

A new species of the genus *Indomyrma* Brown, 1986 (Hymenoptera: Formicidae: Myrmicinae) from Vietnam

Новый вид рода *Indomyrma* Brown, 1986 (Hymenoptera: Formicidae: Myrmicinae) из Вьетнама

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КЛЮЧЕВЫЕ СЛОВА: Formicidae, Myrmicinae, Stenammini, *Indomyrma*, новый вид, жалящий аппарат, национальный парк Кат Тьен, Вьетнам.

ABSTRACT. One new ant species of the subfamily Myrmicinae, *Indomyrma bellae* sp.n. is described from Cat Tien National Park (Southern Vietnam) based on workers and dealate queen. The genus *Indomyrma* was hitherto known only from one species, *I. dasypyx* Brown, 1986, described from two localities of the Southwestern India. A new species differs from *I. dasypyx* in the worker and queen by smaller body size, reduction of erect hairs on alitrunk, petiole and postpetiole, shape of anterodorsal margin of pronotum and petiolar node, features of the sculpture and strongly reduction (only 2–3 ommatidia) of eye in workers. The sting apparatus of genus *Indomyrma* is described for the first time. Biogeography analysis of the genus *Indomyrma* is given.

РЕЗЮМЕ. Новый вид муравьев подсемейства Мурмицинае, *Indomyrma bellae* sp.n., описан по рабочим и самке из национального парка Кат Тьен (Южный Вьетнам). Род *Indomyrma* до сих пор был известен только по одному виду *I. dasypyx* Brown, 1986, описанному из двух пунктов Юго-Западной Индии. Новый вид отличается от *I. dasypyx* по рабочим и самкам меньшими размерами, редукцией отстоящих волосков на груди и стебельке, формой пронотума и узелка петиоля, скульптурой, а также сильной редукцией (всего 2–3 фасетки) глаз у рабочих. Впервые описан жалящий аппарат *Indomyrma*. Дается биогеографический анализ рода *Indomyrma*.

Introduction

In last decade the studying of ant diversity and taxonomy of Vietnam has reached a qualitatively new level due to intensive exploring of local ant faunas mostly in protected nature reserves [see Eguchi et al.,

2011; Zryanin, 2011]. As a result the ant diversity in Indo-Chine became clear at least at genera level. In Generic Synopsis of the Myrmicinae of Vietnam [Eguchi et al., 2011] recognized 38 genera belonging to 15 tribes [sensu Bolton, 2003], however the genus *Indomyrma* was not mentioned.

The genus *Indomyrma* was established by Brown [1986] and is assigned to the tribe Stenammini [Bolton, 2003]. This genus has hitherto been known only from one species, *I. dasypyx* Brown, 1986, described from two localities of the Southwestern India: Kerala (Western Ghats), Cannanore distr., Peria Forest Reserve and vicinity of Mercara (now in Karnataka). This species was described based on all castes of adults and larvae, anatomical features (Malpighian tubules) and karyotype. Nests were found in rotten wood in broadleaf forest at elevations of 650–1000 m, the colony size was estimated as 10–500 adults [Brown, 1986].

During a study of local ant fauna in a monsoon tropical forest of Cat Tien National Park (Dong Nai prov., Southern Vietnam) one new species of the ant genus *Indomyrma* was found and is described here.

Methods

Material for present article (1 dealate queen and 14 workers) was obtained using the following sampling methods: 1) underground carbohydrate baits placed in perforated plastic containers (d = 2.5 cm, h = 5 cm), which were buried at a depth of 5–10 cm for 72 h; 2) Winkler extraction and 3) direct sampling using a sifter. The locality, habitat and other label data of the new species are given in the “Material” section.

The following measurements and indices were used in the present article: CI — cephalic index: HW / HL x



Fig. 1. *Indomyrma bellae* sp.n., worker: a — habitus, side view; b — part of head dorsum (as in Fig. 1a in white contour); c — eye and adjacent cuticle (as in Fig. 1a in black contour).

Рис. 1. *Indomyrma bellae* sp.n., рабочий: а — внешний вид, латерально; б — часть дорсальной поверхности головы (как на рис. 1а в белом контуре); с — глаз и прилегающая кутикула (как на рис. 1а в черном контуре).

100; EL — eye length: maximum diameter of compound eye viewed straight on; GL — gaster length: in lateral view, from anterior edge of first tergum to posteriormost point of second or third tergum; HFL — length of hind femur: maximum length of hind femur, measured from junction with trochanter to junction with tibia; HL — head length: in full face view, maximum longitudinal distance from the anteriormost point of clypeus to midpoint of a line across the back of the head; HTL — length of hind tibia: maximum length of hind tibia, measured from junction with femur to junction with tarsus; HW — head width: maximum width in same view as for HL, excluding eyes; MI — mandible index (as in Brown, 1986): $ML / HL \times 100$; ML — mandible length: in same view as for HL, from anteriormost point of clypeus to the apex of closed mandibles; PetL — petiole length: in lateral view, the axial distance from the dorsal corner of the posterior peduncle to the nearest edge of the propodeal lobe; PpetL — postpetiole length: in lateral view, the axial distance from base of node in front to tip of posterior peduncle; SI — scape index: $SL / HW \times 100$; TL — total length: Sum of $ML + HL + WL + PetL + PpetL + GL$; SL — scape length: length of antennal scape excluding basal condylar bulb; WL — Weber's (alitrunk) length: in lateral view, diagonal length from anterior margin of pronotum (excluding neck) to posterior margin of propodeal lobe.

Images of whole ants and separate parts were obtained using the fluorescent microscope Keyence BZ-9000 and scanning electron microscope Camscan MB2300. Imaging was performed using Helicon Focus

5.2 Pro from a series of source images taken by the Z-stack module, Adobe Photoshop CS2 and Corel Draw X3. Some measurements (length of standing hairs, angles of their inclination, measurements of sting apparatus etc.) performed on the processed images using BZ-II Analyzer 1.42.

The terminology for sting apparatus follows Kugler [1994, 1997], that for sculpture follows Harris [1979], the description of hair inclination from the cuticular surface follows Wilson [1955] with updates by Kugler [1994].

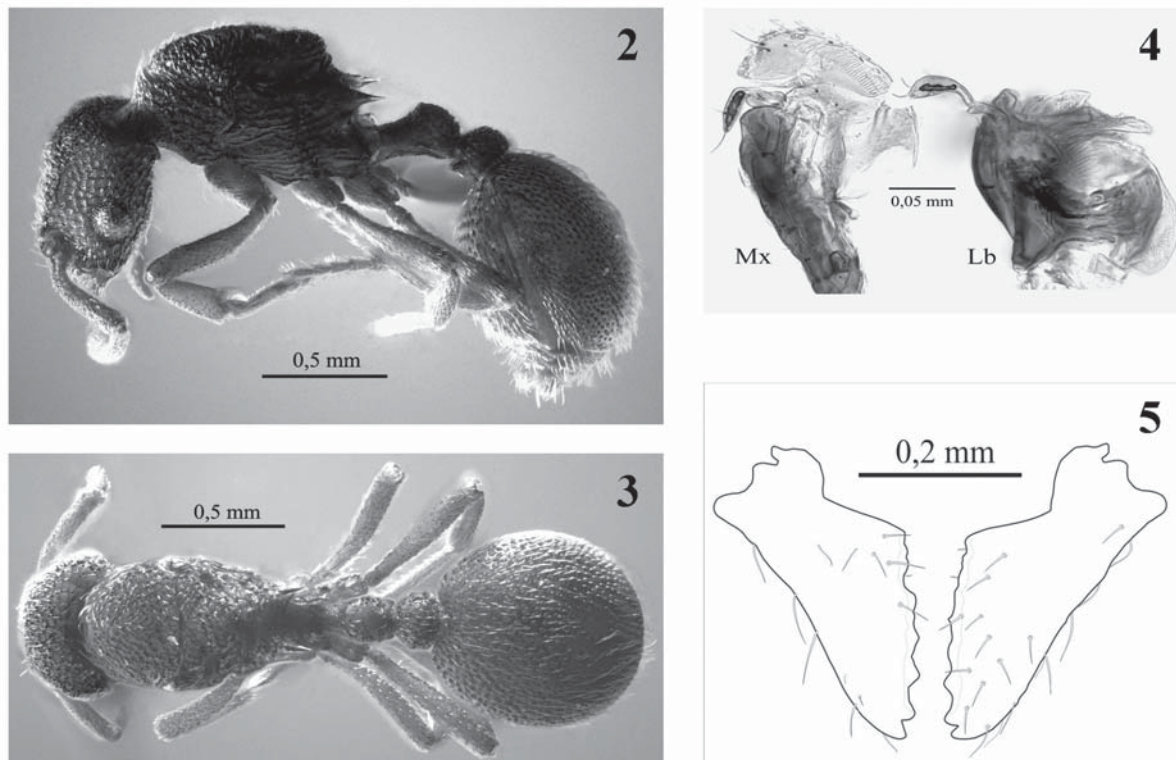
Type material of *I. dasypyx* was not at my disposal, but images of paratypes are available at <http://www.antweb.org> (worker, alate queen and male).

Indomyrma bellae Zryanin, sp.n.

Figs. 1–6.

Monomorphic terrestrial (leaf litter) myrmicine ants with character states of *Indomyrma* as defined by Brown [1986].

MATERIAL. Holotype (worker): Vietnam: Dong Nai: S. Cat Tien N.P., near Bau Sau village, yellow trail, 11°26'N, 107°19'E, 200 m a.s.l., in ferralitic soil from old dipterocarp forest, 24.07.2008, leg. V. Zryanin (BS-353). Paratypes: 4 workers from the same colony to which the holotype belonged; 1 dealate queen from the same locality, in dipterocarp butt, near forest stream, 29.07.2008, leg. V. Zryanin; 2 workers from the same locality, 14.06.2008, leg. V. Zryanin; 5 workers from the same locality, in dipterocarp butt on hill, 26–29.07.2008, leg. A. Tschekanov; 2 workers from the same locality, near forest stream, in leaf litter, 2.05.2010, leg. V. Zryanin. The holotype and two paratypes (worker and queen) are deposited in the collection of the Zoological Museum of the Moscow Lomonosov State University, two paratypes are deposited in the collection of the Zoological Institute of the Russian Academy



Figs. 2–5. *Indomyrma bellae* sp.n.: 2 — dealate queen, side view, 3 — dealate queen, dorsal view, 4 — maxilla (Mx) without cardo and labium (Lb) of the worker, side views, 5 — mandibles of the worker, front view.

Рис. 2–5. *Indomyrma bellae* sp.n.: 2 — внешний вид самки, латерально; 3 — внешний вид самки, дорсально; 4 — максилла (Mx) без кардо и нижняя губа рабочего, латерально; 5 — мандибулы рабочего, фронтально.

of Sciences, St. Petersburg, one paratype is deposited in the collection of Siberian Zoological Museum, Novosibirsk; other paratypes are in the personal collection of the author.

Measurements (in mm) and indices. Worker, holotype: TL 2.87, HL 0.70, HW 0.57, ML 0.18, SL 0.48, EL 0.03, WL 0.83, PetL 0.28, PpetL 0.17, GL 0.70, HFL 0.55, HTL 0.38; CI 81, MI 26, SI 85.

Worker, paratypes (n=10): TL 2.67–2.87, HL 0.67–0.70, HW 0.55–0.58, ML 0.17–0.18, SL 0.43–0.48, EL 0.03, WL 0.77–0.83, PetL 0.25–0.28, PpetL 0.15–0.17, GL 0.67–0.70, HFL 0.50–0.55, HTL 0.35–0.40; CI 80–83, MI 25–27, SI 79–85.

Dealate queen, paratype: TL 3.34, HL 0.72, HW 0.59, ML 0.22, SL 0.50, EL 0.18, WL 0.98, PetL 0.33, PpetL 0.17, GL 0.92, HFL 0.58, HTL 0.42; CI 84, MI 30, SI 83.

DESCRIPTION. Worker: habitus as in Fig. 1a. Head 1.20–1.24 times as long as wide, broad behind, narrowed anteriorly, with convex sides in full-face view; posterior outline weakly concave, the posterolateral corners with a narrow flange (nuchal groove) as seen from side view. Eyes strongly reduced, consist of 2–3 distinct ommatidia (Fig. 1c), situated a little anterior to midlength of head. Frontal lobes, frontal carinae, clypeal shield and mandibles as in *I. dasyptyx* [Brown, 1986]. Masticatory borders of mandibles as in Fig. 5, sometimes denticles poorly separated. Palp formula

maxillary 2: labial 2 (see Fig. 4). Antennae 11-merous with 3-merous club.

Alitrunk with dorsal surface evenly convex from indistinct anterodorsal pronotal margin to the well distinct metanotal groove. Subacute humeral angles not express. Anterior half of propodeal dorsum is slightly convex. Propodeal teeth longer than wide at base, have upcurved dorsal margins. Propodeal spiracles prominent, situated very close to declivitous margins, directly below tooth bases. Metapleural gland bulla is moderately distinct, with two longitudinal sulci leading forward along lower metapleuron, meatus small and obscure. Propodeal declivity higher than wide, margined above by one or two transverse costae connecting propodeal teeth and by thin lateral margins that merges into the propodeal lobes.

Petiole with a short but distinct anterior peduncle and relatively low node without a flanked horizontal area; peduncle with distinct, weakly curved and digitiform subpetiolar process. Viewed from above, petiolar node is elongate oval, with rounded anterior edge. Postpetiole broader than petiole and broader than own length, dorsum and sides strongly rounded.

Gaster broader than deep and first tergum covering more 0.9 of its length in dorsal view. Apical segments forming a small, blunt cone, directed slightly downward as well as caudad.

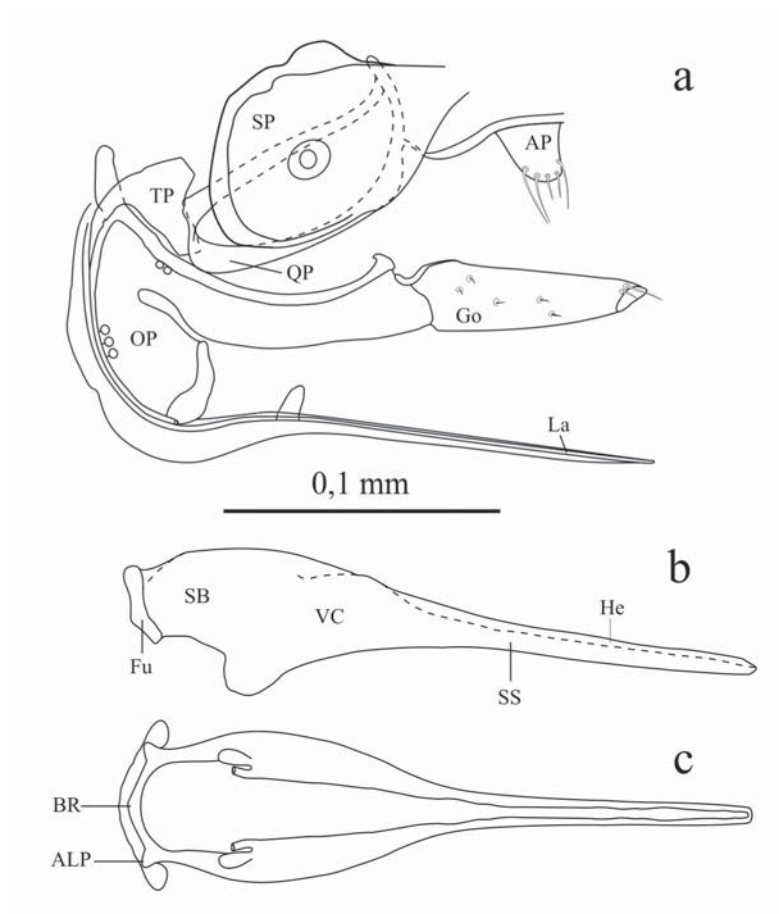


Fig. 6. *Indomyrma bellae* sp.n., sting apparatus of worker: a — spiracular plate (SP), quadrat plate (QP), anal plate (AP), oblong plate (OP), triangular plate (TP), gonostylus (Go), and lancet (La), lateral views; b — lateral sting, sting bulb (SB), sting shaft (SS), valve chamber (VC), hemocoel (He), furcula (Fu); c — ventral sting, basal ridge (BR), anterolateral process (ALP).

Рис. 6. *Indomyrma bellae* sp.n., жалящий аппарат рабочего: а — дыхальцевая пластинка (SP), квадратная пластинка (QP), анальная пластинка (AP), продолговатая пластинка (OP), треугольная пластинка (TP), гоностиль (Go) и ланцет (La), латерально; б — жало сбоку, ампула (SB), створка жала (SS), полость вальвы (VC), гемоцель (He), фуркула (Fu); в — жало снизу, базальный край (BR), переднебоковой отросток (ALP).

Sculpture of head, alitrunk, petiole, postpetiole and gaster as in Fig. 1. Partly sculpture torose (Fig. 1b), i.e. small knobs occur on dorsum of head (particularly towards occiput), alitrunk, nodes of petiole and postpetiole as in *Rostromyrmex* [Rościszewski, 1994]. Sculpture on lateral and ventral sides of head foveate-reticulate with hairs in the pits. The bottom of pits with very finely rugulose sculpture (Fig. 1c). On dorsum of head foveolar interspaces form 8–9 intermittent vermiculate longitudinal costae, including frontal carinae, between antennal scrobes; middle costae very distinct. Pronotal disc, sides of pronotum and mesonotal dorsum sculpture similar. Mesopleuron and sides of propodeum with irregular sculpture of sparse longitudinal ridges and small knobs. Sculpture of gaster foveolate or punctate, with hairs in the pits; foveolar interspaces predominantly larger than diameter of fovea except the base of first tergum. Small knobs are on the femora, tibia and scapes of antennae, main sculpture of the appendages finely alveolate. Mandible smooth and shining, with scattered fine punctures.

Pilosity consisting of widely distributed, moderately abundant, short, decumbent and subdecumbent hairs; shorter, denser, fine and more nearly appressed hairs on antennae and legs. Setae fine and sparse on clypeus and mandibles. Longer erect and suberect hairs on dorsum of head above clypeus shield and alitrunk almost absent (sometimes few hairs). These hairs absent on petiolar node and dorsum of postpetiole; pair of standing hairs on sides of peduncle. The longest standing hairs on clypeal shield reach 145 μm , on other parts of body 50–85 μm . Gaster with many of longer hairs, curved sharply caudad.

Color brownish red, appendages and mandibles dull yellow; some parts of cuticle (occiput, mesopleural edges, masticatory borders of mandibles) are darkened.

In the description of *I. dasypyx* Brown [1986] characterized only general shape of the sting and the suggested structure of gonostylus. Therefore, in present article provides the first detailed picture and description of the skeletal portions of *Indomyrma* sting appa-

ratus (Fig. 6). Spiracular plate: body clearly longer than wide, subrectangular, anterior apodeme wide, has a prominently domelike process. Medial connection membranous. No dorsal notch or posterodorsal lobe. Spiracle small. Quadrate plate: body and apodeme subrectangular, equal in width. Dorsal edge of plate slightly convex, with wide medial and lateral lobes in an acute anterodorsal corner. Anal plate: weakly sclerotized, longer than wide, with 5–6 long setae on terminal edge (marginal setae the longest). Oblong plate: body posterior arm long and narrow, well sclerotized, strongly curved apodeme with subterminal tubercles. Anterior apodeme moderately long, conoid, rounded at apex. Ventral arm wide, separated by a deep postincision on posterior arm, with elongated well sclerotized furcal arm. Gonostylus long and gradually tapered to an acute apex (as in *I. dasypyx*), single-segmented, with a marked constriction between own base and posterior arm and well sclerotized. Lateral surface with 5 moderately long setae, dorsoterminal chaeta, companion seta and terminal membrane present. Triangular plate: body thin, with truncate dorsoapical and ventroapical processes; neither dorsal nor medial tubercle present or they not visible. Lancet: straight, acute, well sclerotized, with distinct ventral ridge and, distally, a dorsal ridge. One elongated lancet valve per lancet. Sting: sting bulb large, slightly arched with distinct basal ridge and anterolateral processes. Valve chamber normal developed, but grade from sting bulb and sting shaft in ventral view. Sting shaft long and slender, without dorsal flange. Furcula: V-shaped in anterior view, lateral arms wrap around sting base; no dorsal arm as in *Lordomyrma* [see Kugler, 1997]. It looks fused to sting base. According to Kugler [1979], the genus *Indomyrma* belong to the *Lordomyrma* (= *Promeranoplus*) branch in structure of sting apparatus.

Queen: habitus as in Figs. 2, 3. Coarser sculptured, differ from the worker in slightly larger size, much larger eyes (max diameter 179 μm), and usual full-queen differences from the workers. The queen has slightly more distinct interfoveolar, longitudinal costae on the middorsal head. Nuchal groove is more prominent. Pilosity and color are similar with to that of worker; appendages slightly darker.

Male. Unknown.

DIAGNOSIS. Weakly defined antennal scrobes, straight masticatory borders of mandibles with 8–9 teeth, 11-merous antennae with 3-merous club, palpal formula 2:2, position of propodeal spiracle close to the margin of propodeal declivity and absence spongiform appendages of the waist segments evidence of belonging a new species to genus *Indomyrma*. The new species is the second described in this genus and easily recognized from *I. dasypyx* by number of ommatidia in worker, 2–3 in the former and 8–10 in the latter. In worker and queen *I. bellae* sp.n. distinguished from those of *I. dasypyx* in absence of subacute humeral angles, shape of petiolar node with rounded anterior edge, strong development of torose sculpture on head,

alitrunk, petiole and postpetiole, foveolate or punctate sculpture at base of gaster and different character of pilosity (reduction of longer erect and suberect hairs).

ETIMOLOGY. The species named in honor of the head of the Laboratory for soil zoology and general entomology, Prof. Bella R. Striganova (A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, Russia).

DISTRIBUTION AND BIONOMICS. At present, this species is only known from Cat Tien National Park of Southern Vietnam. During three years of research only few specimens of *I. bellae* were collected. Probably nests are located in rotten wood as in *I. dasypyx* (single queen was found in big butt of *Dipterocarpus* sp.). In artificial nest *I. dasypyx* workers were not attracted to small droplets of diluted honey [Brown, 1986], but Brown noted that these preliminary results should not be taken as conclusive evidence that the ants always ignore sweet substances. In Cat Tien NP five workers of *I. bellae* were found in perforated plastic container with carbohydrate bait (see methods). This may indicate that food spectrum of this genus includes sugars (such as in fallen fruits).

Discussion

The finding of the new species of *Indomyrma* in Southern Vietnam demonstrates disjunctive recent area of this genus and suggests probable ways of its formation. The territory of current Indochina was the central part of Sunda during the greater part of Tertiary period [Sinitsyn, 1962]. It explains partly the high diversity of the Vietnam entomofauna, ant fauna specifically. Here in autochthonic processes area, probably, occurred divergence of oriental genera of Stenammini (*Lasiomyrma*, *Lordomyrma*, *Indomyrma*, *Rostromyrmex*, *Tethemyrma*, *Dacetinops*), in the late Palaeogene and the early Neogene. The genus *Lordomyrma* Em. is likely primary in divergence of listed genera, it confirmed by some plesiomorphic characters (12-merous antennae, the bicarinate median portion of the clypeus, anterodorsal position of the propodeal spiracle, unsettled palpal formula, structure of sting apparatus), rather high species diversity and large recent genus area [Taylor, 2009; Branstetter, 2009]. Prochoresis of *Lordomyrma* to east from the mainland Asia from Miocene mainly [Lucky, Sarnat, 2009]. In the *Indomyrma* case prochoresis proceeded probably to the west. Active occupation of India by oriental fauna in the late Pliocene was demonstrated in Rhopalocera [Holloway, 1974]. Among ants the example of similar disjunction shows the genus *Tyrannomyrmex* that includes two species from West Malaysia [Fernandez, 2003] and Southwestern India [Borowiec, 2007]. Recent findings of members of related to *Indomyrma* genus *Lasiomyrma* in Thailand [Jaitrong, 2010] and North Vietnam [Eguchi et al., 2011] are additional examples of prochoresis from Sundaland, where this genus is represented by three species [Terayama, Yamane, 2000]. It is quite possi-

ble that genus *Indomyrma* stands apart in Burma area and spread to south-east to the Southern Vietnam territory and to south-west to Indian tropical forests. Anyway, there was a possibility to prochoresis from South-east Asia to India due to continuous zone of evergreen forests. Probably, the disjunction generation in *Indomyrma* area can be explained by conservation of isolated species in pleistocene refugia. However, further material collection between known points were *Indomyrma* was found, can change this point of view.

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