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Morphology of the First Zoeal Stage of the Shrimp *Typton distinctus* Chace, 1972: The Second for the Genus *Typton* O.G. Costa, 1844 After 100 Years

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ABSTRACT

The marine shrimp of the genus *Typton* are widely distributed, known to be associated with sessile organisms such as sponges. Information about this genus is limited, highlighting the scarcity of important features in its biology, including larval forms. This study aims to describe the first larval stage of *Typton distinctus*, marking the third larval description for the genus and the second for the first zoea after 100 years. An ovigerous female was sampled manually by freediving in January 2019 at Cais do Porto, Itaguá Bay, Ubatuba, São Paulo. The parental female was kept in an aquarium until the larvae hatched. The morphology of the first larval stage was described and illustrated, then compared to the only first zoea of the genus available in the literature in this stage, *T. spongicola,* to identify diagnostic larval patterns in the genus. Both species shared similar morphological characteristics, typical of first zoea in caridean shrimp; however, an elevated number of distinct traits were identified too that could be a result of incomplete details in the description of *T. spongicola*. This study enhances the understanding of *Typton* larvae, assisting in their identification and providing information for future research on this genus through the morphological data provided.

1 | Introduction

Typton O.G. Costa, 1844 is composed of 22 species of exclusively marine shrimp, most of which are < 10 mm in total length, distributed in tropical and subtropical areas (De Grave and Fransen 2011; Almeida et al. 2014; Ayón-Parente et al. 2015; Neves 2020; Anker et al. 2021; Paixão et al. 2021). In the Western Atlantic, 10 species are known (Pachelle et al. 2015), of which 7 occur in Brazilian waters: *T. carneus* Holthuis, 1951, *T. distinctus* Chace, 1972, *T. fapespae* Almeida, Anker & Mantelatto, 2014, *T. gnathophylloides* Holthuis, 1951, *T. prionurus* Holthuis, 1951, *T. tortugae* McClendon, 1911 and *T. vulcanus* Holthuis, 1951 (Ramos-Porto and Coelho 1998; Coelho et al. 2006; Vieira et al. 2012; Almeida et al. 2014; Soledade et al. 2015; Terossi and Cardoso 2024).

Species from *Typton* are mostly found associated with sea sponges (from Demospongiae Sollas, 1885) (Holthuis 1951), composing a widely documented relationship of occurrence, although little discussed, such as the nature and adaptive value

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they play with their respective hosts (Holthuis 1951; Ďuriš et al. 2011; Hultgren 2014). Although uncertain, analyses of stomach contents and chelipod morphology suggest that there is a tendency towards obligate/parasitical association (Ďuriš et al. 2011).

Part of the studies on *Typton* deal with association, occurrence and morphology of adult organisms, while certain biological aspects, such as reproduction and larval development, remain little explored. This can be evidenced by the total number of larval stages described, with only two with information on their larval morphology (Lebour 1925, 1949) of the 22 species described (Chace 1972; Ramos-Porto and Coelho 1998; Vieira et al. 2012; Almeida et al. 2014; Pachelle et al. 2015; De Grave and Anker 2017), representing < 10% of the total. *Typton distinctus* is a widely distributed species in the Western Atlantic, with records in the United States (Florida), Mexico (Bahía de la Ascensión), Cuba (Los Arroyos) and Brazil (Pernambuco, Rio de Janeiro, São Paulo), the latter being documented for the first time only in 2020 (Camp et al. 1998; Chace 1972; Coelho et al. 2006; Moraes et al. 2020). However, despite its wide geographical distribution, the knowledge about its life history remains limited, especially regarding its larval development (Pachelle et al. 2015; Moraes et al. 2020; Paixão et al. 2021).

Among the known *Typton*'s larval stages in the literature, Lebour (1925, 1949) described the morphology of the first and last zoea of *T. spongicola* and described the post-larvae of *T. spongicola* and *T. tortugae* (Lebour 1949). The definition of post-larvae used by Lebour (1949) indicates a stage reached after the last larval stage; however, this term is usually used to designate the decapodite stage in Caridea (Guerao and Cuesta 2014). Thus, considering the characteristics described and illustrated, it is not possible to ascertain with certainty whether the stages described are decapodites (post-larvae) because, although the exopods are described as vestigial in the pereiopods, there is no information on their presence or absence in the maxillipeds, a characteristic usually observed in decapodites (Nagai and Shokita 2003; Guerao and Cuesta 2014).

There has been a gap of a century since the last zoea I for *Typton* was described; moreover, the existing description is general, with illustrations and nomenclature without a clear descriptive pattern, differing from the ones observed nowadays for Caridea larvae (Pasinatto et al. 2020; Pantaleão et al. 2021; Sousa et al. 2022; Pescinelli et al. 2022; Sanches et al. 2024; Santos et al. 2024; Pasinatto, Bochini, et al. 2025; Pasinatto, Almeida, and Terossi 2025), which are based on works that organised the standards of description and nomenclature for larval morphology of Caridea and Brachyura, (e.g., Pohle and Telford 1981; Clark et al. 1998; Garm 2004; Clark and Cuesta 2015). Thus, the low number of larval description studies constitutes a challenge for the other species and larval stages of *Typton*, restricting information on the genus almost exclusively to its adult representatives (Vieira et al. 2012; Pachelle et al. 2015).

Studying new larval morphology of *Typton* species is fundamental to understanding the life history of their representatives (Anger 2006; Pantaleão et al. 2021). In this context, identifying the number of ontogenetic stages and their morphological characteristics plays an essential role in the group's taxonomy, allowing us to distinguish developmental patterns, such as extended development, characterised by a greater number of larval stages, and abbreviated development, in which this number is considerably reduced (Clark and Webber 1991; Pohle 1991; Bauer 2023). Therefore, by elucidating the larval aspects of a species, combined with molecular data, it becomes possible to investigate their phylogenetic relationships, identify intra- and subspecific differentiations in congeneric species and corroborate the classification of new species (Clark and Webber 1991; Pohle 1991; Mathews 2006). Thus, this study aims to describe zoea I of *T. distinctus*, the second description of the first post-embryonic stage of this genus after a century.

2 | Material and Methods

2.1 | Parental Female and Larvae Acquisition

The parental female was collected in January 2019 at Cais do Porto, Itaguá Bay, Ubatuba, São Paulo (23°27′05″ 45°02′48″ W) (Figure 1). It was captured by manually sampling biogenic substrate, performed by two divers using freediving to remove fragments of a sponge belonging to the class Demospongiae Sollas, 1885, and then the associated fauna are inspected.

An ovigerous female of *T. distinctus* was then separated and properly placed in a container with water from the collection site, with constant aeration. In the laboratory, the female was placed in an aquarium (3 L) containing shelter, with salinity (35), temperature (25°C) and photoperiod (12:12 Light–Dark) parameters simulated like the natural environment. Partial water changes and siphoning were also carried out periodically when necessary, and the female was fed *ad libitum* and monitored daily until the larvae hatched.

After hatching, the larvae were collected and preserved in a 1:1 solution of 70% ethanol and glycerin. The parental female was preserved in 80% alcohol and deposited with some larvae in the Crustacean Collection of the Biology Department, FFCLRP, University of São Paulo, Ribeirão Preto, Brazil (CCDB/FFCLRP/USP); CCDB—7883.

2.2 | Morphological Description

A total of 10 larvae were randomly selected and measured for the carapace length (CC mm), following the maximum length from the posterior margin of the orbit to the posterior margin of the carapace; and for total length (CT mm), following the distance from the tip of the rostrum to the posterior margin of the telson, excluding setae. After measurement, the larvae were dissected using a Zeiss Stemi 2000C trinocular stereomicroscope. Descriptions and illustrations were made using a Leica DM750 microscope equipped with a *camera lucida*, following the description standards proposed by Clark et al. (1998), updated by Clark and Cuesta (2015), and using the setae terminology proposed by Pohle and Telford (1981) and Garm (2004).

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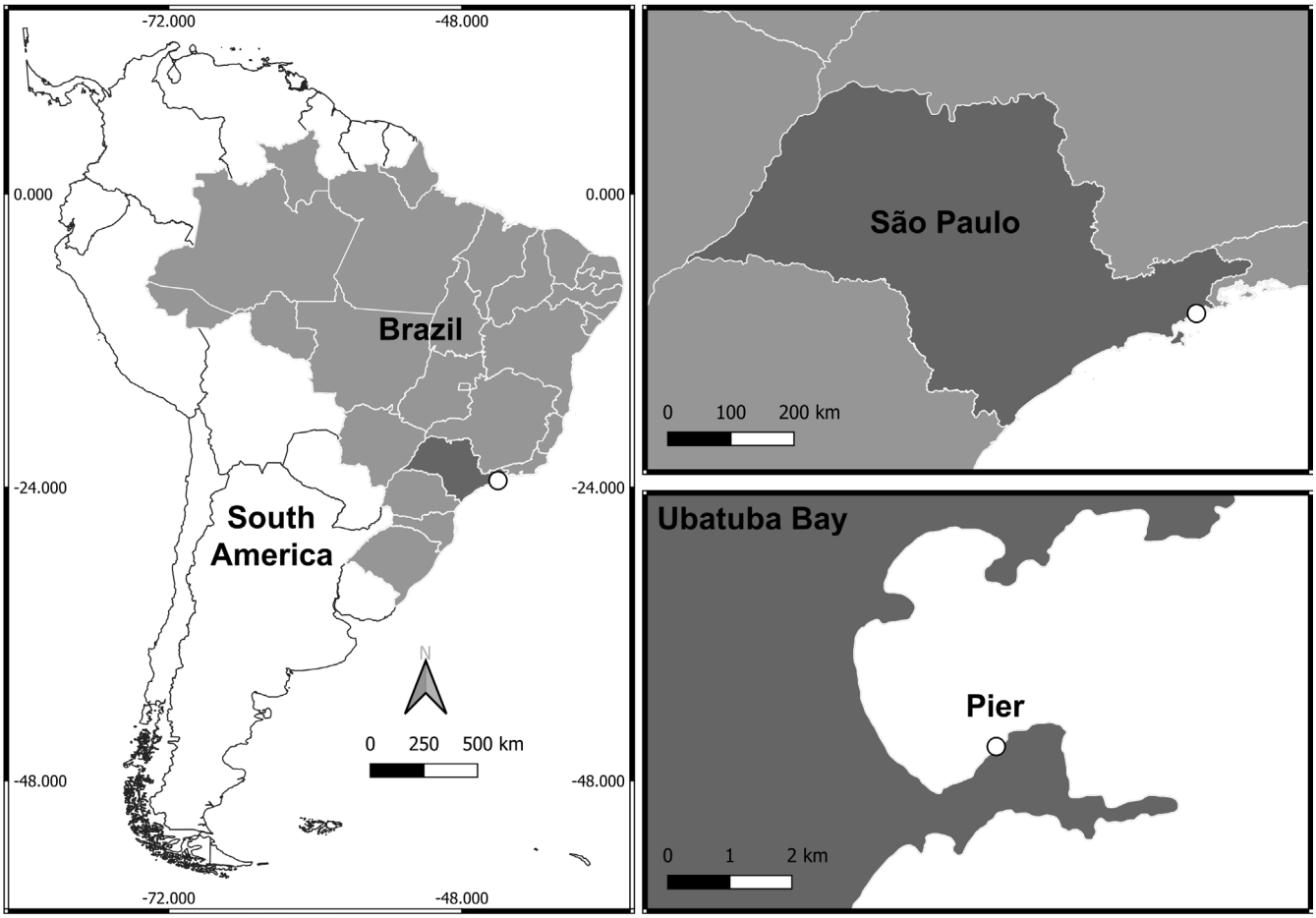

FIGURE 1 | Map of the sampling area of the ovigerous female of *Typton distinctus* Chace 1972.

2.3 | Morphology Comparison

The morphology of *T. distinctus* was compared with zoea I of *T. spongicola*. To this end, the descriptions and illustrations carried out by Lebour (1925) were used to construct a table; characteristics that were present in the illustrations but were not described in the text were included with an asterisk '*', as done in Pasinatto, Bochini, et al. (2025). The comparison aimed to highlight similarities between the two species and particularities observed in *T. distinctus*.

3 | Results

3.1 | Morphological Description of Zoea I of *Typton distinctus* Chace, 1972

The parental female measured 2.7 mm in carapace length.

3.2 | Zoea I

Dimensions: CL = 0.24 ± 0.01 mm; TL = 2.18 ± 0.07 mm. (n = 10).

Carapace (Figure 2A,B): rostrum unarmed, short, reaching the distal portion of the eyes and slightly curved downwards; sessile eyes; carapace unarmed. The carapace forms an approximately 90° angle with the pleon.

Antennule (Figure 2C): unarticled peduncle, with 1 outer terminal spine; endopod as a long plumose seta; exopod with 4 aesthetascs and 1 short plumose seta on the inner margin.

Antenna (Figure 2D): unarticled peduncle, with 1 inner terminal short spine; endopod with a strong spine at the distal end and 1 long plumose seta; exopod (antennal scale) 6-articled with 9 plumose setae in the inner margin (2,1,1,1,1,3), 1 lateral plumose in the second article (0,1,0,0,0,0), 1 simple seta in the inner margin of the first article (1, 0, 0, 0, 0, 0) and 2 simple setae in the outer margin (1,0,0,0,0,1).

Mandible (Figure 2E): asymmetrical, developed incisor and molar process; palp absent.

Maxillule (Figure 2F): coxal endite with 6 simple setae; basial endite with 3 serrate setae and 2 stout spines bearing spinules; unarticled endopod, with 2 simple setae and 1 short spine.

Maxilla (Figure 2G): coxal endite unilobed with 4 setae (1 simple -and 3 sparsely plumose); basial endite bilobed with 3 + 2 simple setae; endopod unarticled, with 1 long simple seta; scaphognathite with 3 terminal and 2 proximal plumose setae. Microtrichia along

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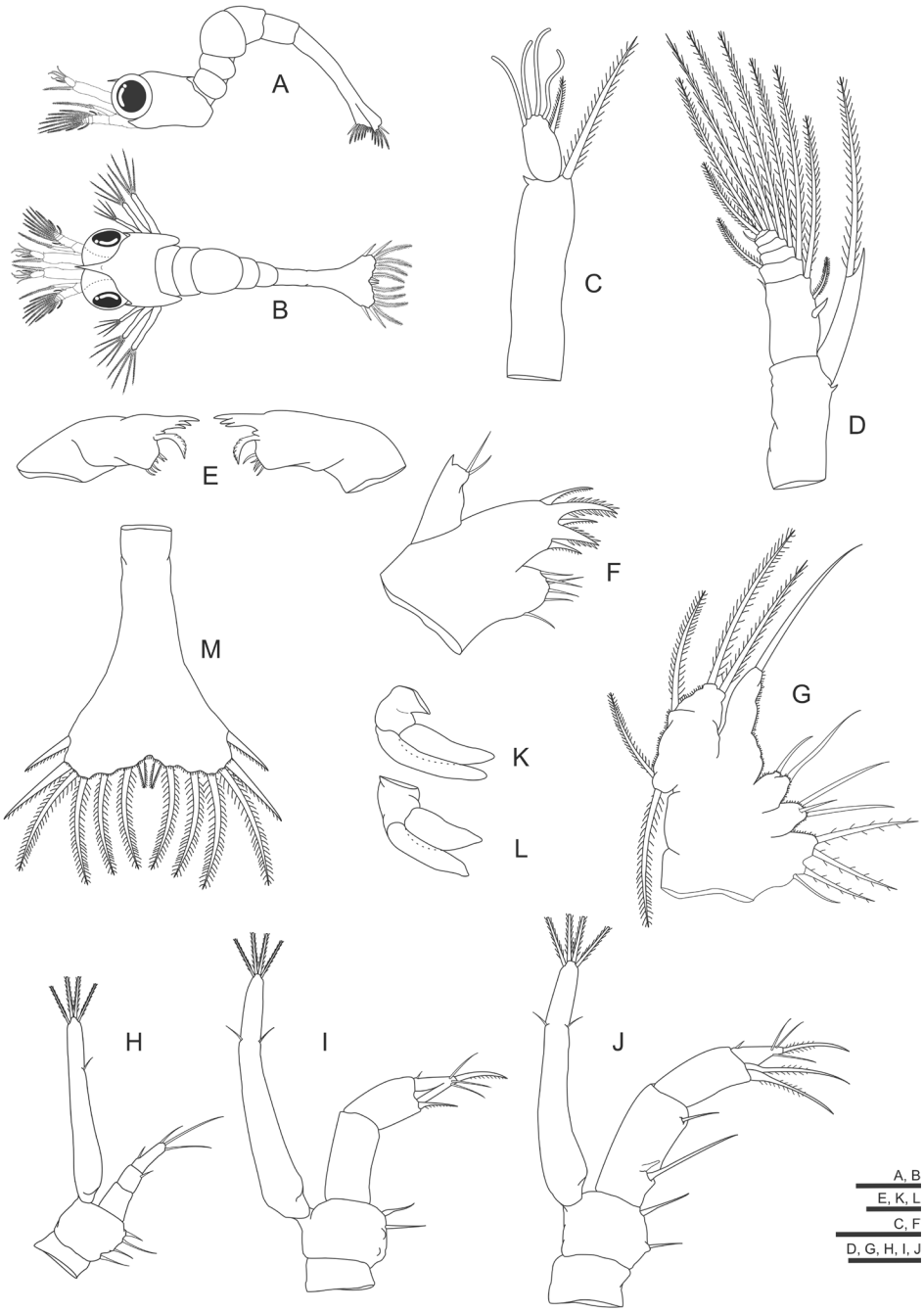

FIGURE 2 | *Typton distinctus* Chace, 1972, Zoea I. (A) Lateral view; (B) Dorsal view; (C) Antennule; (D) Antenna; (E) Mandible; (F) Maxillule; (G) Maxilla; (H) first maxilliped; (I) second maxilliped; (J) third maxilliped; (K) first pereiopod; (L) second pereiopod; (M) telson. Scales: A, B = 0.6 mm; C, D, K, L, H, I, J, M = 0.1 mm; E, F, G = 0.05 mm.

the outer margin of the scaphognathite and in the inner margin of the endopod to the distal region of the coxal endite.

First maxilliped (Figure 2H): coxa unarmed; basis with 4 simple setae; endopod 3-articled with 0, 1 distal, 4 (1 proximal and 3 distal) simple setae; exopod unarticled with 1 simple short subterminal seta in the inner margin and 4 terminal plumose natatory setae.

Second maxilliped (Figure 2I): coxa unarmed; basis with 2 simple setae; endopod 3-articled with 0, 2 (1 serrate and 1 simple) setae, 5 (4 simple, 1 proximal and 3 terminal and 1 serrate) setae; exopod unarticled with 2 simple short subterminal setae and 4 terminal plumose natatory setae.

Third maxilliped (Figure 2J): coxa unarmed; basis with 2 simple setae; endopod 3-articled, with 2 simple setae and 1 spine, 2 cuspidate setae, 5 (4 simple, 1 proximal and 3 terminal and 1 cuspidate) setae; exopod unarticled with 2 simple short subterminal setae and 4 terminal plumose natatory setae.

Pereiopod (Figure 2K,L): first and second biramous buds.

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Pleon (Figure 2A,B): 5 rounded pleonites, third pleonite more robust than the others, forming a conspicuous hump, sixth pleonite not differentiated from the telson, spines absent, pleopods absent.

Telson (Figure 2M): triangular shape, with 7 + 7 plumose setae, outermost 2 pairs plumose only in the inner margin. Presence of spinules along the entire distal region of the telson, between the plumose setae, except between the last two outermost pairs.

4 | Discussion

The zoea I described in this study is not only unprecedented but also increases knowledge about the morphology of the larvae of the genus, as it is the second species evaluated, following the current standards of description proposed in the literature, bringing advances to the study area. In *T. distinctus*, a series of morphological characteristics were observed that are usually found in the first zoeas of Caridea, with extended development (Guerao et al. 2011; Guerao and Cuesta 2014; Pasinatto et al. 2020). These characteristics include: absence of dorsal spines on the carapace; sessile eyes; antenna with articulated exopod in the distal portion (scaphocerite) and non-articulated endopod; first three maxillipeds provided with swimming plumose setae; pereiopods absent or present in the form of buds; pleopods and uropods absent; and sixth abdominal somite (pleonite) not separated from the telson, showing 14 plumose setae arranged in a 7 + 7 pattern, with two outer pairs plumose only on the inner face (Guerao and Cuesta 2014).

When comparing the larval morphology of zoea I of *T. distinctus* with representatives of Palaemonidae, highlighting species previously included in the extinct subfamily Pontoniinae Kingsley, 1879, a taxonomic category later refuted on the basis of molecular phylogeny analyses (De Grave and Fransen 2011; De Grave et al. 2015), morphological similarities are observed between its representatives and the larval stages known for *Typton*, a genus that belonged to this extinct subfamily. For the zoeas I of *T. distinctus* described here, as well as for *T. spongicola* (Lebour 1925), a dorsal connection was observed between the carapace and the pleon, forming an angulation close to 90°. This morphological feature is one of the diagnostic features used to group the first larval stages in species of (ancient) Pontoniinae (Dos Santos and González-Gordillo 2004), named as 'double bend' by Fincham and Figueras (1986), based on the description of *T. spongicola*.

However, the presence of the 'double bend' was not described for all the species that belonged to the Pontoniinae, such as *Periclimenes sagittifer* (Norman, 1861) and *Conchodytes nipponensis* (De Haan, 1844), while species such as *Gnathophyllum elegans* (Risso, 1816) and *Hymenocera picta* Dana, 1852, which were grouped in the families now synonymised with Palaemonidae, Gnathophyllidae Dana, 1852 and Hymenoceridae Ortmann, 1890 (De Grave et al. 2015), respectively, are described as having a 'strongly flexed' abdomen, very similar to the characteristic described for Pontoniinae (Bruce 1988; e2021026: 1–12.Dos Santos et al. 2004; Meyer et al. 2013). Divergences in the morphology used to separate the subfamilies had already been discussed, with inconsistencies being pointed out by Bruce (1986), highlighting the similarity of *G. elegans* and *H. picta* with typical Pontoniinae larvae.

The absence of spines on the carapace and the length of the rostrum reaching until the proximal half of the antennular peduncle has also been observed for *Typton*'s zoeas I described to date (Lebour 1925; present study), characteristics highlighted by Fincham and Figueras (1986) and Dos Santos and González-Gordillo (2004) as diagnostic for Pontoniinae. However, species that belonged to the synonymised subfamily Palaemoninae Rafinesque, 1815 (De Grave et al. 2015), such as *Nematopalaemon schmitti* (Holthuis, 1950) and *Macrobrachium latimanus* (von Martens, 1868) show the same characteristic (Ito et al. 2006; Pantaleão et al. 2019). Therefore, it is noteworthy that the absence of robust and consistent morphological characteristics, such as the absence of dorsal spines on the carapace, a common feature for zoeas I of Palaemonidae (Pantaleão et al. 2013), does not corroborate a clear distinction between Pontoniinae and Palaemoninae, reinforcing the integration into a single family, Palaemonidae (De Grave et al. 2015).

During the comparative analysis of the larval morphology of *T. distinctus* with its congener, we identified the absence of essential information in the description of *T. spongicola*. Among those, the precise delimitation of the appendage articles, the nomenclature of the setae and the detailed description of structures which, despite being illustrated, were not mentioned or adequately described in the study (Lebour 1925). The lack of information limits morphological comparison, making it difficult to identify possible similarities that could elucidate morphological patterns characteristic of the genus.

Despite these limiting factors in the comparative process, a set of morphological characteristics shared between *T. distinctus* and *T. spongicola* was observed, such as: endopod of antenna with 1 long plumose seta and 1 spine, exopod of antenna with 6 articles, with 10 plumose setae; coxal endite of maxillule with 6 setae and basial endite of maxillule with 2 stout spines; endopod of maxillula with 2 setae; scaphognathite of maxilla with 5 plumose setae, bilobed basial endite with 2 setae on distal lobe and coxal endite with 4 setae; endopod of second and third maxilliped with 3 articles, basis of third maxilliped with 2 setae. However, it should be borne in mind that some of the structures, as well as their proper nomenclature and distribution, when not actually described, were compared based on observation of the illustrations, for example, setae of the coxal endite of the maxillule.

Although similarities were observed between the morphology of zoea I of the two species, the first larval stage of *T. distinctus* contains several distinct characteristics when compared to *T. spongicola*, these being: short rostrum reaching the end of the eyes; antennular peduncle with 1 outer distal spine and exopodite with 4 aesthetascs; antennal peduncle with 1 inner distal spine and exopod with 3 simple setae; basial endite of maxillula with 3 serrate setae and endopod with 1 spine; endopod of maxillula with 1 simple seta and basial endite with 3 setae on the proximal lobe; basis of first maxilliped with 4 simple setae, endopod with 3 articles and exopod with 1 distal simple seta; basis of second maxilliped with 2 simple setae and exopod with 2 distal simple setae; exopod of third maxilliped with 2 apical simple setae; second pair of pereiopod biramous (Table 1).

In view of the large number of morphological distinctions between the same larval stage of two congeneric species, it is

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TABLE 1 | Morphological comparison of *Typton distinctus* Chace 1972 with *Typton spongicola* O.G. Costa, 1844 highlighting the morphological variations.

Structure	Characteristic	*T. distinctus* Chace 1972	*T. spongicola* O.G. Costa, 1844
Carapace	Rostrum	Short, unarmed	Long, unarmed
Antennule	Peduncle	N-artic., 1 sp	N-artic.
	Exopod	4 ae + 1 ps	3 ae + 1 ps
Antenna	Peduncle	N-artic., 1 sp	N-artic.
	Exopod	6-artic., 4 (2 ss + 2 ps), 2 ps, 1 ps, 1 ps, 1 ps, 4 (1 ss + 3 ps)	6-artic., 10 ps* + 1 sp
Maxillule	Coxal endite	6 ss	6 s*
	Basial endite	2 sts + 3 se	2 sp + 2 s
	Endopod	2 ss + 1 sp	2 s
Maxilla	Coxal endite	Unilobed, 1 ss + 3 sps	Unilobed, 4 s
	Basial endite	Bilobed, 3 + 2 ss	Bilobed, 2 + 2 s
	Endopod	N-artic., 1 ss	N-artic., 1/3 s
First maxilliped	Coxa	Unarmed	NA
	Basis	4 ss	NA
	Endopod	3-artic., 0, 1, 4 ss	N-artic., 8 s
	Exopod	N-artic., 1 ss + 4 ps	N-artic., 4 ps
Second maxilliped	Coxa	Unarmed	NA.
	Basis	2 ss	NA
	Endopod	3-artic., 0, 2 (1 se + 1 ss), 5 (4 ss + 1 se)	3-artic., 7 s*
	Exopod	N-artic., 2 ss + 4 ps	N-artic., 4 ps
Third maxilliped	Coxa	Unarmed	NA.
	Basis	2 ss	2 s
	Endopod	3-artic., 3 (2 ss + 1 sp), 2 cs, 5 (4 ss + 1 cs)	3-artic., 10 s
	Exopod	N-artic., 2 ss + 4 ps	N-artic., 4 ps
Pereiopod	N°	2 (1° and 2° biramous)	2 (1° biramous and 2° uniramous)

Abbreviations: ae, aesthetasc; artic., article; cs, cuspidate seta; NA, not applicable; ps, plumose seta; s, undifferentiated seta; se, serrate seta; sp, sparsely plumose seta; sp, spine; ss, simple seta; sts, stout spine.
*Seen in the illustration.

worth pointing out that some of the characteristics observed in *T. spongicola*, as well as the way in which they were textually approached, contribute to these variations. On the antennular peduncle described for *T. spongicola*, it is possible to notice an inner distal projection that resembles a short simple seta, but there is no mention of the occurrence of this structure in the description, making it difficult to define whether it is in fact part of the morphology of zoea I of the species. In addition, differences in the number of aesthetascs present on the exopod of the antennule also stand out, 3 aesthetascs + 1 short plumose seta for *T. spongicola* and 4 aesthetascs + 1 short plumose seta for *T. distinctus*. Variations in the number of aesthetascs can be observed for zoeas I of Caridea, such as those of the families Alpheidae Rafinesque, 1815 and Processidae Ortmann, 1896 (Terossi and Mantelatto 2014; Santos et al. 2020; Pantaleão et al. 2020), as well as for representatives of Palaemonidae, which are often used for identification between species present in the plankton (Pantaleão et al. 2013; Muzio et al. 2018).

Differences in the way of describing structures that visually appear to be the same type of ornamentation may contribute to the high number of variations between the first zoeas of both species. When comparing the distal short spine present on the peduncle of the antenna of *T. distinctus* with the same appendage for *T. spongicola*, there is a definition described as 'very slender branch' (Lebour 1925). The presence of a short distal spine in the same region of this article is present in other species of Palaemonidae, such as *C. nipponensis*, *Pontonia simplex* Holthuis, 1951, *Periclimenes pandionis* Holthuis, 1951 and *Palaemon floridanus* Chace, 1942 (Gore et al. 1981; Knowlton and Vargo 2004; Yang and Ko 2004; Ayón-Parente et al. 2014), which leads us to believe that, despite not using the same

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nomenclature, *T. spongicola* may in fact have this spine like the other species in the family, which could increase the similarities between the two *Typton* species described until now. In addition, other possible similarities may exist between the species, such as in the exopod of the antenna. Both species had six articles with 10 total plumose setae. Although for the present study it is possible to ascertain the distribution of setae on the inner margin, for *T. spongicola*, this morphological detail is not only not described but is also not present in illustrations of the previous study (Lebour 1925), making it impossible to distinguish the insertions of the setae on the distal articles.

The number and type of setae is also crucial information for identifying and distinguishing species (Santos et al. 2020, 2024). However, when comparing the zoea I of *Typton* species, for some appendages this is not possible to ascertain. For the coxal endite of the maxillule, six simple setae were described here, while for *T. spongicola* it is described as 'short with short setae', without informing the number or type of its setae. Although this information is not reported in the description of the species (Lebour 1925), in the illustration the tip of 6 setae can be seen, with 1 proximal and 5 distal setae, the same number and distribution observed in *T. distinctus*. As for the basial endite, the comparison between the two species is made impossible by the inconsistencies observed between the description and the illustration of *T. spongicola* (Lebour 1925), which is described as 'two large thick hook-like spines and two fine setae, also a short knob externally', although only one of the 'fine setae' is illustrated. Thus, there is no way of determining whether the morphology of *T. distinctus* should be compared based on the descriptions or illustrations for *T. spongicola*.

Another important point for comparing the morphology of the species is the exact definition of the number of setae present on an appendage. The endopod of the maxilla of *T. spongicola* is described as having between 1 and 3 setae, while for *T. distinctus* only 1 simple seta was observed on this structure in all the larvae observed. This is an important factor for the morphological comparison between the two species, since when comparing the same structure with Zoea I of *T. distinctus* with other species of Palaemonidae, e.g., *Periclimenes aegylios* Grippa & d'Udekem d'Acoz, 1996; *Periclimenes amethysteus* (Risso, 1827); *Periclimenes paivai* Chace, 1969; *Palaemon ortmanni* Rathbun, 1902; *Zenopontonia soror* (Nobili, 1904) the same morphology is observed (Wear 1976; Gore et al. 1981; Calafiore et al. 1991; Yang and Ko 2002; Geiselbrecht and Melzer 2009; Pantaleão et al. 2013).

The three maxillipeds also have distinct morphologies that are difficult to compare between the two species. This is mainly due to the lack of information in the illustrations, which do not include the clear division of the endopod articles and their division with the basis in *T. spongicola* (Lebour 1925), leaving room for interpretation of different distribution patterns. For the first maxilliped, in *T. distinctus*, the presence of 5 setae distributed in three articles and 4 simple setae at the basis is observed for the endopod, while for *T. spongicola*, Lebour (1925) describes the endopod as 'unjointed' (unarticled) 'with three terminal setae, one lateral and four, at the base'. It is unclear, therefore, whether the 4 setae that Lebour (1925) mentions are at the base, belong to the proximal portion of the endopod or to the basis of the appendage, given the absence of the divisions in the illustration, so it is possible that the 4 proximal setae of this structure belong to the basis, as observed for *T. distinctus*.

For the second maxilliped, a similar pattern is observed, in which the division between the endopodite and the basis in *T. distinctus* allows the distribution of setae along this branch to be delimited, while for *T. spongicola*, although the structure is described as having 3 articles, the lack of delimitation makes it impossible to actually identify which part of the structure the setae belong to. In addition, for *T. distinctus*, the presence of 2 simple setae at the basis is described, but there is no clear definition of what is described for *T. spongicola*, and it is only possible to observe 3 undescribed proximal ornamentations, making it impossible to determine whether they are setae or spines.

In the endopod of the second and third maxillipeds of *T. distinctus*, setae similar to the 'thick hook/hook-like spines' present in *T. spongicola* were identified on the same appendages. However, although morphologically similar, these structures differ in position and type between the two species. In *T. distinctus*, there is a serrate seta on the third article of the endopod of the second maxilliped, while on the third maxilliped, there are three cuspidate setae: two distal on the second article and one terminal on the third. Lebour (1925), in turn, describes that in the third maxilliped of *T. spongicola* the three hooks belong to the third article, two at the basis and one terminal. Despite the differences observed in the endopods of maxillipeds, on the exopods, 4 terminal plumose setae are present for both species, but *T. distinctus* has 1 subterminal simple seta on the first and 2 on the second and third, differentiating it from *T. spongicola*.

Even though the two species have unique characteristics, the use of these particularities for separation and identification should be approached with caution, given the high number of variations presented. Drastic changes in morphology are rare among congeneric species, especially when comparing the same stages of ontogenetic development (Pescinelli et al. 2017). This is because some of the variations observed may not only be associated with genuine morphological differences but also with the lack of detail in the illustrations and descriptions available for *T. spongicola*.

The limited information on the morphology of *T. spongicola*, as well as the small number of larval descriptions available for *Typton*, highlights the importance of filling in gaps in the knowledge of species that have already been described or that have yet to be described. Even in genera with a relatively small number of known species, descriptions of their larval forms are rare or non-existent, and when they do exist, they tend to be incomplete or excessively generalised, which can lead to inconsistencies in the descriptions. This study, therefore, provides new information through the description of *T. distinctus* and its morphological comparison with *T. spongicola*, enriching knowledge about the larval morphology of the genus.

Author Contributions

Matheus Sene: larvae illustration and description, measurements, bibliography observation, main text writing. Rafael Carvalho Santos:

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bibliography observation, sampling shrimp and larvae rearing, English grammar correction, main text revision. Rogerio Caetano Costa: main text correction, sample coordination, full text revision, main financial support.

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Ethics Statement

All ethical standards were observed in compliance with Brazilian laws and the licenses required for invertebrate collection.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data underlying this study is available from the corresponding author, R. C. C., upon reasonable request. The parental females and their respective larvae were deposited in the Crustacean Collection of the Biology Department (CCDB) of the FFCLRP, University of São Paulo, available for consultation by the number: CCDB—7883.

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