

## A new species of the genus *Bothriomyrmex* Emery, 1869 (Hymenoptera: Formicidae: Dolichoderinae) from Costa Rica

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### Abstract

*Bothriomyrmex paradoxus* Dubovikov and Longino sp. nov. is described from Costa Rica, based on two collections from widely separated localities. These are the first collections of the genus *Bothriomyrmex* in the Americas. The genus *Bothriomyrmex* can be divided into Palearctic species (*Bothriomyrmex s.s.*) and Oriental and Australian species, based on differences in palp formula and queen wing venation. *Bothriomyrmex paradoxus* shares palp and wing characters with the Palearctic species. It is probably native to Central America and long separated from its Old World relatives.

**Key words:** *Bothriomyrmex*, Formicidae, Dolichoderinae, Costa Rica

### Introduction

The subfamily Dolichoderinae is comprised of 22 genera, the majority of which are Old World (Shattuck 1992, Bolton 2003, Brandão et al. 1999). The dolichoderine genera with significant indigenous radiations in the New World are *Azteca*, *Dolichoderus*, *Dorymyrmex*, *Forelius*, *Linepithema*, *Liometopum*, and *Tapinoma*. Three additional genera have been reported as rare or introduced elements. *Technomyrmex*, a diverse genus in the Old World, is represented in the New World by one introduced tramp species and, paradoxically, one native species from Panama and Costa Rica (Wheeler 1934, Longino pers. obs.). *Anillidris* is a rare genus of subterranean ants known only from southern South America. *Ochetellus* is an Australasian genus, one species of which has been reported from Florida as a recent introduction (Smith 1979, Deyrup et al. 1989). Santschi's 1936 publication on *Anillidris* featured the last addition of a native dolichoderine genus to the New World fauna. Thus, we were surprised to discover an undescribed species of *Bothriomyrmex* from Central America. This discovery was first reported in a table of Neotropical genera in

Fernández & Ospina (2003), based on a personal communication. Here we provide a description of the new species and details of its discovery.

The genus *Bothriomyrmex* is currently composed of 33 species, all of which are known only from the Old World: southern Europe, northern Africa, India, Southeast Asia, and Australia (Santschi 1919, Emery 1925, Shattuck 1992). Little is known of the biology of *Bothriomyrmex* in general, but several species are known to be temporary social parasites, using colonies of *Tapinoma* to establish their own colonies (Santschi 1906, Wheeler 1910). Lloyd et al. (1986) found that the pygidial glands of *B. syrius* queens and the *Tapinoma simrothi* host workers contained the same ketone, and they suggested that this aids the queen in gaining access to the *Tapinoma* colony. All the known species have diminutive queens, so temporary social parasitism could be the mode of colony founding for the whole genus.

The species of *Bothriomyrmex* may be divided into *Bothriomyrmex s.s.* from the Palearctic and a separate group of species from the Indo-Australian region (Dubovikoff 2002, unpub.). Workers of the Palearctic species have palp formula 4:3, and the queen has a closed discoidal cell on the forewing. Oriental species have palp formula 2:3, and the queen forewing has a closed discoidal cell and some reduced cubital and medial veins. The Australian species have palp formula 2:2 and the queen forewing has an open discoidal cell. The American species we describe here shares palp formula and queen forewing characters with the Palaeartic species in *Bothriomyrmex s.s.*

## Methods

The following linear measurements (in mm) and indices are used: HL - head length, with head in full-face view, from center of line connecting two lobes of vertex margin to anterior-most projection of clypeus; HW - maximum width of head, including the eyes; SL - scape length, excluding the condylar bulb; OL - maximum length of eye (measured on males only); TL - mesosoma length from the base of anterior slope of pronotum to the lower posterior angle of propodeum; TH - maximum height of mesosoma, measured as perpendicular distance between two parallel lines, one touching ventral margins of katapisternum and propodeum (upper margins of middle and hind coxae), the other at highest point of mesosomal dorsum; PH - petiole height, including protruding lobe on the ventral margin; CI - cephalic index (HW/HL); SI - scape index (SL/HL); OI - ocular index (males only) (OL/SL); TI - mesosomal index (TH/TL).

The following institution abbreviations are used:

CAS: California Academy of Sciences, San Francisco, CA, USA.

INBio: Instituto Nacional de Biodiversidad, Costa Rica.

LACM: Los Angeles County Museum of Natural History, Los Angeles, CA, USA.

MCZC: Museum of Comparative Zoology, Cambridge, MA, USA.

MHNG: Muséum d'Histoire Naturelle, Geneva, Switzerland.

UCDC: University of California, Davis, CA, USA.

USNM: National Museum of Natural History, Washington, DC, USA.

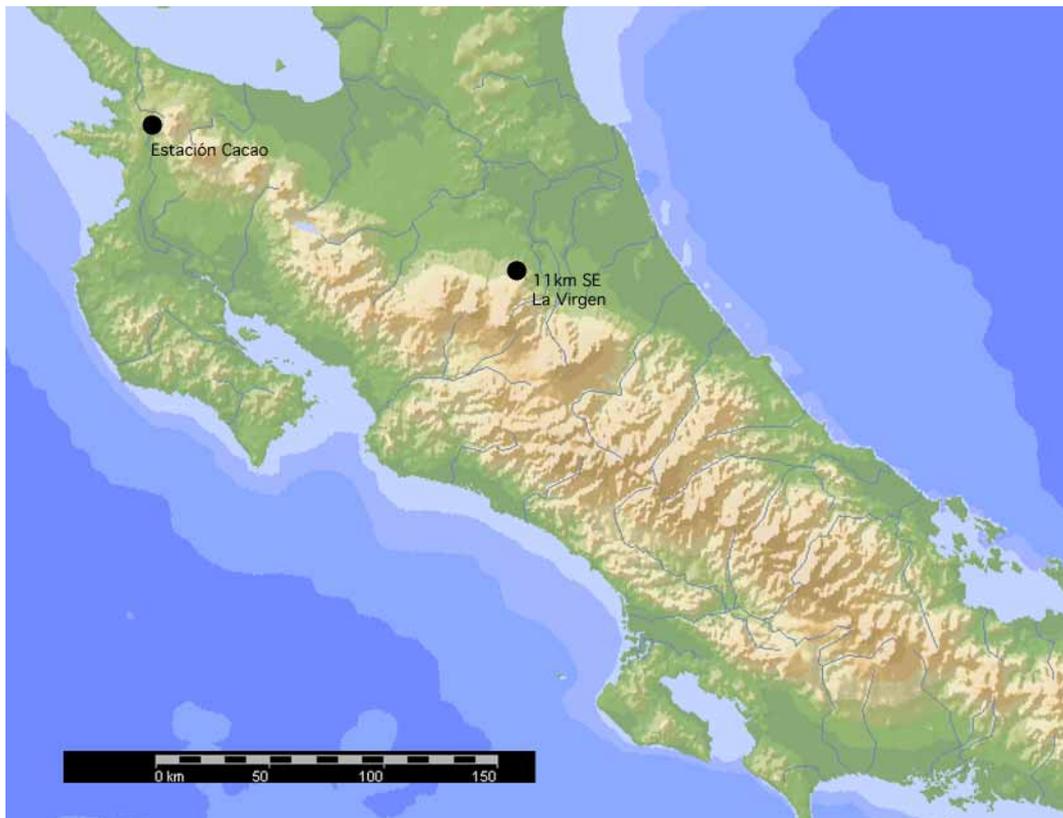
ZIN: Zoological Institute, Russian Academy of Sciences, Saint Petersburg, Russia

***Bothriomyrmex paradoxus* Dubovikov and Longino, sp. nov.**

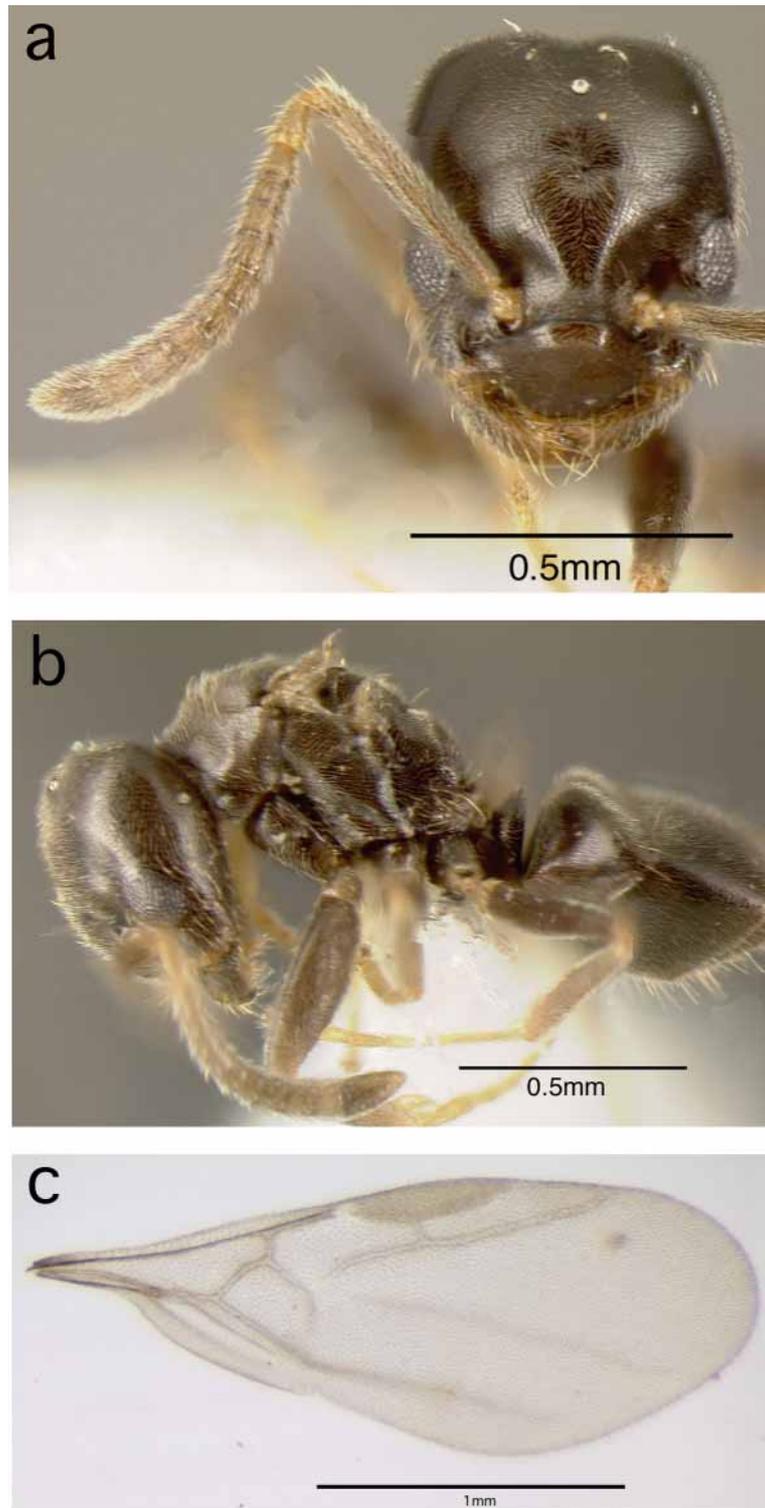
Figures 1–5

*Holotype queen*: Costa Rica, Prov. Guanacaste, Guanacaste Conservation Area, Estación Cacao, 10°55'N 85°30'W, 1100m, 22 Feb 2003, tropical montane moist forest, sweep sample (J. S. Noyes), specimen barcode JTLC000004280 [INBio].

*Paratypes*: 3 queens and 3 males, same data as holotype [ZIN]; queen and 2 males, same data as holotype [MCZC]; 2 queens, same data as holotype [LACM, INBio]; 5 workers, Costa Rica, Prov. Heredia, 11 km SE La Virgen, 10°20'N 84°04'W, 500m, 19 Apr 2003, coll. R. Vargas C., 05–RVC-007 [ZIN]; 4 workers, same data [MHNG]; 5 workers, same data but 16 Feb 2003, coll. J. Longino (JTL4938) [same colony] [CAS, INBio, LACM, UCDC, USNM].



**FIGURE 1.** Collection localities of *Bothriomyrmex paradoxus*.



**FIGURE 2.** *Bothriomyrmex paradoxus* queen. a. Face view, holotype. b. Lateral view, holotype. c. Wing, paratype.

*Holotype measurements*: HL 0.600; HW 0.526; SL 0.424; TL 0.697; TH 0.448; PH 0.227; TI 0.643; CI 0.876; SI 0.706.

*Paratype measurements (average for 3 queens)*: HL 0.600; HW 0.543; SL 0.436; TL 0.700; TH 0.450; PH 0.257; TI 0.643; CI 0.905; SI 0.726.

*Paratype measurements (average for 5 workers)*: HL 0.586; HW 0.520; SL 0.434; PH 0.239; CI 0.888; SI 0.742.

*Paratype measurements (average for 3 males)*: HL 0.457; HW 0.479; SL 0.257; OL 0.171; PH 0.179; OI 0.667; CI 1.047; SI 0.563.

*Etymology*: named for the paradoxical occurrence of this species in the New World, when the genus was previously considered strictly Old World.

*Diagnosis*: Queen with short suberect setae on mesosoma and gaster; queen mesosoma short and high (TI > 0.64); worker mesosoma with impressed metanotal groove.

*Description (queen)*: Palp formula 4:3; head oblong, with rounded posterolateral vertex margins; suberect hairs of variable length on genae (Fig. 2a); clypeus broad, width in center 0.2 mm (average for 4 queens), with curved setae on anterior margin; mandible long, with outer and basal margin subparallel, masticatory margin with three teeth and 4-5 denticles; mesosoma short and high, with erect setae on dorsum and posterior face of propodeum; wings with closed cubital and radial cells (Fig. 1c); petiole with strongly developed ventral lobe, dorsal scale inclined anteriorly; gaster with many long setae on posterolateral margins of tergites; body dark brown; entire body with short suberect pubescence, distance between hairs subequal to length.

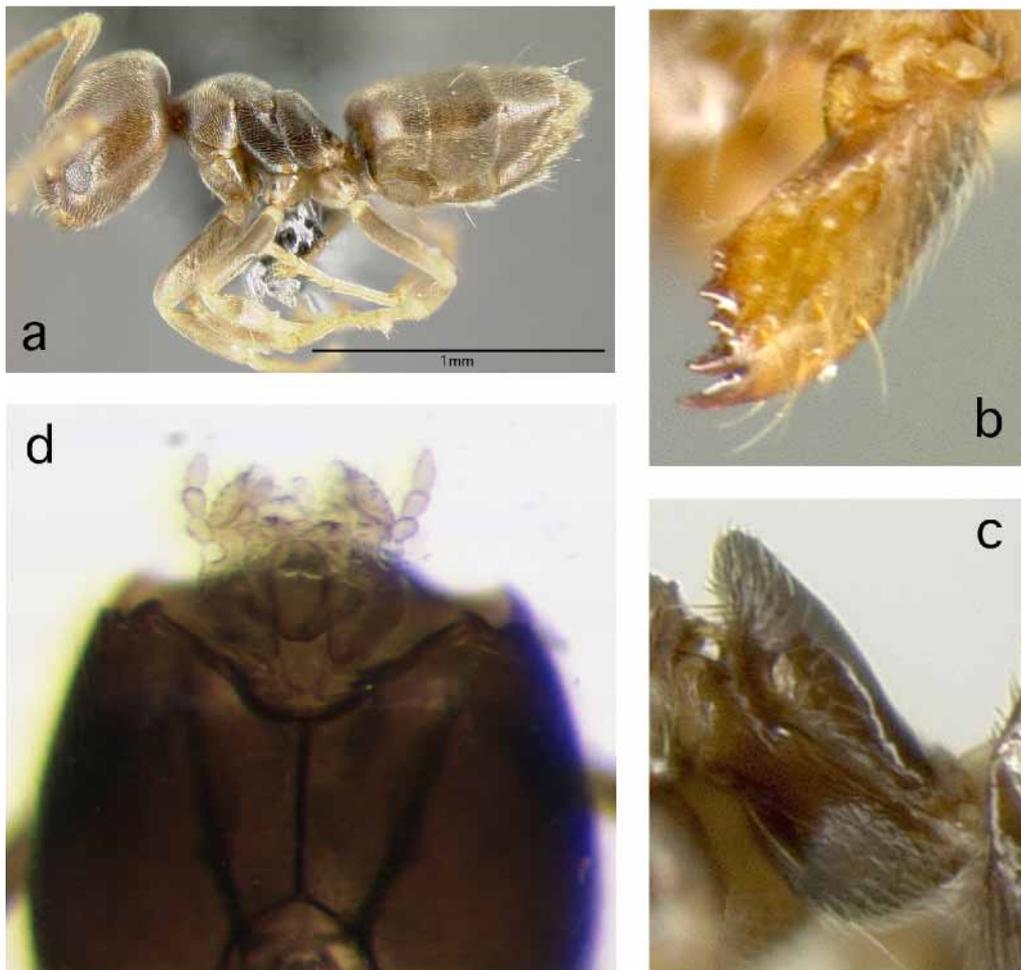
*Description (worker)*: Palp formula 4:3; medial hypostoma absent (Fig. 3d); head with two long setae on the frons, two on the posterior clypeal margin, and many curved setae on the anterior clypeal margin; metanotal groove impressed (Fig. 3a); dorsal face of propodeum rounded, much shorter than posterior face; petiolar node scale-like, tall, inclined anteriorly; ventral margin of petiole with prominent lobe (Fig. 3c); gaster with long setae on posterior margins of tergites; pubescence short and dense over entire body; body dark brown, with lighter antennae and legs.

*Description (male)*: Scape long, projecting beyond outer eye margin (in face view) by about half of its length; propodeum rounded, without differentiated dorsal and posterior faces; petiole with short anterior peduncle; petiolar node low, thin, vertical; ventral margin of petiole with small anterior denticle and strongly developed medial lobe (Fig. 4); sagitta thin, with apex weakly folded down.

*Description (larva)*: Body with two protuberances on the prothorax, located ventrolaterally; hairs short; eight pairs of spiracles (Fig. 5).

*Biology*: *Bothriomyrmex paradoxus* is known from two different collections from widely separated localities in Costa Rica (Fig. 1). One collection was made in February 2003, during the Project ALAS expeditions to the 500m site on the Volcan Barva transect. The expeditions were based at the "El Ceibo" guard station, on the west bank of the Rio Peje. The station building itself is in pasture abutting mature rainforest. A few meters

inside the forest a large tree had fallen sometime during the months prior to the expeditions. A few of the tree's leaves were still green; most were brown but still attached to branches. There were still extensive epiphyte mats covering the trunk and major branches. Longino collected from beneath these mats and found *Bothriomyrmex* workers and brood piles to be abundant beneath most of the mats. Large Margarodidae (Hemiptera, Coccoidea) were also scattered amongst the *Bothriomyrmex*. Other ant species occurred under the mats and were somewhat interdigitated with the *Bothriomyrmex*, although much less abundant. These included *Hypoponera opacior*, a small yellow *Solenopsis*, and *Tapinoma*. Smaller nests or aggregations were also found of *Crematogaster sotobosque* and *Pheidole biconstricta*. One part of the tree, near the pasture edge, was being invaded by *Solenopsis geminata*. I found only workers and brood. Ronald Vargas of Project ALAS collected more from the same tree in April. His collections included two adult males.



**FIGURE 3.** *Bothriomyrmex paradoxus* worker. a. Lateral view. b. Mandible. c. Petiole. d. Mouthparts and anterior head capsule, ventral view. b, c, d not to scale.



FIGURE 4. *Bothriomyrmex paradoxus* male, lateral view. Inset is enlarged view of petiole.

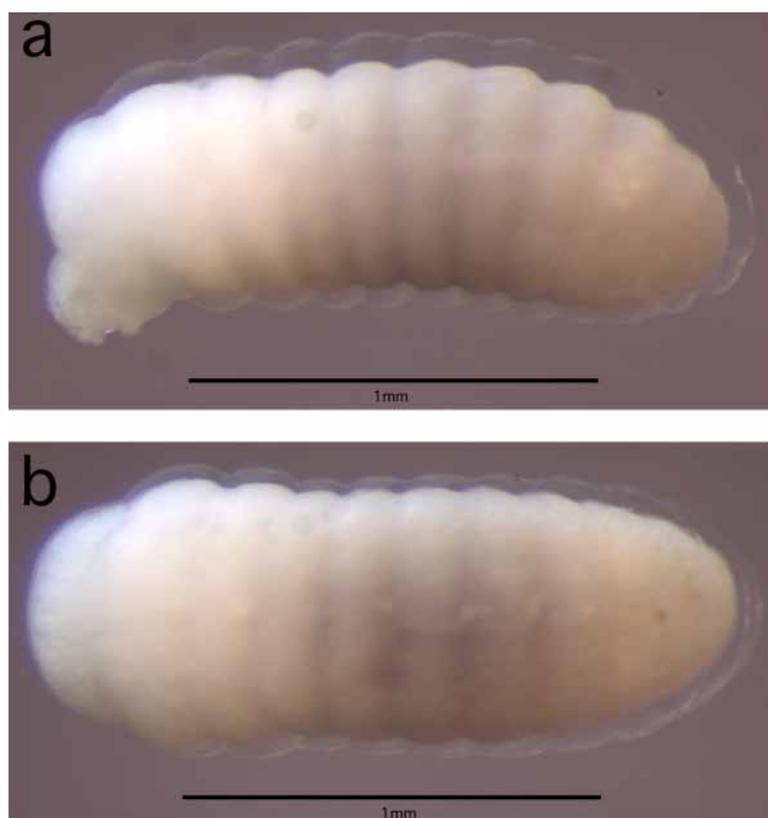


FIGURE 5. *Bothriomyrmex paradoxus* larva. a. Lateral view. b. Dorsal view.

The second collection was also made in February of 2003. John Noyes of The Natural History Museum (London) was taking large sweep samples from vegetation at several Costa Rican localities and extracting Encyrtidae, his primary focal taxon. He also separated ants and sent these samples to Longino. Each sample contained hundreds to thousands of ants, including many alates. In the sample from Estación Cacao were about a dozen males and a similar number of dealate queens of *Bothriomyrmex*. The habitat at Estación Cacao is a mosaic of mature montane moist forest with epiphyte-laden trees and abandoned pastures. This is a site on the Pacific slope of the northern-most cordillera in Costa Rica, 170km from the El Ceibo site on the Atlantic slope.

*Comments:* Although it is typical to choose workers as holotypes of ant species, we have chosen a queen because queens exhibit much greater morphological differences among species in *Bothriomyrmex*. This is true of several dolichoderine genera, including *Azteca* and *Tapinoma*. For example, Longino (1991) used queens as holotypes in taxonomic work on *Azteca*.

The new species undoubtedly belongs to the genus *Bothriomyrmex*. It has all the traits typical of the genus: 4:3 palp formula, strongly reduced hypostomal margin, and a characteristic venation on the forewing of the queen (closed discoidal cell, RM-2 absent, and radius reaching costal margin of wing). The systematics of the genus *Bothriomyrmex* are complex, and the previous classification (Dubovikoff, 2002) is not complete. *Bothriomyrmex paradoxus* belongs to *Bothriomyrmex s.s.* and not among the Asian and Australian species (Dubovikoff unpub.). However, it does not fit cleanly into one of the Palearctic species groups. The short suberect setae on the queen's mesosoma and gaster is a trait also found in members of the *B. syrius* group (*B. syrius* Forel, *B. turcomenicus* Emery, *B. communistus* Santschi, *B. kusnezovi* Emery and *B. urartus* Dubovikoff). However, *B. paradoxus* differs from all species of this group by the higher and shorter mesosoma of the queen. TI of *B. paradoxus* is 0.64, while other species have TI < 0.50. Also, the impressed metanotal groove on the worker is a trait found in members of the *B. gibbus* complex and not in the *B. syrius* group.

## Discussion

This is the first collection of the genus *Bothriomyrmex* in the New World. The occurrence in mature forest habitats and the fact that it is not conspecific with any known Old World species suggest it is truly native and not a recent introduction. *Bothriomyrmex paradoxus* may be a very old species, long isolated from the Palearctic species. Other putative relict species in Central America include *Technomyrmex fulvus* (Wheeler 1934) and *Perisomyrmex snyderi* (Longino and Hartley 1995). Central America appears to be a refuge for several ancient lineages of ants.

In the Palearctic, *Bothriomyrmex s. s.* are temporary social parasites of monogynous *Tapinoma*. It is unknown whether *B. paradoxus* is also a temporary social parasite of *Tapi-*

*noma*. Given its geographic isolation, elucidating the nest foundation behavior of *B. paradoxus* would be particularly valuable.

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