature

Waterhouse 1891 – Ecuador: Chiquinda (Type locality); Olsoufieff 1924 – Ecuador; Blut 1939 – Ecuador: environs of Archidona (Eastern slopes of the Andes), 640 m, Rich. Haensch S., viii. 1889, coll. Berlin Zoological Museum (1 specimen); Sabanilla, 1900m, 20. ix. 1905, Ohaus (1 specimen); Blackwelder 1944 – Ecuador; Vulcano and Pereira 1967 – Ecuador; Edmonds 1972 – Ecuador: Macas (2 specimens); Arnaud 2002 – Ecuador: Morona-Santiago; Larsen et al. 2006 – Peru: Madre de Dios, CICRA Biological Station near Río Los Amigos (12°34'S; 70°06'W).

Discussion

From the time of its description until 2006, *M. buckleyi* was known only from Ecuador, or at least the only published records were from that country. The type locality of 'Chiquinda' is apparently in the province of Morona-Santiago, Ecuador, and is locally spelt Chiguinda (3°16'52.46"S; 78°41'53.74"W). The type was collected either by Clarence Buckley or one of his collectors, who were active in the area at the time and who sent specimens back to Europe for study (Waterhouse 1891; Bates 1870). Chiguinda lies at an elevation of 2230 m which is much higher than all other subsequent localities. However, as is common with much historical material, the actual locality of capture may have been quite distant from Chiquinda itself. Blut (1939) records 2 further Ecuadorian specimens from the eastern slopes of the Andes ('Ostkordillere'): 1 from Archidona at 640 m elevation and 1 from Sabanilla at 1900 m. Both of these localities appear presently to be located on the outskirts of Cuenca, the capital of the Azuay province of Ecuador. However this area actually lies between 2500-2600 m elevation, again calling into question the accuracy of these records. Several specimens of *M. buckleyi* have been collected in the environs of Macas (approximately 2°18'S; 78°07'W), the capital of Morona-Santiago. Much of Morona-Santiago is located within lowland Amazonian rainforest, although Macas itself is situated at an altitude of approximately



Figure 10. Distribution map for *Megatharsis buckleyi* Waterhouse. All known confirmed localities are indicated by black circles. The unconfirmed locality of Iquitos is marked by a question mark and the Andean localities presented by Blut (1939) around the city of Cuenca, are shown by a cross.

1000 m, and at least one specimen of *M. buckleyi* has certainly been collected in the environs of Macas at a similar altitude (P. Arnaud pers. comm.). One of us (CG) was fortunate to collect a single specimen of *M. buckleyi* whilst conducting fieldwork with students of the University of Manchester in the Payamino area of Orellana province in Ecuador during August 2008. The specimen was collected in a flight intercept trap (FIT) set in mature secondary Amazonian rainforest. Neither a large number of dung and carrion baited pitfall traps set in the area, nor the setting of two additional FITs nearby, yielded additional specimens during two weeks of sampling. The record is significant as it extends the known distribution of the species in Ecuador some 300 km northwards beyond the concentration of records from Morona-Santiago.

Trond Larsen was able to collect the species in Peru during a period of exhaustive Scarabaeinae sampling in mature flood plain Amazonian rainforest in the Madre de Dios region (Larsen et al. 2006). Despite the fact that Larsen used a large number of baited traps, including several novel baits such as

invertebrate carrion and live millipedes in addition to the standard dung and vertebrate carrion baits, and that he sampled a variety of habitats including the forest canopy, only a single specimen of this beetle was captured in a FIT. In his study, *M. buckleyi* was shown to have an extremely low abundance, considering a total of 1953 individual trap samples were studied, including 226 FIT samples. Larsen's record was in fact a new country record for Peru although he did not explicitly state this. A second confirmed Peruvian specimen, also from Madre de Dios, exists, which was collected by Nico Quinte at the nearby site of the Oculito biological station. It therefore appears that the Madre de Dios region in south-eastern Peru is also a 'hotspot' for this species. A further specimen ambiguously labelled 'Iquitos' may also be from Peru. Interestingly, the specimen from Oculito was hand collected as it perched on a leaf, a behaviour often observed in coprophagous tropical Scarabaeinae and which may function to partition resources in a competitive environment (Howden and Nealis 1978). However, the fact that *M. buckleyi* has not yet been collected in dung baited traps could possibly indicate that this was a coincidental find, or that it may have been waiting for a specific source of vertebrate or invertebrate dung not yet used in baited pitfall traps. Alternatively, although *M. buckleyi* has not yet been associated with ants, Vaz-de-Mello et al. (1998) and Philips et al. (2004) postulated that primarily because of the assumed monophyly of the clade containing *Megatharsis* and the known myrmecophilous genera *Tetramereia* and *Dendropaemon*, this association is a likely one.

The distribution of *M. buckleyi* can now be extended to a third country with the discovery of an old specimen from Brazil deposited in the BMNH. The exact locality for this record is difficult to be certain about because the name 'Abuna' now refers to a town, Abua (approximately 9°41'S; 65°22'W), situated on the banks of the Rio Madeira in the Brazilian State of Rondônia, but which had not yet been founded in the year the specimen was collected. The river Abuña is a tributary of the river Madeira, and most probably the locality on the label 'Abuna', associated with the name of the river Madeira, indicates an amerindian village or frontier camp at the junction of the Abuña and the Madeira rivers. There is also a nearby frontier fort named Abuña, but this was probably only constructed during the 1930s, after the specimen was collected (F. Z. Vaz-de-Mello pers. comm.). Both the river Abuña and the town of Abuña lie very near the frontier with the Bolivian region of Pando and are located in lowland Amazonian rainforest. Despite comparatively thorough work on the phanaeina faunas of Colombia (Medina et al. 2001; Vítolo 2000 and Noriega et al. 2008), Venezuela (Gámez 2004; Martínez and Clavijo 1990) and Bolivia (Hamel-Leigue et al. 2006), *M. buckleyi* has not yet been recorded in these countries. A map showing the location of the collecting sites for specimens studied in this paper is shown in figure 10. It is impossible to offer any convincing explanation for the absence of the species from the vast area separating the Ecuadorian localities from those in southern Peru and Rondônia other than it being the result of limited collecting. This intervening area, comprising the eastern lowlands of Amazonian Peru (especially in the provinces of Loreto and Ucayali), the states of Amazonas and Acre in Brazil and the department of Pando in Bolivia, would appear to offer suitable habitat for the species based on the currently known localities. The single specimen dubiously labelled 'Iquitos', and perhaps from Peru (Loreto region), would fit in well with this proposed distribution. However, because Iquitos is an important Amazonian port, there is a strong possibility that the specimen was collected elsewhere and was subsequently sold by one of the many insect dealers based in that city (F. Z. Vaz-de-Mello pers. comm.).

Specimens of *M. buckleyi* have been recorded in the months of January to February and April to September, although the imagos are probably active throughout the year, a feature common to many species of Phanaeini distributed in the Amazon basin (e.g. Edmonds 1994).

Despite the present study being limited to only a small number of specimens, an interesting chromatic variation was identified. More specifically, the dorsal coloration of all specimens so far known from the Ecuadorian localities is of an overall bright green or blue/green hue. The single specimen from Rondônia is entirely dark and black, with only faint vestiges of metallic reflections. Both Peruvian specimens are also dark, though retaining more obvious metallic coloration. Notably, this variation appears to be geographically correlated; specimens from north of the known range are metallic colored, whilst those from the south are either black or very dark. In all specimens the elytra are dull and the pronotum somewhat shining. Whilst intraspecific variation in color is often the norm within the tribe Phanaeini, several taxa (usually of subspecific rank) have been described based primarily on dissimilar coloration and disparate geographic distribution. Examples are *Oxysternon festivum nigerrimum* Arnaud and *Sulcophanaeus auricollis joffrei* (Harold), both of which differ from their respective nominate subspecies predominantly

in color. Whilst the large gap (of at least 1500 km) separating the two color forms of *M. buckleyi* tempts the recognition of localized subspecific taxa, no morphological characters supporting this have been detected. This combined with the fact that few comprehensive faunal studies have been undertaken in the intervening areas and that the insect is extremely scarce, indicate that for the moment *M. buckleyi* should remain a monotypic species exhibiting some geographic variation in color.

Conclusions

According to the few known detailed records, it appears that the preferred habitat for *M. buckleyi* is lowland rainforest (both *terra firme* and floodplain forest) in western Amazonia, below 500 m altitude, although the many records from Macas and the records presented by Blut suggest that it can occur at higher elevation, probably in areas of moist tropical forest. The species' distributional range has now been extended considerably both to the north and to the south of the original Ecuadorian localities, clearly splitting the range into two 'hotspots' – a northern one in Ecuador and a southern one in the south-east of Peru. The Peruvian and Brazilian localities each are at least 1500 km away from the nearest locality in Ecuador, begging the question of whether the species will eventually be found in the intervening areas. In particular, due to the proximity of the Brazilian locality to Bolivia, the species would be expected to also occur in the Bolivian Amazonian department of Pando.

The color variation within the species appears to have a geographic correlation, although further specimens would need to be studied before confident conclusions could be drawn with regards to any taxonomic implications. The considerable effort and luck that is required to locate the species is evidence that it is an exceptionally rare insect, which, in turn, supports the idea that it has peculiar ecological requirements.

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