

Description of the immature instars of three species of *Podium* Fabricius (Hymenoptera, Sphecidae) from Brazil

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ABSTRACT. Immature instars of three species of the neotropical cockroach-hunting genus *Podium* Fabricius, 1804 are described. All larval instars and the cocoon of *P. denticulatum* Smith, 1856; the last instar and the cocoon of *P. aureosericeum* Kohl, 1902 and the last instar larva of *P. fumigatum* (Perty, 1833) were treated. The last larval instar of *P. denticulatum* is distinct from those of other species by lacking cephalic rugosity and spinning cocoons tapered in the posterior extremity. *P. aureosericeum* and *P. fumigatum* are unique in bearing small lamellae between mandibular teeth. **KEY WORDS.** Cocoon, larva, morphology, Neotropical, wasp.

RESUMO. São descritos estádios imaturos de três espécies do gênero neotropical caçador de baratas *Podium* Fabricius, 1804. Todos os estádios e o casulo de *P. denticulatum* Smith, 1856; a larva de último estágio e o casulo de *P. aureosericeum* Kohl, 1902 e a larva de último estágio de *P. fumigatum* (Perty, 1833) são tratados. A larva de último estágio de *P. denticulatum* é distinta da de outras espécies pela falta de rugosidade cefálica e por tecer casulos afilados na extremidade posterior. *P. aureosericeum* e *P. fumigatum* são únicos em possuir pequenas lamelas entre dentes mandibulares.

PALAVRAS CHAVE. Casulo, larva, morfologia, neotropical, vespa.

Podium Fabricius, 1804 is a Neotropical genus of cockroach-hunting wasps, which nest in pre-existent cavities (RAU 1937, KROMBEIN 1967, 1970, GENARO 1994, CAMILO *et al.* 1996). Although it includes 23 described species (AMARANTE 2002), only the last instar larvae of two species have been described: *P. rufipes* Fabricius, 1804 (EVANS & LIN 1956) and *P. luctuosum* Smith, 1856 (EVANS 1964). As part of a major systematic study of Sphecidae wasps based on larvae, the last instar larvae of three species of *Podium* are described: *P. denticulatum* Smith 1856, *P. aureosericeum* Kohl, 1902, and *P. fumigatum* (Perty, 1833). The cocoons of *P. denticulatum* and *P. fumigatum* and the early instars of *P. denticulatum* are also described.

MATERIAL AND METHODS

The head and the entire body of the larvae were separately heated in KOH (10%) for about 15 minutes to eliminate the soft tissues. Several specimens were studied, but the morphometric characters were measured in only one specimen in each instar. Following the usual nomenclature, the pre-defecating fifth larval instar was named mature larva and the post-defecating fifth larval instar was named pre-pupa. Only the

last instar larva of *P. denticulatum* was completely described. In the descriptions of the last larval instar of *P. fumigatum* and *P. aureosericeum* only the differences from the last larval instar of *P. denticulatum* were remarked. In a similar way, in the descriptions of the early instars of *P. denticulatum* it was remarked only the differences from the subsequent older instar.

The material was deposited in the entomological collection of Departamento de Zoologia da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil. Adults of *P. fumigatum* and *P. aureosericeum* reared from the collected nests were deposited in the Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP).

RESULTS

Podium denticulatum Smith, 1856

Mature larva (Figs 1-6)

Body. White, approximately cylindrical, curved; length 16 mm; maximum width 3 mm. Intersegmental lines weakly distinct. Prothorax with three pairs of dorsal callosities with areas lightly pigmented. Pleural lobes indistinct on thorax

and weakly distinct on abdomen, absent on segment AX. Integument densely spinulose, spines 5-15 μm long; rare and isolated setae on all the body, 13-16 μm long; prothoracic callosities without spines, with setae. Spiracles pigmented; 113 μm in diameter, all about the same size; wall ornamented with polygonal sculptures; opening into the subatrium armed with spines; peritreme unpigmented. Anus a transverse sub-apical slit.

Head. Height 1.1 mm, width 1.1 mm. Coronal suture distinct. Parietal bands pigmented, 250 μm long. Antennal orbits lightly pigmented; with three sensilla; ovoid; 70 μm in height and 55 μm in width. Antennal, frontal, and clypeal concavities pigmented, clypeal one very shallow. Cephalic rugosity absent. Coronal area with 11 punctures, about 5 μm in diameter, and six setae, 13-15 μm long. Frontal area with six punctures, about 5 μm in diameter, and one seta, 13 μm long. Genal area with about 25 punctures, 5-6 μm in diameter, and five setae, up to 25 μm long. Clypeal area with 20-25 punctures, 5-7 μm in diameter, and 15 setae, 8-20 μm long. Anterior tentorial arms, hypostoma and pleurostoma pigmented, posterior thickening of the head capsule unpigmented.

Mouthparts. Labrum bilobed; 200 μm in height, 440 μm in width; with about 50 punctures, 6-8 μm in diameter, 29 setae, 10-25 μm long, and several small basiconic sensilla on lateral and marginal portions; margin with 20 pigmented barrel-shaped sensilla, about 18 μm wide, longer toward the median portion, up to 12 μm long. Epipharynx with spines on lateral, marginal, and median portions, smaller on the base and gradually longer toward the margin, up to 13 μm long, spines on median portion thinner and shorter, up to 10 μm long; sensorial area very lightly pigmented, with six basiconic sencilla, about 5 μm in diameter. Mandibles pigmented, darker in the apical portion; 450 μm long; with four teeth; basal portion with two punctures and 1-2 conspicuous setae, 18 μm long. Maxillae with a pigmented ring near to the apex; lateral and ventral portions with about 10 setae, up to 23 μm long; inner and dorsal portions densely covered with scale-like structures, each scale with acute papillae marginally, up to 5 μm long; maxillary palpi, pigmented, conical, 55 μm long, 30 μm wide; galeae pigmented, conical, 83 μm long, 53 μm wide; lacinial area densely with curved spines, up to 15 μm long. Labium pigmented in superior margin; dorsal portion strongly papillosae; margin with setae, up to 20 μm long; labial palpi pigmented, conical, 53 μm long, 33 μm wide; spinneret a transversal slit, protected by lips with densely papillose fringes.

Morphological variation. The thoracic pleural lobes varies from indistinct to slight distinct. The basal margin of the third mandibular tooth was weakly serrated in only one examined specimen. The epipharyngeal spines sometimes extend beyond the margin. The degree of pigmentation of the head capsule is variable, but in general follows the same pattern of distribution in different specimens.

Pre-pupa (Figs 7-8)

Body more compacted than those of the mature larvae. Pleural lobes conical, developed on abdomen, indistinct on

thorax. Intersegmental lines sharply defined. Other features as in mature larva.

Fourth instar (Figs 9-II)

Body. Length 6.5 mm; maximum width about 1.3 mm. Prothoracic dorsal callosities absent. Pleural lobes indistinct. Integument without spines or setae. Spiracles with 65 μm in diameter. The anus is not sharply distinct, but an anal sulcus is visible. Other features as in mature larva.

Head. Height about 1 mm; width 1 mm. Coronal suture weakly distinct. Parietal bands 188 μm long. Antennal orbits 40 μm in height and 50 μm wide. Antennal, frontal, and clypeal concavities unpigmented. Punctures and setae absent. Anterior tentorial arms and hypostoma lightly pigmented, pleurostoma unpigmented; posterior thickening of the head capsule pigmented. Other features as in mature larva.

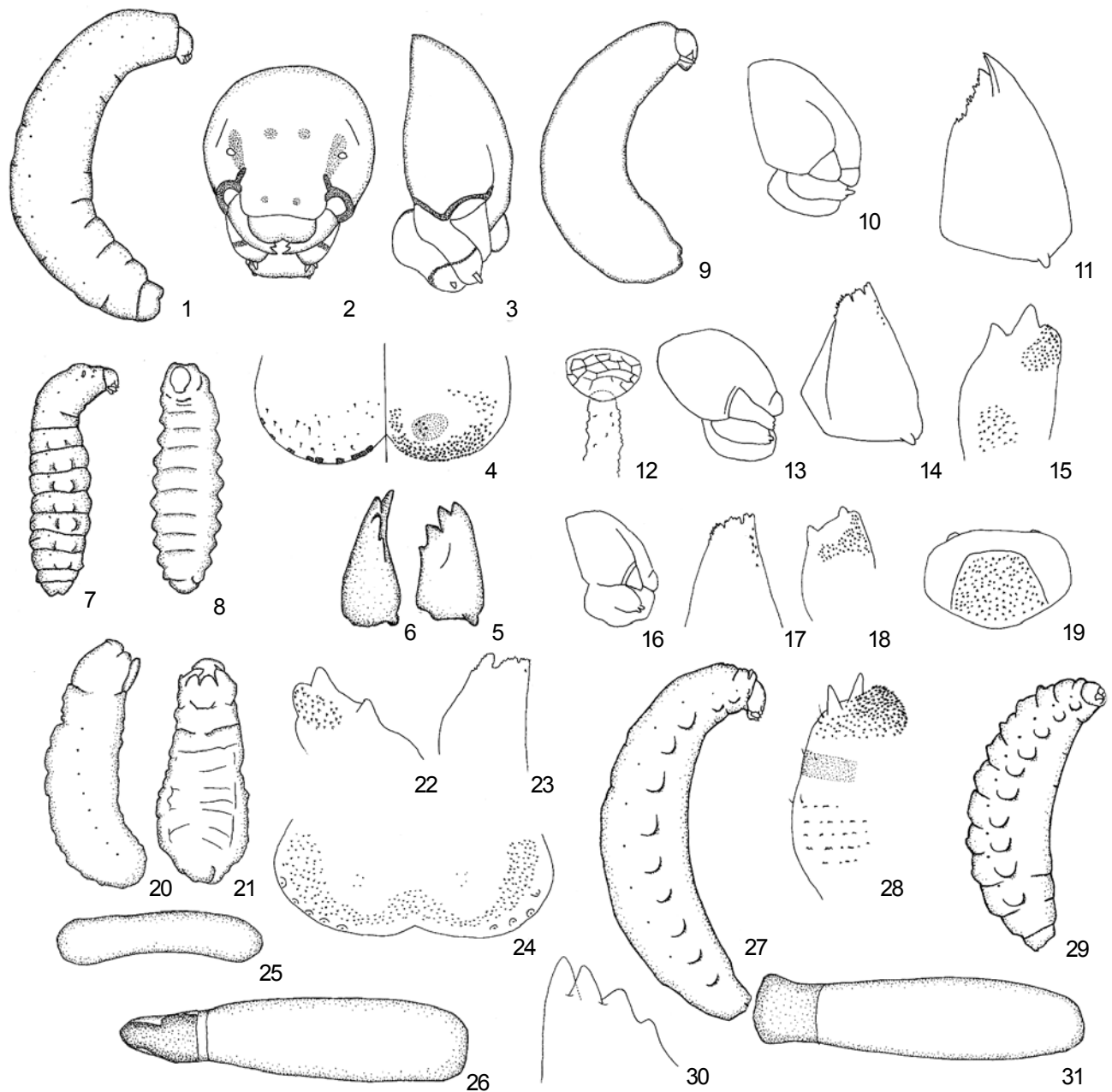
Mouthparts. Labrum about 150 μm in height; with few sparse punctures, setae absent; margin somewhat pigmented, with about 10 pigmented barrel-shaped sencilla, 5 μm long and 15 μm wide. Epipharyngeal spines up to 10 μm long, absent on median portion; sensorial area indistinct. Mandibles lightly pigmented, 400 μm long; with three apical teeth, about 15 denticles basad to the third tooth; punctures and setae absent. Maxillary palpi lightly pigmented, 50 μm long and 35 μm wide; galeae lightly pigmented; 88 μm long, 53 μm wide; punctures and setae absent. Dorsal portion of the labium not papillose, with spines 3-5 μm long; labial palpi unpigmented; 40 μm long, 13 μm wide. Spinnerets indistinct; labial projection absent. Other features as in mature larva.

Third instar (Figs 12-15)

Body. Length 5 mm; width 1 mm. Spiracles about 45 μm in diameter. Anal sulcus indistinct.

Head. Height 750 μm ; width 750 μm . Coronal suture and parietal bands absent. Antennal orbits unpigmented, very weakly distinct. Other features as in fourth instar.

Mouthparts. Labrum approximately quadrangular; height 150 μm , width 320 μm ; with a few very inconspicuous punctures; lateral and marginal portions with some weakly distinguishable, unpigmented, basiconic sencilla, about 2 μm in diameter; barrel-shaped sencilla absent. Epipharyngeal spines up to 5 μm long on lateral and marginal portions, more sparse than in the fourth instar; some sensilla similar to those of labrum are present. Mandibles about 310 μm long; three apical teeth, each divided in several small denticles, several additional denticles apically on the external margin; very lightly pigmented, the denticles a few darker. Maxillae without scale-like structures, with spine 2-3 μm long, more sparse than in the fourth instar; maxillary palpi 38 μm long, 30 μm wide; galeae 58 μm long, 40 μm wide; lacinial area sharply prominent, spines up to 5 μm long. Frontal portion of the labium with a prominent central spinulose area, spines 3-5 μm long; labial palpi 14 μm long, 30 μm wide. Other features as in fourth instar.



Figures 1-31. (1-8) *Podium denticulatum*. (1-6) Mature larva: (1) body, lateral view; (2-3) head, frontal and lateral views; (4) labrum and epipharynx, frontal view; (5-6) mandible, dorsal and inner views; (7-8) pre-pupa body lateral and ventral views; (9-19) *Podium denticulatum*. (9-11) Fourth instar: (9) body, lateral view; (10) head, lateral view; (11) mandible, dorsal view; (12-15) third instar: (12) spiracle, lateral view; (13) head, lateral view; (14) mandible, as seen in frontal view of the head; (15) maxilla, dorsal view; (16-19) Second instar: (16) head, lateral view; (17) superior portion of the mandible, frontal view; (18) maxilla, dorsal view; (19) labium, dorsal view; (20-26) *Podium denticulatum*: (20-24) first instar: (20-21) body lateral and ventral views; (22) superior portion of the maxilla, dorsal view; (23) superior portion of the mandible, dorsal view; (24) epipharynx, frontal view; (25) egg, lateral view; (26) cocoon, lateral view; (27-29) *Podium aureosericeum*: (27-28) mature larva: (27) body, lateral view; (28) maxilla, dorsal view; (29) pre-pupa body, lateral view. (30-31) *Podium fumigatum*: (30) apical portion of the mandible, dorsal view; (31) cocoon, lateral view.

Second instar (Figs 16-19)

Body. Length 4 mm, width 1 mm. Spiracles somewhat conical; about 35 μm in diameter; opening into the sub-atrium apparently not armed with spines; atrium wall ornamented with small pigmented grains, sometimes forming polygonal sculptures. Other features as in the third instar.

Head. Height about 650 μm ; width 650 μm . Other features as in the third instar.

Mouthparts. Labrum rounded; about 280 μm in width; without punctures. Epipharynx with spines only on lateral portions, up to 5 μm long; sensorial area indistinct, but some small and inconspicuous structures similar to basiconic sensilla are present. Mandibles about 230 μm long. Maxillary spines very sparse, about 2 μm long; maxillary palpi about 15 μm long, 20 μm wide; galeae about 18 μm long, 23 μm wide; spines on lacinial area more sparse than in the third instar, 2-3 μm long, contiguous with those on the frontal portion. Labium 280 μm wide; spines about 1-2.5 μm long, more sparse than in the third instar; labial palpi greatly reduced. Other features as in the third instar.

First instar (Figs 20-24)

Body. Length about 2 mm; width about 0.5 mm. Inter-segmental lines distinguishable. Pleural lobes slightly developed, laterally jointed. Spiracles 25 μm in diameter. Other features as in the second instar.

Head. Height 135 μm ; width about 128 μm . Other features as in the second instar.

Mouthparts. Labrum somewhat bilobed; 250 μm in width, 95 μm in height. Epipharynx with spines on lateral and marginal portions, up to 2 μm long; median portion with small grains; a sensorial area somewhat distinct, unpigmented, with four basiconic sencilla, about 1.5 μm in diameter. Mandibles 188 μm long; with three apical teeth, each strongly divided in small denticles. Spines on base of the maxillae not detected; spines on lacinial area up to 3 μm long; galeae 20 μm long and 25 μm wide; maxillary palpi 15 μm long and 17 μm wide. Labium reduced; with spines, about 1-2 μm long; labial palpi not detected. Other features as in the second instar.

Egg (Fig. 25)

White. Approximately cylindrical; extremities rounded; one exemplar very slightly curved, other one not curved. Length 2.7 mm; width in the midline 7 mm. Wall smooth.

Cocoon (Fig. 26)

Wall a one-layer of silk, coated with substance expelled by the larva. Texture as a brittle paper. Claviform, anterior extremity rounded, posterior one tapered. Dark-brown, external surface opaque, internal one brilliant. Meconium cylindrical, narrower distally; isolated from the central portion by a silky wall.

Material examined. BRAZIL, *São Paulo*: Ribeirão Preto (Campus of the Universidade de São Paulo, 21°05', 21°15'S and 47°50', 47°55'W), C.A. Garófalo *leg.* (collected with trap-nests): two eggs, one first instar larva, one second instar larva, one

third instar larva, two fourth instar larvae, three mature larvae, two pre-pupa, and four cocoon.

Podium aureosericeum Kohl, 1902

Mature larva (Figs 27-28)

Body. Length 16 mm; maximum width 4 mm. Spines on integument 5-13 μm long; setae about 15 μm long; setae on prothoracic callosities 13-28 μm long. Pleural lobes developed on segments TII and TIII, absent on segment TI. Spiracles about 120-130 μm in diameter. Other features as in the mature larvae of *P. denticulatum*.

Head. Height 1.3 mm; width 1.3 mm. Cephalic rugosity distinct. Parietal bands 70 μm long. Antennal orbits circular, 63 μm in diameter. Coronal area with 10 punctures, 5-7 μm in diameter, and six setae, 10-20 μm long. Frontal area with seven punctures, 4-5 μm in diameter, and six setae, 13-15 μm long. Genal area with about 35 punctures, about 5 μm in diameter, and 5-7 setae, 13-18 μm long. Clypeal area with 16 punctures, about 5 μm in diameter, and about 15 setae, 9-19 μm long. Other features as in the mature larvae of *P. denticulatum*.

Mouthparts. Labrum 320 μm in height, 540 μm in width; with 39 punctures, 5 μm in diameter, and 30 setae, 11-18 μm long; margin with 15 pigmented, barrel-shaped sencilla, about 20 μm wide, longer toward the median portion up to 23 μm long. Epipharynx with spines on the lateral, marginal and median portions; spines extending beyond the margin; sensorial area with a small area lightly pigmented, with five basiconic sencilla, about 5-7 μm in diameter. Mandibles 590 μm long; with small lamellae between the second and the third, and the third and the fourth tooth; base with five punctures, 7 μm in diameter, and one seta, 18 μm long. Spines on maxillae up to 8 μm long; lateral and ventral setae 11-21 μm long; maxillary palpi 65 μm long, 30 μm wide; galeae 83 μm long, 30 μm wide; spines on lacinial area up to 18 μm long. Labium pigmented in lateral portion; 470 μm wide; setae on marginal portion up to 25 μm long; labial palpi 63 μm long, 43 μm wide; labial projection 440 μm wide. Other features as in the mature larvae of *P. denticulatum*.

Pre-pupa (Fig. 29)

Body with 12 mm long and 3,7 mm in maximum width; other features of the body as in the pre-pupa of *P. denticulatum*. Head and mouthparts as in the mature larva.

Material examined. BRAZIL, *Acre*: Senador Guiomard (Reserva Catuaba, area belonging to the Universidade Federal do Acre, 10°04'S and 67°36'W); E.F. Morato *leg.* (collected with trap-nests): one mature larva, one pre-pupa.

Podium fumigatum (Perty, 1833)

Pre-pupa (Fig. 30)

Body. Length 13 mm; maximum width 3 mm. Spines on integument about 12 μm long; setae about 15-25 μm long; se-

tae on prothoracic callosities 17-20 µm long. Pleural lobes somewhat developed on segment TII and TIII, absent on segment TI. Spiracles about 120 µm in diameter. Other features as in the mature larvae of *P. denticulatum*.

Head. Height 1.2 mm; width about 1.2 mm. Cephalic rugosity slightly distinct. Parietal bands about 130 µm long. Antennal orbits circular, 50 µm in diameter. Antennal, frontal, and clypeal concavities unpigmented. Coronal area with eight punctures, 5 µm in diameter, and 10 setae, 13-18 µm long. Frontal area with four punctures, about 6 µm in diameter, and eight setae, 12-15 µm long. Genal area with 23/25 punctures, 5 µm in diameter, and 6/8 setae, 12-23 µm long. Clypeal area with 18 punctures, 5-7 µm in diameter, and 12 setae, 12-23 µm long. Other features as in the mature larvae of *P. denticulatum*.

Mouthparts. Labrum 520 µm in width, 210 µm in height; with 31 punctures, about 5-7 µm in diameter; 27 setae, 12-23 µm long; margin with 18 barrel-shaped sencilla, about 20 µm wide. Epipharynx with spines on lateral and marginal portions up to 18 µm long; sensorial area with seven basiconic sencilla, very lightly pigmented. Mandibles 560 µm long; with four teeth and small lamellae between the second and third and the third and the fourth teeth; base with nine punctures 5 µm in diameter, and one seta, about 20 µm long. Spines on maxillae up to 5 µm long; about 12 setae on lateral and ventral portions, 12-20 µm long; maxillary palpi 65 µm long and 68 µm wide; galeae 90 µm long and 50 µm wide; spines on lacinial area up to 15 µm long. Labium 530 µm wide; marginal portion with setae, up to 12-28 µm long; labial palpi 60 µm long, 30 µm wide. Other features as in the mature larvae of *P. denticulatum*.

Cocoon (Fig. 31)

Posterior extremity somewhat rounded. Meconium approximately cylindrical. Other features as in those of *P. denticulatum*.

Material examined. BRAZIL, Acre: Senador Guiomard (Reserva Catuaba, area belonging to the Universidade Federal do Acre, 10°04'S and 67°36'W); E.F. Morato leg. (collected with trap-nests): one pre-pupa and one cocoon.

Remarks. The last instar larvae of *P. denticulatum* is distinct from those of other species of *Podium* by the lacking of cephalic rugosity. The serrated margin on the third mandibular tooth, which occurs in some specimens of *P. denticulatum* was not observed in other species. Moreover, the cocoon in this species is tapered in the posterior extremity. The somewhat rounded posterior extremity of the cocoon of *P. fumigatum* is similar to those of *P. fulvipes* (GENARO 1994), as those of some species of the related genera *Trigonopsis* (VARDY 1978) and *Sceliphron* (RAU 1915, GRANDI 1961, GEPP & BREGANT 1986). The last instar larva of *P. fumigatum* and *P. aureosericeum* are unique in bearing small lamellae between mandibular teeth and developed thoracic pleural lobes. *P. luctuosum* and *P. rufipes* have cephalic rugosity, but are distinct from the other species in having unpigmented parietal bands (EVANS & LIN 1956, EVANS 1964).

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