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A NEW SUBSPECIES OF *INCA CLATHRATA* (OLIVIER) FROM TRINIDAD, WEST INDIES, AND RANGE EXTENSIONS FOR *INCA CLATHRATA SOMMERI* WESTWOOD (COLEOPTERA: SCARABAEIDAE: TRICHIINAE)

Julius Boos
Ft. Lauderdale, FL

Brett C. Ratcliffe
University of Nebraska-Lincoln, bratcliffe1@unl.edu

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JULIUS BOOS

314 N.E. 26 Drive, Wilton Manors, Ft. Lauderdale, FL 33334, U.S.A.

AND

BRETT C. RATCLIFFE

Systematics Research Collections, University of Nebraska State Museum, W436 Nebraska Hall, Lincoln, NE 68588-0514, U.S.A.

ABSTRACT

Inca clathrata quesneli is described as a new subspecies from Trinidad, West Indies. New distribution records are given for *Inca clathrata sommeri* Westwood that extend its range northward in Mexico by approximately 200 km and southward into Colombia and Ecuador in South America west of the Andes. A brief analysis of the historical biogeography of *Inca clathrata* (Olivier) suggests vicariance (Andean uplift) to explain the separation of the *clathrata/sommeri* subspecies lineage, and dispersal to explain the separation and isolation of the *quesneli* lineage on Trinidad and occurrence of *sommeri* in Mesoamerica.

RESUMEN

Se decribe al *Inca clathrata quesneli* como una nueva subespecie de Trinidad, Antillas. Nuevos registros de distribución se dan para el *Inca clathrata sommeri* Westwood que extiende su distribución hacia el norte en Mexico por aproximadamente 200 km y hacia el sur dentro de Colombia y Ecuador en Sud America, al occidente de los Andes. Un breve analisis de la biogeografía histórica del *Inca clathrata* (Olivier) sugiere el establecimiento de una barrera (un levantamiento andino) para explicar la separación del linage de la subespecie *clathrata sommeri* y la difución para explicar la separación y el aislamiento del linage *quesneli* en Trinidad y la presencia del *sommeri* en Mesoamerica.

Sappy wounds of injured or diseased trees attract a wide variety of insects (Ratcliffe 1970). Carter (1945) stated that when fluxing is prolific or long-continued, air-borne bacteria, yeasts, and fungi contaminate the oozing sap, ferment it, and produce the material called slime flux. Apparently the oozing flux is toxic to the wound and so prevents callusing by the tree. Consequently, the same tree is often a good collecting site for insects over a period of years.

In 1967, Boos collected a cetoniine scarab, *Gymnetis bajula* (Olivier), feeding at a sap flow on a small tree, *Ilex arimensis* (Loes.) Britt. (Ilicaceae), on the side of a trail at the 6¼ mile post on the road to Maracas Bay on the north coast of Trinidad. This proved to be the first of many beetles attracted to this tree that were subsequently caught by collectors over a span of ten years.

Specimens of *Inca clathrata* (Olivier) were taken at the sap flow, usually between the hours of 7–10 am. We surmise they flew in before dawn to feed; they would usually leave and seek shelter before noon. Few specimens of *Inca* were observed feeding between 10 am–6 pm or at night. The annual period of activity for these beetles in Trinidad ranged from May through August.

Species of *Inca* have been reported feeding at sap flows and taken from *Ficus* spp. and *Citrus* spp. in Argentina (Richter 1913) as well as the legume *Gliricidia sepium* (Jacq.) in Mexico (Morón 1983). Campos (1921) reported *Inca* feeding on the rotting fruit of the silk banana (*Musa sapientum* L.) in Ecuador. We have observed *Inca clathrata* feeding on the sap flows of avocado trees in Panama (Ratcliffe) and on rotting mango fruit and sap flows of *Ilex arimensis* in Trinidad (Boos).

Two subspecies of *Inca clathrata* have been previously described: *Inca clathrata clathrata* (Olivier) (South America east of the Andes) and *Inca clathrata sommeri* Westwood (Mesoamerica). Upon examination, the *Inca* from Trinidad was seen to be significantly different from the two described subspecies and is described below as a new subspecies.

Inca clathrata quesneli Boos and Ratcliffe, **new subspecies**
Figures 1, 2

TYPE MATERIAL. Holotype male labeled "Trinidad, 89-57." Allotype female with same data (both collected in 1889 by W. E. Broadway). Paratypes (41) with the following data, **Trinidad:** V-7-1932, A.M.G. (1); 6¼ mile post, Maracas Bay Road, J. Boos, V-28-1968 (1), V-29-1968 (1), VI-1-1969 (1), VI-10-1968 (2), VI-11-1977 (5), VI-12-1969 (2), VI-17-1977 (2), VI-18-1977 (1), VI-24-1968 (1); VII-20-1977 (1); 6½ mile post, Maracas Bay, H. and A. Howden, VIII-6-1969 (7), VIII-8-1969 (1); 6 mile post, Maracas Bay Road, J. Boos, V-24-1968 (1); Maracas Bay, J. Boos, VI-17-1969 (6), VI-28-1969 (2), VII-2-1968 (2); Maracas Bay Road, J. Boos, VIII-1976 (1); Chagaramas, NW Trinidad, C. Barcant, on mango bait, VIII-1977 (1); Morne Bleu, J. Glaser, VI-20-1970 (1); Fonds Amandes Road, Maraval, J. Boos, V-24-1968 (1).

Holotype, allotype, and some paratypes are deposited in the British Museum (Natural History) (London). Paratypes are deposited in the collections of the Florida State Collection of Arthropods (Gainesville), United States National Museum (Washington), American Museum of Natural History (New York), Museum für Naturkunde (Berlin), Museum National d'Histoire Naturelle (Paris), Julius Boos (Ft. Lauderdale), John Glaser (Baltimore), Henry Howden (Ottawa), and Brett Ratcliffe (Lincoln). The specimens deposited in Washington, Berlin, and Paris were donated by the Florida State Collection of Arthropods.

HOLOTYPE MALE. Length from front of median notch between horns to apex of elytra 37.5 mm (horns an additional 5.5 mm long); width across humeri 18.3 mm. Color black; markings on pronotum, elytra and pygidium creamy white. Legs and ventral surface black, with feeble dark green reflection. *Head:* Divergent clypeal horns projecting forward and upward; horns triangular in cross section, apex of each shallowly emarginate; carina on median edge of each horn not curving to inner or outer apical angle but ending abruptly in center of horn well before apex; inner surface in basal ⅔ of each horn with dense, tawny setae. *Pronotum:* Longitudinal lines formed by cretaceous marks incomplete or becoming obsolete in places. Base and apex with fine marginal bead, sides with a series of connected, globose swellings (subtuberculate); continuity of bead briefly interrupted in anterior angle. Scutellum entirely black. *Elytra:* Spots dense (except at center where sparser), small (subequal to diameter of apical half of posterior tarsal claw). *Py-*

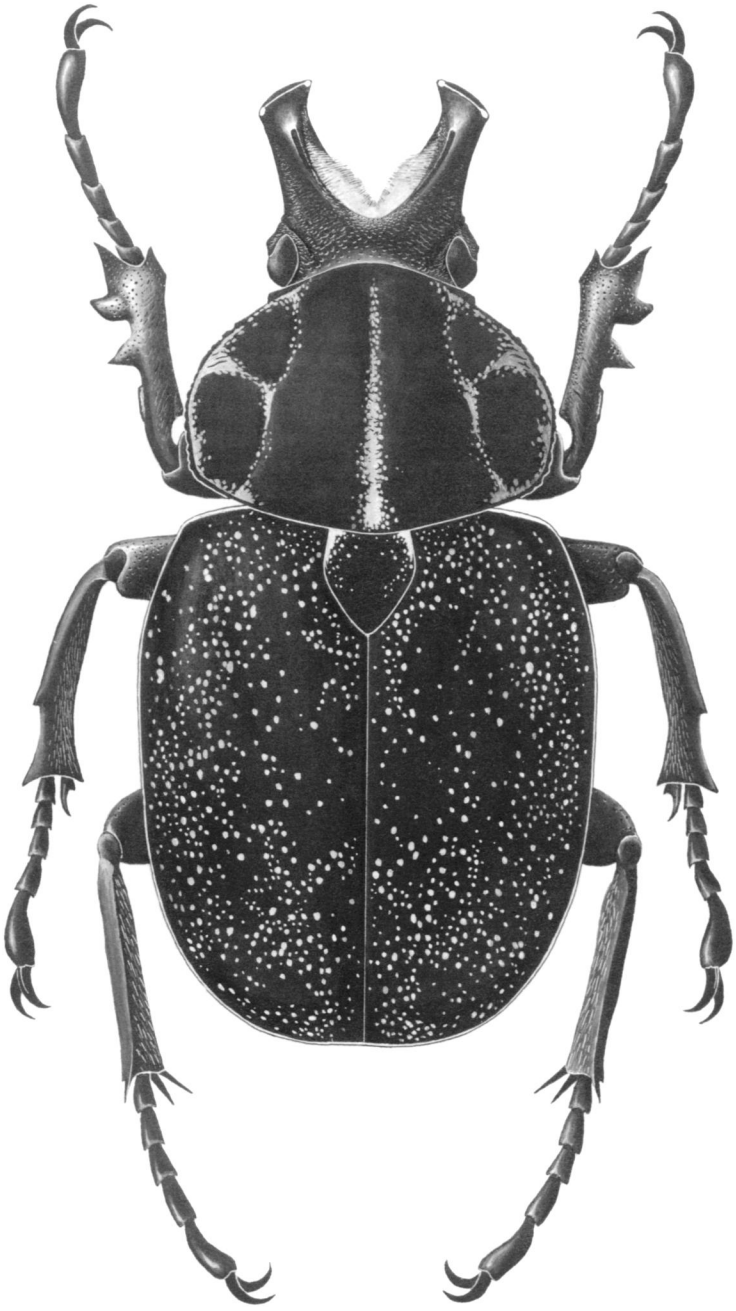


Fig. 1. Habitus of *Inca clathrata quesneli.*

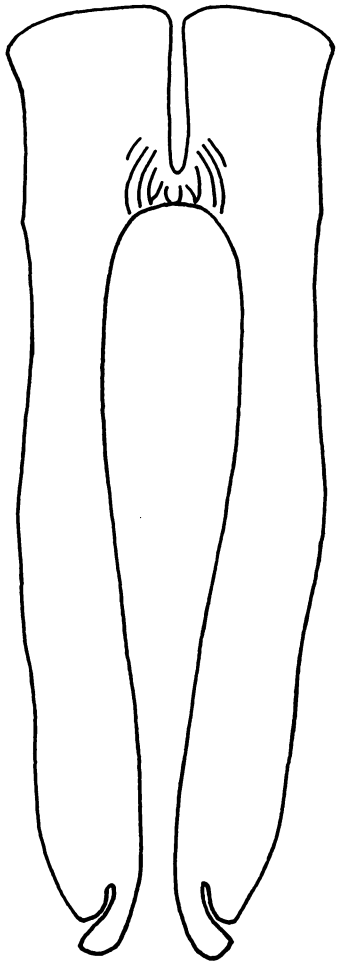
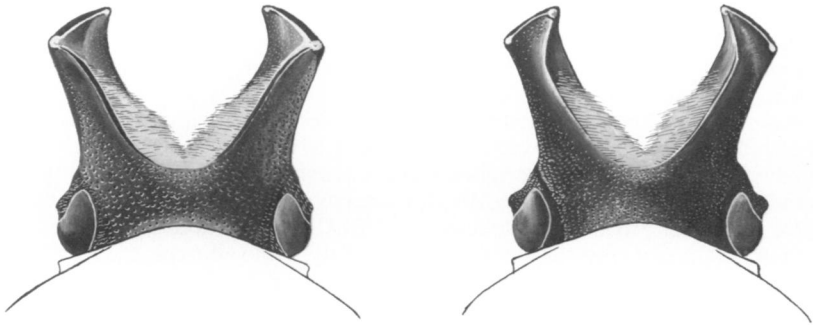


Fig. 2. Parameres of *Inca clathrata quesneli.*

gidium: Surface with longitudinal white band laterally and in center, faint trace of transverse band at base. *Parameres:* As in Fig. 2.

ALLOTYPE FEMALE. Length from clypeal apex to apex of elytra 42.4 mm; width across humeri 19.4 mm. As in holotype except in the following: *Head:* Clypeal horns absent, instead clypeus moderately deeply concave, apex broadly truncate, reflexed, anterior angle sharp. *Pronotum:* Sides with marginal bead distinctly tuberculate, tubercles largest at center, becoming gradually smaller anteriorly and posteriorly. Scutellum with several white spots in basal angles. *Elytra:* Spots mostly small to a little larger (subequal in diameter to base of last segment of posterior tarsus).

VARIATION. Males (18 paratypes): Length 34.1–43.9 mm; width across humeri 16.0–20.3 mm. Color as in holotype to dark brown, frequently with weak metallic green reflection on head, pronotum and scutellum. *Head:* Clypeal horns vary from as in type (majors) to much reduced (minors). *Pronotum:* White markings vary from indistinct to



Figs. 3, 4. Heads of *I. clathrata clathrata* and *I. clathrata sommeri* respectively.

distinct. Scutellum with or without spotting in basal angles. *Elytra:* Spotting as in type to denser, spots occasionally a little larger. *Pygidium:* As in holotype to basal band distinct. *Parameres:* Apical lamella varies slightly in relative width and shape.

Females (23 paratypes): Length 30.7–44.4 mm; width across humeri 13.8–19.5 mm. *Pronotum:* White markings vary from indistinct to complete and well marked. *Elytra:* Density and size of spots vary slightly.

DISCUSSION: The males of *Inca clathrata quesneli* are easily distinguished from the males of *I. clathrata clathrata* and *I. clathrata sommeri* by the form of the clypeal horns. Bates (1889) may have been the first to record this distinction when he wrote "In all the males I have seen from Mexico and Central America, the upper inner carina of the male horns curves towards the inner apical angle, and in all those from South America towards the outer apical angle. This is a more constant difference than the straight truncature [of the horns] specified by Westwood as the distinctive character of *I. sommeri,* as Mexican examples vary much in this respect, the apex being sometimes strongly sinuated." The carina on the median edge of the horn curves toward the outer apical angle in *I. c. clathrata* (Fig. 3) and towards the inner apical angle in *I. c. sommeri* (Fig. 4). In *I. c. quesneli,* the carina abruptly ends well before curving to an apical angle (Fig. 1).

In addition, specimens of *I. c. quesneli* are all consistently black or very dark brown, whereas the other subspecies are more typically dark brown to dark olive green on the head and pronotum and reddish brown on the elytra. Although some specimens of *I. c. sommeri* and *I. c. clathrata* are occasionally dark brown or black, no specimens of *I. c. quesneli* were lighter in color. Moreover, the elytral spotting of *I. c. quesneli* is consistently smaller than in the two other subspecies. Inasmuch as size of spots is relative, this can be observed only when series of all three subspecies are examined simultaneously. As with the partially shared color character, an occasional specimen of *I. c. clathrata* or *I. c. sommeri* may also have small spotting, but no specimens of *I. c. quesneli* had larger elytral spots.

The parameres of the male genitalia (Fig. 2) were examined to determine if they were diagnostic for *I. c. quesneli.* The parameres of the three subspecies differed no more amongst themselves than the variation observed within a single subspecies. The apical lamella of each paramere varied in relative width and shape. No consistent differences were seen in the parameres to aid in separation of these taxa.

Other than the relative expressions of color and elytral spotting, we have been unable to find any characters to reliably separate the females of the three subspecies. The best method for identifying the females remains, therefore, the locality from where it was collected.

As a point of historical interest, this subspecies was first illustrated in 1892 as a club emblem on the cover of volume one of the Journal of the Trinidad Field Naturalists' Club. The original woodcut engraving was completed by the founding President of the Club, Mr. H. Caracciolo (Devenish and Mole 1892). Since Dr. W. E. Broadway, a colleague of Mr. Caracciolo and also a founding member of the club, was the collector of the holotype and allotype, the specimen used as the model for the emblem was probably our holotype described herein. V. C. Quesnel, A. T. Carr, and G. Jenkins (1956), joint editors of the Journal, noted that a specimen was borrowed from the British Museum in order to make a new illustration for the Journal. The drawing was done by Dr. J. S. Kenny, and the specimen used was in all likelihood our holotype. The drawing continues to be used today as the emblem of Living World, the Journal of the Trinidad and Tobago Field Naturalists' Club.

ETYMOLOGY. This new subspecies of *Inca clathrata* is named in honor of Dr. Victor C. Quesnel, Trinidadian naturalist, in grateful acknowledgment of his friendship, encouragement and assistance to Julius Boos.

Inca clathrata sommeri Westwood

Inca clathrata sommeri was known from tropical areas ranging from Otongo in Hidalgo, Mexico, to Panama (Howden 1968; Morón 1983). We record here both northern and southern range extensions for this subspecies. The following are new records. **Mexico:** San Luis Potosi: 5 mi. E. Ciudad de Maiz, VI-16-1979, Terry Taylor (1); VII-21-1979, Terry Taylor (1); VIII-2-1981, Brett Ratcliffe (1). Tamaulipas: El Naranjo, Terry Taylor, IX-23-1981 (1). Hidalgo: 3 mi. N. Chapulhuacan, Terry Taylor, VI-16-1979 (1), VII-7-1982 (1), IX-24-1981 (1). **Colombia:** Valle del Cauca, Buga, XI-1982, D. Torres (1); Valle del Cauca, Darien (between Buga and Buenaventura), no date (3). **Ecuador:** Rio Toachi, road from Quito to Santo Domingo de los Colorados near Alluriquin, V-1982, G. Onore (1); IX-1984, native collector (1); Rio Palenque, 47 km S. Santo Domingo, II-25-1976, H. & A. Howden (1).

These Mexican records extend the distribution of this beetle approximately 200 km north of previous records. *Inca clathrata sommeri* was previously known only from Mesoamerica. These new records represent a southward extension of its range by approximately 780 km and place it for the first time in South America.

Inca clathrata (Olivier)

Distribution of the species of *Inca* in combination with data from paleogeography indicate clearly to us that this genus is South American in origin. The principal upheaval of the northern Andes occurred during the Pliocene, and they reached their present elevation near the beginning of the Quaternary approximately 3 MYBP (Van der Hammen 1982). This suggests to us that the ancestral stock for *Inca clathrata* was in place prior to the principal Andean uplift, and that the rise of the Andes then led to fragmentation of the former population. It seems reasonable to estimate that the age of the *sommeri/clathrata* dichotomy dates from the time when the newly formed mountains func-

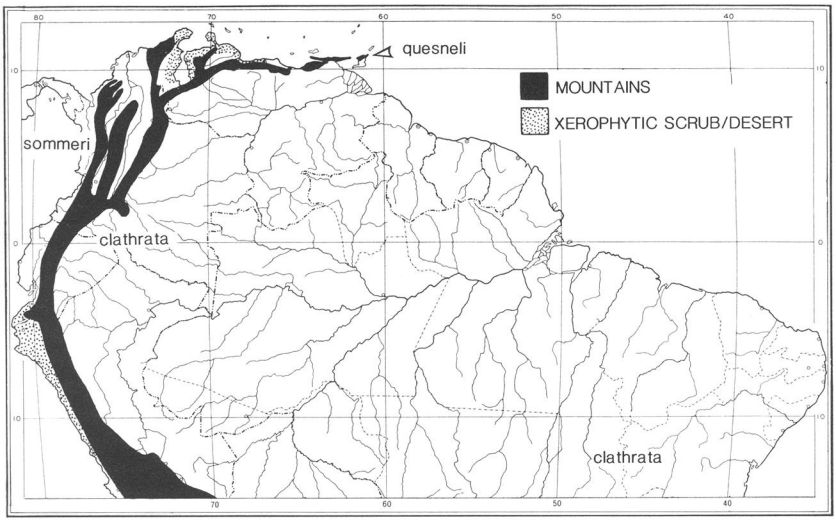


Fig. 5. Map of northern South America showing mountain and desert barriers and distribution of *Inca clathrata* subspecies.

tionally separated the once continuous distribution of the ancestors of *Inca clathrata*. This would be sometime between the Pliocene to the Pleistocene.

Inca clathrata clathrata is found in much of tropical South America *east* of the Andes. *Inca clathrata sommeri* is now known from Mesoamerica and extreme northwestern South America; Morón (1983) indicated that it is found from sea level to 1,300 m in Mexico. Figure 5 shows how *I. c. sommeri* could have been isolated by mountains and desert barriers in this region from the remainder of the South American population of *I. clathrata*. The map also shows a relatively barrier-free dispersal route from South America into Central America. Dispersal to Central America was made possible after the formation of the Panamanian land bridge in the Pliocene approximately 5.7 MYBP (Lloyd 1963). Morón (1983; personal communication, 1984) stated penetration of South American taxa (and specifically *Inca clathrata*) into southern Mexico was a post-Pleistocene event.

Inca clathrata quesneli is known only from Trinidad. Northern South America shows widespread evidence of geologic block uplift but no volcanism. Most of Trinidad was probably uplifted, eroded, and tilted within the last 25 million years during plate slip along the complex system of faults dissecting this area (de Almieda 1978; Mattson 1984). In Trinidad there is an extreme difference in the ages of rocks on either side of the El Pilar fault with strata 140 million years old in the Northern Range north of the fault and 27 million years old in the remainder of the island south of the fault. This indicates the possibility that this fault line represents the present-day boundary between the Caribbean and South American plates (Mattson 1984; Vierbuchen 1984), and that Trinidad is composed of the edges of these two tectonic plates.

There is little geologic evidence to suggest that Trinidad was ever connected to South America by dry land except possibly during the Pleistocene glacial maxima when sea levels fell several tens of meters, and paleoclimates became

generally cooler and drier (Ab'Saber 1982; Hopley 1982). Dispersal of humidophilous *Inca* from Venezuela to Trinidad during these times is considered unlikely because of the increased zone of aridity in northern Venezuela that would have proved a barrier to dispersal. We rely, therefore, on over-water dispersal from the mainland (less than 25 km away) to explain the occurrence of *Inca clathrata* in Trinidad. The ancestors of *quesneli* arrived in Trinidad probably as a result of wind or waif dispersal over the short, intervening distance of water. When this happened remains uncertain. The establishment and isolation of these founder animals on Trinidad resulted in restricted gene flow or genetic alteration which led to the different phenotypic expression observed today in *Inca clathrata quesneli.*

We believe that detailed studies are still needed for *Inca clathrata* that occur in N Colombia, Venezuela, and NE Brazil in order to determine exactly where the three subspecies occur or do not occur.

Acknowledgments

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