



## A new Peruvian species of *Megarthus* Curtis (Coleoptera: Staphylinidae: Proteininae)

LUIS PÉREZ<sup>1\*</sup>, MARYZENDER RODRÍGUEZ<sup>1</sup> & ANGÉLICO ASENJO<sup>2,3</sup>

<sup>1</sup>Departamento de Entomología, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Perú. E-mail: [lperezsauni@gmail.com](mailto:lperezsauni@gmail.com), [maryzender@gmail.com](mailto:maryzender@gmail.com)

<sup>2</sup>Museu Paraense Emílio Goeldi - MPEG, Av. Perimetral, 1901. CEP: 66077-530. Terra Firme, Belém, Brazil.

<sup>3</sup>Universidade Federal de Mato Grosso, Instituto de Biociências, Departamento de Biologia e Zoologia, Av. Fernando Correa da Costa, 2367. CEP: 78060-900. Boa Esperança, Cuiabá, MT, Brazil. E-mail: [pukara8@yahoo.com](mailto:pukara8@yahoo.com)

\*Corresponding author

### Abstract

A new species of *Megarthus* Curtis is described from the Eastern slopes of the Andes in southeastern Peru (Department of Cuzco). Major diagnostic features are photographed and illustrated, and COI molecular barcode is given.

**Key words:** rove beetles, cloud forest, Peruvian Yungas, Neotropical region, DNA barcoding

### Pisiyachiynin

Huq musuq *Megarthus* Curtis sutichasqa tarikun Perú suyupi, Qosqo llaqtapi, kaymi rikuchikun imaymana masthariymanta. Chaupi rurunmanta mast'arisqa, kaykuna fotografiasqa chaynallataq qhawarichisqa, hinallataqmi kaykuna qonku código de barras ADN sutichasqata.

**Yuyaykunakuy:** estafilínidos, Sachasacha puyuchasqa, yunka qechincha, suyu neotropical nisqa, código de barras de ADN sutichasqata

### Introduction

The genus *Megarthus* Curtis, 1829 comprises 158 species described around the world (Cuccodoro 2003, 2010, 2011a, 2011b, 2018, Cuccodoro *et al.* 2011, Cuccodoro & Liu 2016, Herman 2001, López-García *et al.* 2011, Rodríguez & Navarrete-Heredia 2015). Cuccodoro (2011a) reviewed the nine Neotropical species hitherto described from the Americas South of Rio Grande and added two new species from Costa Rica and Peru. Then López-García *et al.* (2011) and Rodríguez & Navarrete-Heredia (2015) described two new species from Colombia and Mexico respectively. In the Neotropical region the genus appears thus distributed from Mexico to northern Argentina, with most diversity in Central America (ten species) and only three species are recorded from South America (Asenjo *et al.* 2019). However, the true diversity of *Megarthus* in South American is much greater as Cuccodoro (2011a) noted that at least fifteen undescribed species from the entire continent, except Chile are known from collections worldwide.

This study aims to describe a new species from Peru (Department of Cuzco) using morphological and molecular characters.

## Material and methods

**Specimens.** The specimens were relaxed in warm water for five minutes and then the last abdominal segments were dissected. The apical segments were cleared in a double boiler using 10% KOH for two minutes. Dissections were made under a Leica LED2500 stereo-microscope (10X–160X) and the dissected parts were put inside polyethylene micro vials with glycerin and pinned with the specimen. The habitus was photographed with a Leica MC190HD camera attached to a Leica LED2500 stereo-microscope and Photoshop CC 2015 was used for the image processing. Zerene Stacker was used for image stacking. Illustrations were made with Adobe Illustrator CC 2015. Micrographs were obtained using a JEOL JSM-6610LV scanning electron microscope. Measurements are in millimeters and were done using the measuring tools of Leica Application Suite software and are based on the holotype. The length of antennomeres does not include the peduncle. Terms for structural features follow Cuccodoro (2011a) and Cuccodoro (2016) for aedeagal terminology, except for the use of “ventrite” instead of “sternite” when describing thoracic structures. Abdominal sternites and tergites are counted from the first morphological segment and quoted in Roman numerals. To obtain the sequence of the Cytochrome Oxidase I (COI), right proleg, right mesoleg and right metaleg were removed from three specimens, placed in a sampling well filled with absolute ethanol and sent to the Biodiversity Institute of Ontario, University of Guelph where the sequencing was carried out.

### The following abbreviations are used:

BL	body length (anterior margin of labrum to posterior margin of tergum VIII)
BW	body width (maximum width of elytra)
EL	elytral length (along the sutural length)
EW	elytral width (maximum)
HL	head length (from anterior margin of clypeus to posterior margin of head disc)
HW	head width (including eyes)
PL	pronotum length (maximum)
PW	pronotum width (maximum)
PL+EL	length of pronotum and elytra combined (length from anterior margin of pronotum to inner apical angle of elytron)

The type label data are reproduced verbatim between quotation marks “ ” and separate different labels and a slash / separates different lines. Text within square brackets [ ] is explanatory and was not included on the original labels.

## Depositories

The type material belong to the MUSM, the FMNH, and the MHNG. Some of the specimens of the MUSM will be donated to other institutions according to the following list:

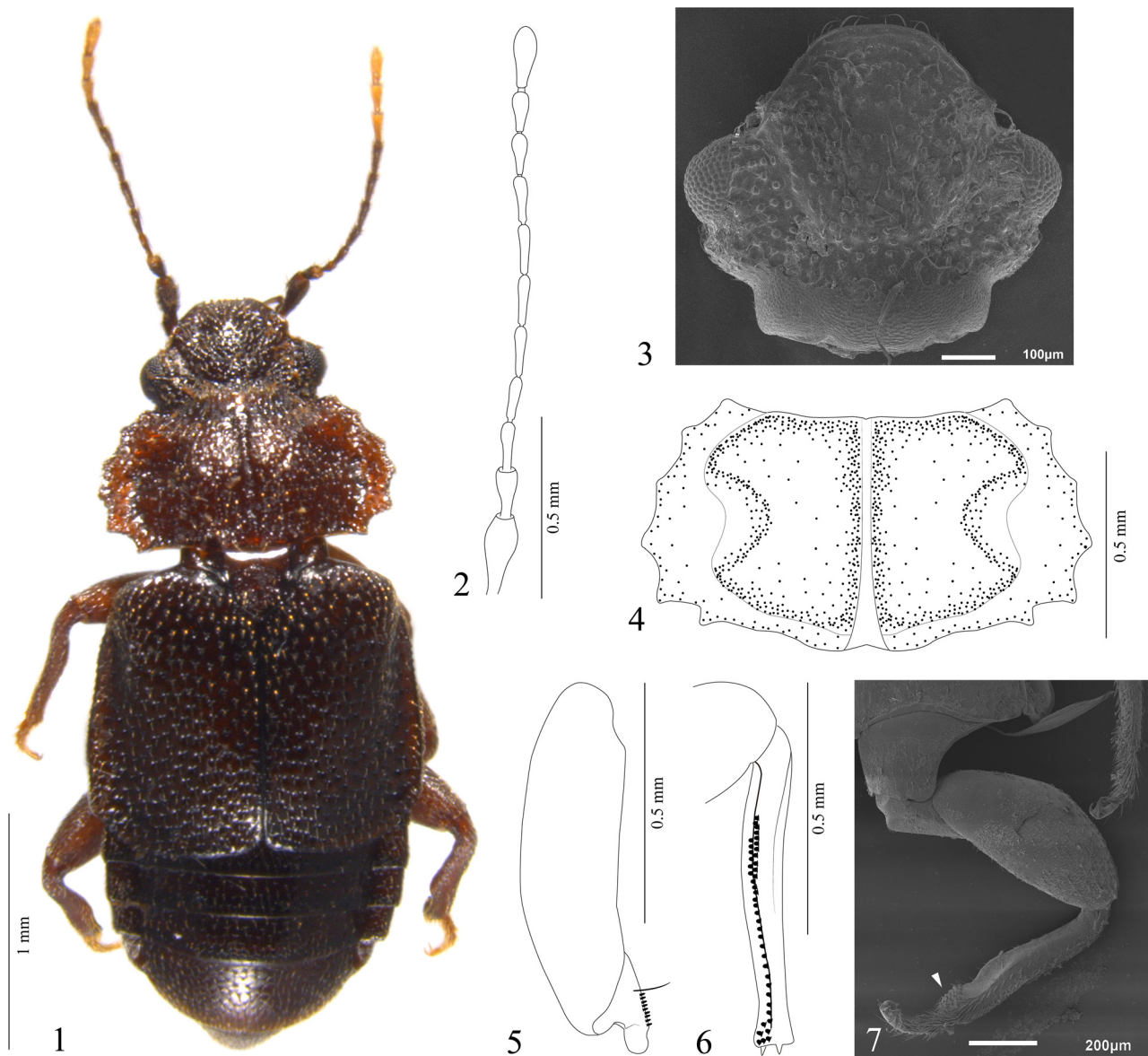
MUSM	Entomological Collection of Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (Diana Silva).
CEMT	Setor de Entomologia da Coleção Zoológica da Universidade Federal de Mato Grosso, Departamento de Biologia e Zoologia, Cuiabá, Mato Grosso, Brazil (Fernando Vaz-de-Mello).
FMNH	The Field Museum, Chicago, Illinois, U.S.A. (Margaret K. Thayer, Alfred F. Newton & Maureen Turcatel).
IADIZA	Instituto Argentino de Investigaciones de las Zonas Áridas, Mendoza, Argentina (Sergio Roig-Juñent).
MEKRB	Entomological Museum Klaus Raven Buller, Universidad Nacional Agraria La Molina, Lima, Peru (Clorinda Vergara).
MHNG	Muséum d’histoire naturelle, Genève, Switzerland (Giulio Cuccodoro).
MPEG	Museu Paraense Emilio Goeldi, Terra Firme, Belém, Brazil (Orlando Silveira).
VMDC	Víctor Manuel Diéguez (Private collection), Santiago de Chile, Chile.

## Taxonomy

### *Megarthus wayqecha* Pérez, Rodríguez & Asenjo, sp. nov.

(Figs. 1–21)

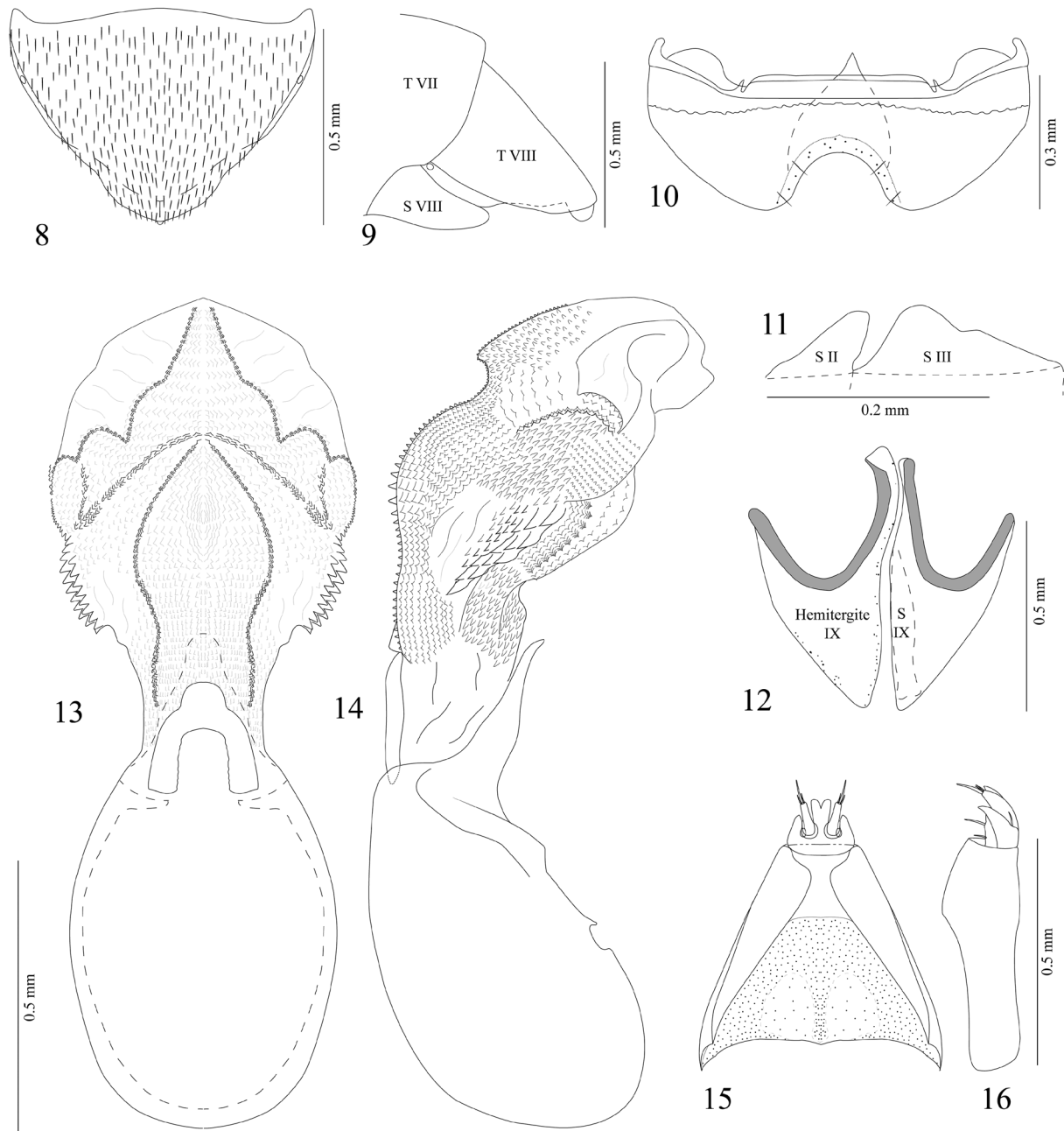
urn:lsid:zoobank.org:act:D381BA9B-848E-4D9B-B125-37EE635F93D4



**FIGURES 1–7.** *Megarthus wayqecha* sp. nov., male holotype from Wayqecha, Trocha Canopy (2, 4–6). 2, antenna; 4, pronotum; 5, mesotrochanter and mesofemur; 6, mesotibia. *Megarthus wayqecha* sp. nov., male paratype from Wayqecha, Trocha Canopy (1, 3, 7). 1, habitus, dorsal view; 3, head, dorsal view; 7, metaleg with peg-like setae in the apex of metatibia.

**Type material** (43♂♂, 51♀♀). **Holotype:** PERU: ♂, labeled “PERU: CU[Department of Cuzco], Kosñipata, / Wayqecha, Trocha / Canopy, 13°11’32.8”S, / 71°35’16.0”W, 2931 m,” “02.xi.2017, cloud forest, / sifting of leaf litter, M. / Rodríguez & L. Pérez leg.” “HOLOTYPE [red label] / *Megarthus wayqecha* / sp. nov. / Desig. Pérez et al., 2019” (MUSM). **Paratypes (94):** 32♂♂, 33♀♀ labeled with the same data as holotype (21♂♂, 28♀♀ MUSM; 2♂♂, 1♀ MEKRB; 1♂, 1♀ CEMT; 2♂♂, 1♀ FMNH; 2♂♂, 1♀ MHNG; 1♂, 1♀ VMDC; 2♂♂, MPEG; 1♂, IADIZA). 3♂♂ labeled as holotype with additional green label “DNA BARCODING / VOUCHER / BOLD Systems / CCDB-30362-B01 to B03” (MUSM). 2♂♂, 6♀♀ labeled “PERU: CU[Department of Cuzco], Kosñipata, / Wayqecha Research / Center, 13°10’29.07”S,” “71°35’11.98”W, 2950 m, /23.x.2017, cloud forest, /sifting of leaf litter, M. /Rodríguez & L. Pérez leg.” (MUSM). “Peru: Cuzco Dept./, Pillahuata. Manu rd, / km 126, 24.IX.1982, /

FMND #82-2861, ex” “vine litter & fungus / nr. seepage area, / L. E. Watrous and G. / Mazurek ”(2 ♀♀ FMNH); same data but “km 128, 17.IX.1982, FMND #82-249, ex litter & seepage area” (1 ♀ FMNH); same data but “19. IX.1982, FMND #82-262, ex litter nr. falls” (1 ♂, 1 ♀ FMNH); same data but “23.IX.1982, FMND #82-281, ex litter & fungus nr. seepage area” (2 ♀♀ FMNH); same data but “25.IX.1982, FMND #82-293, ex litter, some nr. stream” (1 ♂, 2 ♀♀ FMNH; 2 ♂♂ MHNG); same data but “26.IX.1982, FMND #82-299, ex litter along stream” (1 ♂, 2 ♀♀ FMNH, 2 ♀♀ MHNG); same data but “27.IX.1982, FMND #82-307, ex leaf litter”(1 ♂ FMNH). All paratypes labeled “PARATYPE [yellow label] / *Megarathrus wayqecha* / sp. nov. / Desig. Pérez *et al.*, 2019”.



**FIGURES 8–16.** *Megarathrus wayqecha* sp. nov., holotype (8–14). **8**, tergite VIII, dorsal view; **9**, tergite VII, tergite VIII, sternite VIII, lateral view; **10**, sternite VIII; **11**, medial area of abdominal sternites II–III in lateral view; **12**, hemitergites IX and sternite IX; **13**, aedeagus, ventral view; **14**, aedeagus, lateral view. *Megarathrus wayqecha* sp. nov., female paratype, from Wayqecha, Trocha Canopy **15**, genital segments, dorsal view; **16**, genital segments, lateral view.

**Diagnosis.** Among the members of the genus possessing the eleventh antennomeres piriform, *Megarathrus wayqecha* sp. nov. uniquely shares with the Argentinian *M. ogloblini* Bruch, 1940 (Fig. 147: Cuccodoro 2011) and the Colombian *M. andinus* López-García *et al.*, 2011 the pronotum shallowly notched laterobasally with the lateral



outline forming 4 distinct angles. However *M. andinus* is readily distinguished from these species by its conspicuous anterior adsutural elytral humps, and *M. ogloblini* has the male metatibiae cylindrical bearing peg-like setae on apical half, while males of *M. wayqecha* have the metatibiae enlarged and notched with peg-like setae grouped subapically. The shape of the aedeagus of *M. wayqecha* is also diagnostic: the median lobe in lateral view has the ventral face subapically straight with the tip of apex acute (Fig. 18) and the dorsal valve (seen in dorsal view) is V-shaped (Fig. 19).



FIGURES 17–19. *Megarthus wayqecha* sp. nov., male paratype. 17, aedeagus, ventral view (the side of the basal foramen); 18, aedeagus, lateral view; 19, aedeagus, dorsal view.



FIGURES 20–21. Habitat of *Megarthus wayqecha* sp. nov. 20, panoramic view of the cloud forests of the Kosñipata valley, where the biological station Wayqecha is located. 21, sifting leaf litter on Trocha Canopy from the biological station Wayqecha.

**Description.** Holotype male (BL=3.11, BW=1.18, PL+EL=1.82). Body dark brown with appendages and legs somewhat paler, antennomeres 9–11 paler than antennomeres 1–8 (Fig. 1). Dorsal pubescence of body fairly uniform, frontal setae directed forward, median area of frons less dense than on vertex; pronotum, elytra and abdomen with setae directed backward, denser on pronotum than on elytra, pronotal setae curved and recumbent, denser on pronotal disc; elytral setae curved and recumbent, becoming denser near humeral area with interspaces as wide as puncture diameters; metaventral pubescence uniform, with small protuberance near posterior margin; pubescence

on abdominal tergites parallel, uniform. Frons with granulation conspicuous, with granulae about as high as their diameter or higher; pronotum and elytra granulofossulate, with granulation small.

Head (Fig. 3) wider than long (HW=0.71, HL=0.53), mesal portion of disc strongly convex in lateral view; U-shaped frontal impression shallow; eyes medium size on posterior half; clypeus carinate, nearly rounded; temples convex in dorsal view. Antenna (Fig. 2) symmetrical and filiform, 2.1 times longer than pronotum, antennomeres 1–4 without pubescence, antennomeres 5–11 pubescent; antennomere 11 piriform.

Pronotum wider than long (PW=1.27, PL=0.65), 1.2 times longer than head, anterior margin slightly concave and posterior margin slightly convex and bilobed in the middle (Fig. 4). Pronotum with disc strongly convex and deeply depressed near middle of lateral edges, lateral and posterior edges shallowly depressed along disc. Anterior angles projected forward, lateral contours forming four denticles, posterior angles weakly projected backwards. Medial groove punctate and flat, slightly narrower in middle (Fig. 4). Hypomerion with inner edge wider in its median portion, ridged from anterior margin to laterobasal angle, without a discal pit. Proventral medial ridge absent.

Scutellum triangular with anterior border rounded and posterior border slightly acute, margins slightly raised and with pubescence directed backward. Elytra wider than long (EL=0.96, EW=1.30), 1.8 times longer than pronotum, gradually widened toward apex (Fig. 2), humeral callus raised, moderately convex; disc with low swellings, moderately depressed posteriorly and along lateral external edge, the latter finely carinate, slightly arcuate in dorsal view. Protrochanter without transverse ridge, small, subtriangular with one macroseta near the apex; profemur oblong with base flattened; protibia thin and shorter than profemur, inner face with many setae in the apical two thirds; protarsomere 1–4 dorsoventrally setose, protarsomere 1 as long as protarsomere 2–3 combined, protarsomere 5 with scarce setae, longer than protarsomere 1. Mesotrochanter subtriangular with peg-like setae arranged in two rows, one row with 7–8 peg-like setae and the second with 4–5 peg-like setae, and bearing one subapical macroseta (Fig. 5); mesofemur oblong; mesotibia sinuate, shorter than mesofemur, with peg-like setae arranged in two rows, a row along 4/5 apical length and a short row from base to middle, and some apical peg-like setae not aligned (Fig. 6); mesotarsomeres similar to protarsomeres. Metatrochanter subtriangular, incrassate (Fig. 7); metafemur strongly very robust about twice as long as broad (0.71/0.30) (Fig. 7); metatibia gradually enlarged toward apex, shorter than metafemur, with notched at subapical quarter constriction, and with peg-like setae grouped on apical quarter (Fig. 7); metatarsomeres similar to protarsomeres.

Tergites III–VII pubescent with one pair of paratergites; tergites II–III covered by elytra, tergite IV partially covered. Medial process of sternite II shorter and smaller than medial process of sternite III (Fig. 11). Sternite III–VII rectangular with pubescence. Tergite VIII triangular with anterior angles slightly projected forward, posterior margin forming an obtuse angle (Fig. 8), with small and broad medial apical projection convex in lateral view (Fig. 9). Sternite VIII trapezoidal, with lateral margin slightly convex, posterior margin strongly concave and membranous with four short macrosetae, anterior margin characteristic, inner plate asymmetrical with apex acute exceeding a little the anterior margin of sternite VIII (Fig. 10). Hemitergites IX slightly asymmetrical, left hemitergite slightly bigger in ventral view, anterior margin of right hemitergite more concave than left (Fig. 12). Sternite IX asymmetrical, oblong and thin (Fig. 12).

Aedeagus as in Figs. 13–14 (internal sac evaginated), with median lobe oval-shaped in ventral view (Fig. 13), in lateral view with ventral face subapically straight with the tip of apex acute (Fig. 14), dorsal valve V-shaped.

*Female.* Similar to male, except mesotrochanter without peg-like setae; mesotibia without peg-like; metafemur thin; metatibia without peg-like setae; tergite VIII in lateral view with little and thin medioapical projection convex; sternite VIII without inner plate and posterior margin almost straight; genital segments as in Figs. 15–16; gonocoxal plate lacking mediodorsal ridge.

**Remarks.** The new species *M. wayqecha* **sp. nov.** is included in the definition of *Megarthus inaequalis*-supergroup proposed by Cuccodoro (2011a) based on the following characters: presence of a long prohypomeral ridge extended posteriorly to the laterobasal angle, frontal pubescence directed forward (Figs. 1, 3), antennomere 11 piriform (Figs. 1, 2), and lack of adventral adhesive setae on the first male protarsomere. Within this supergroup only *M. wayqecha*, *M. andinus* and the Costa Rican *M. mammiger* Bierig, 1940, lack a mediodorsal ridge on the female gonocoxal plate. However, *M. mammiger* has the pronotum conspicuously notched laterobasally, while it is only slightly notched laterobasally in *M. wayqecha* and *M. andinus*. *Megarthus wayqecha* differs notably from *M. andinus* by its elytra lacking conspicuous antebasal adsutural humps. The sexually dimorphic features on the male legs, the shape of the aedeagal ventral wall, and the conformation of the female valvifers are also diagnostic.

Aedeagus with the internal sac not evaginated from a paratype as in Figs. 17–19.



Three male paratypes and 16 female paratypes have the antennomere 9 yellow in apical half and brown in basal half.

**Distribution and natural history.** The specimens from wayqecha were collected in a cloud forest between 2931 m and 2950 m, from the biological station “Wayqecha”, a private area recently protected by Peruvian law with the aim to preserve the biodiversity of Peruvian Yungas (MINAM, 2016) (Figs. 20, 21). Wayqecha is placed 19 km SW of Pillahuata (13°08’S, 71°25’W), the type locality of *M. machu* Cuccodoro, 2001. According to the information provided by the collector, the specimens were found in leaf litter with moss, ferns, and bamboo leaves alongside the roots and trunks of trees as observed in Fig. 21.

**Etymology.** The specific name “Wayqecha” refers to the locality of collection of this new species. Wayqecha means ‘little brother’ in Quechua language. This is a noun in apposition.

**Barcoding.** The mitochondrial DNA sequences (COI) of three paratypes were identical (Table 1). One COI sequence is as follows:

**TABLE 1.** Accession number in GenBank and barcoding voucher codes in BOLD Systems for COI sequences from three paratypes of *Megarthus wayqecha* sp. nov.

Specimens	GenBank	BOLD Systems
<i>Megarthus wayqecha</i> sp. nov.	MN015579	CCDB-30362-B01
<i>Megarthus wayqecha</i> sp. nov.	MN015580	CCDB-30362-B03
<i>Megarthus wayqecha</i> sp. nov.	MN015581	CCDB-30362-B02

### *Megarthus wayqecha* sp. nov., 646 bp

GACTCTATACTTCATTTTTGGAGCCTGATCGGGTATAATTGGAACCTCCCTAAGAATTTTAATTC-GAGCCGAAATAGGAAACCCCGTTCTTTAATCGGAGATGACCAAATTTATAATGTTATTGTCACTGCT-CATGCTTTTATCATAGTTATGCCTATCGTAATCGGCGGATTCGGAAACTGGCTTGTAACCCCTAATAC TGGGGGCCCTGACATAGCTTTTCCCCGAATAAATAATATAAGATTTTGGTTATTACCCCTCTATTTCCCT-TACTTTTAATTAGAAGAATGGTTGAAAGAGGAGCTGGAACCTGGCTGAACGGTCTACCCCCCAT-TATCATCAAATATTGCCCATGGCGGAGCTTCTGTAGATTTAGCTATCTTTAGGCTTCATCTCGCC-GGAATTTCTTCCATTTTAGGAGCCGTAATTTTACTACTGTAATTAATATGCGATCTGTAGGAATATCATTT-GATCGAATACCCCTATTTGTATGATCAGTAGCAATTACTGCTCTTCTCCTTTTACTCTCTCTCCCAGTTT-TAGCAGGAGCTATCACCATACTTCTTACAGACCGTAACATCAATACCTCCTTCTTTGACCCCGCAG-GAGGAGGAGATCCCATTTTATACCAACATTTATTT

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