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New species of *Travisia* Johnston, 1840 (Annelida, Travisiidae Hartmann-Schröder, 1971) from south-eastern Australia

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Abstract

Avery L., Vodopyanov S. & Wilson R.S. 2023. New species of *Travisia* Johnston, 1840 (Annelida, Travisiidae Hartmann-Schröder, 1971) from south-eastern Australia. *Memoirs of Museum Victoria* 82: 133–142.

Two new species of *Travisia* Johnston, 1840 (Annelida, Travisiidae) are described from the continental shelf of south-eastern Australia: *Travisia tribus* sp. nov. and *Travisia una* sp. nov. *Travisia olens novaezealandiae* Benham, 1927 is raised to species rank as *Travisia novaezealandiae* Benham, 1927 new status. We describe epidermal structures using scanning electron microscopy, and discuss pygidial morphology of the two new *Travisia* species and distinguish an additional character. We recognise four species of *Travisia* recorded from Australia and include a dichotomous key to allow their identification. A separate downloadable resource provides access to an annotated morphological character list for *Travisia* species, a downloadable interactive key using the Delta (Descriptive Language for Taxonomy) Intkey software, and concise descriptions and minimal diagnoses and descriptions of all currently recognised species of *Travisia*.

Keywords Scalibregmatidae, interactive key, benthic, polychaetes, diagnosis, DELTA, Intkey

Introduction

Travisia Johnston, 1840 is a genus of marine annelids with short, stout bodies that taper abruptly to anterior and posterior ends; most have fewer than 50 segments. Species of *Travisia* are easily recognised by their distinctive tapering slug-like body, pale body and unpleasant odour when alive. They are recorded from soft sediments in locations worldwide and from the intertidal to depths of 8,300 m (Read and Fauchald, 2023).

Travisia is assigned to the family Travisiidae Hartmann-Schröder, 1971 in most recent treatments (Blake and Maciolek, 2016; Rizzo and Salazar-Vallejo, 2020; Yang et al., 2022; Read and Fauchald, 2023). Recent molecular studies show *Travisia* to be sister group to Scalibregmatidae Malmgren, 1867 (Persson and Pleijel, 2005; Paul et al., 2010; Law et al., 2014; Rouse et al., 2022). However, in the absence of a phylogenetic analysis with more complete sampling of all 16 scalibregmatid genera, it remains unclear whether *Travisia* would be sister group to all other Scalibregmatidae and in which family the genus might ultimately be placed. In this study, we therefore retain *Travisia* in the family Travisiidae.

Travisia currently includes 38 described species, excluding the two new species described below (Read and Fauchald, 2023). Rizzo et al. (2020) include a key to all species of *Travisia* described to that time. We recognise four species of *Travisia* from Australian waters: *T. lithophila* Kinberg, 1866 (from New South Wales), *T. oksae* Hartmann-Schröder and Parker, 1995 (from South Australia and Victoria), plus the two new species from south-eastern Australia described below: *T. tribus* sp. nov. and *T. una* sp. nov. All four species are known only from Australia.

Two additional *Travisia* species are also nominally recorded from Australia, but we do not accept these records. *Travisia forbesii* Johnston, 1840 was recorded from Port Phillip Bay, Victoria, by Poore et al. (1975) but this material was referred to *T. oksae* by Hartmann-Schröder and Parker (1995). A further report of *T. forbesii* from Australia in the Australian Faunal

Directory (Hutchings et al., 2013) attributed to Augener (1922) is probably an error based on the Poore et al. (1975) record; no *Travisia* species is treated in Augener (1922).

A single record of *Travisia olens* Ehlers, 1897 (type locality Strait of Magellan) from north-western Western Australia is based on a single 27 chaetiger, 12 mm long specimen described by Hartmann-Schröder (1980: 74). This description lacks sufficient detail, for example regarding pygidial lobes, to distinguish from about 12 other *Travisia* species with triannulate anterior chaetigers and biannulate mid- to posterior chaetigers. The Australian record should be instead considered *Travisia* cf. *olens*.-Hartmann-Schröder (1980). *Travisia olens* Ehlers, 1897 is not recorded from Australia. A key to the four Australian species of *Travisia* is included below.

Methods

Descriptions and comparisons with other taxa used the Delta (Descriptive Language for Taxonomy) suite of programs (Dallwitz and Paine, 2015), now available as a revised version, Open-Delta, implemented in Java; this version runs on all popular operating systems – Windows, Mac, Linux (Atlas of Living Australia, 2014). Another implementation, Free Delta (Cavalcanti, 2022) supports some different editing functionality and other features including outputs in .csv format but lacks an implementation of interactive identification equivalent to Intkey. All three implementations of Delta (Atlas of Living Australia, 2014; Dallwitz, 2020; Cavalcanti, 2022) read data files in the same format; we used Open-Delta, but most functions are compatible across all implementations, and below we refer to the system simply as Delta.

Delta is a suite of software based on a database (conceptually, a matrix of characters by taxa), enabling consistent, efficient descriptions of taxa using a standardised character set. Components of the software generate outputs including natural language descriptions, diagnoses (discussed further below), linear keys and interactive keys (Dallwitz, 1980).

Travisia species are described and distinguished using a relatively restricted set of characters (Blake and Maciolek, 2016; Rizzo and Salazar-Vallejo, 2020) and can be readily studied using the Delta system. A Delta interactive key enabling identification of all species of *Travisia* is available for download (Wilson and Avery, 2023); use of the key requires installation of either version of the Intkey software, although we recommend the 2014 Java version (Atlas of Living Australia, 2014). An introduction to the use of either version of Intkey is provided by Coleman et al. (2010). In addition to the Delta Intkey files, Wilson and Avery (2023) allows download of the descriptions and diagnoses of all 40 recognised species of *Travisia* and an annotated list of characters (as text documents).

For the *Travisia* species in this study and in Wilson and Avery (2023), we include both a description and a diagnosis for each species. Our descriptions are Delta-generated natural language outputs, with additional detail in the case of the new species described below. Diagnoses should be minimal statements that precisely distinguish taxa (Borkent, 2021); ours are generated using the Delta system with settings (DiagLevel=2) that specify the minimum number of characters needed to distinguish a taxon from all other included taxa.

Light photography was performed using a Leica® M125 stereo microscope and Flexcam C3 (Leica Microsystems). Scanning electron micrographs were taken with an FEI Inspect® F50 scanning electron microscope (SEM), otherwise SEM methods are as described in Vodopyanov et al. (2014). Measurements of epidermal papillae were taken from SEMs, averaged from 10 papillae per specimen, one specimen per species. Two measurements of each papilla were taken: the maximum length (along the length axis of the worm, dimension x in figs 7 and 15) and maximum width (around the circumference of the worm, dimension y in figs 7 and 15).

Specimens were collected during several benthic surveys of Bass Strait in south-eastern Australia (Coleman et al., 1997, 2007), from Western Port, an adjacent coastal bay (Poore, 1986) and from several smaller benthic surveys in South Australia and Tasmania (specimens now deposited in Museums Victoria). All specimens were formalin-fixed when collected, thus molecular data were not available. Specimens are deposited in the collections of Museums Victoria, Melbourne, Australia (previously National Museum of Victoria – NMV), the Australian Museum, Sydney, Australia (AM), the South Australian Museum, Adelaide, Australia (SAM) and the Natural History Museum, London, United Kingdom (NHMUK). Specimen data are provided in "material examined" lists below and the Atlas of Living Australia (2023).

Morphological characters for *Travisia*

Terminology for characters follows Blake and Maciolek (2016), with some minor modifications aimed at practical separation of alternative conditions (character states). Many of the characters currently used to describe and discriminate species of *Travisia* potentially vary with size of worm. Investigation of this issue is beyond the scope of this study but remains a concern, especially as only 13 of the 38 species of *Travisia* are based on descriptions of more than six specimens, and 17 species descriptions are based on one or two specimens (based on published data in original descriptions). Yang et al. (2022) do show that numbers of chaetigers and branchiae and position of first parapodial lobes do not vary with length for *T. amoyanus* Yang, Wu, Wang, Zhao, Hwang and Cai, 2022, but size-related variation of other characters and in other species remains poorly understood.

Coding of morphological characters in this study follows recent literature (Blake and Maciolek, 2016; Yang et al., 2022 Table S5) except where noted below. Our complete list of characters and states is available from Wilson and Avery (2023).

Prostomium form. In most *Travisia* species the prostomium is conical and pointed, but in some it may be anteriorly truncate or rounded. Blake and Maciolek (2016) distinguish four prostomial forms (rounded, conical, pointed, or truncate) but many pointed prostomia are also conical so we distinguish three states: pointed (more or less conical); truncate; rounded.

Prostomium proportions. Proportions of the prostomium are given as either shorter than maximum width; about as long as maximum width; longer than maximum width. Distortion of prostomium during preservation means that not all specimens can be scored for this character, which is not provided in many published descriptions.

Mouth location. The mouth emerges ventrally, the upper lip formed by extension of the annulation on chaetiger 1, and the lower lip is formed similarly from chaetiger 2 (Blake and Maciolek, 2016). However, these ventral extensions are apparently transformed so that in some species the mouth is positioned on chaetiger 1 or 2, instead of the more common location on the border between chaetigers 1 and 2.

Peristomium. The achaetous ring posterior to the prostomium is termed the peristomium by Blake and Maciolek (2016) but some authors refer to it as segment 1 or the anterior achaetous segment. The peristomium is apparently undivided in all *Travisia* species, although for some this information is not available from published descriptions.

Epidermal papillae. The structure of papillae and other epidermal ornamentation varies considerably between species of *Travisia*. For example, papillae may cover the body in regular rows or in irregular patterns, they may be small or large, in which case papillae are often described as pustules. Papillae are sometimes described as absent ("epidermis smooth"), but this probably reflects superficial observations. Elsewhere, the fine structure of epidermal papillae in *T. forbesii* has been compared with other annelids and was found to be different from those of all other annelid families studied so far (Vodopyanov et al., 2014). Studies of the fine structure of epidermal papillae are yet to be made in other *Travisia* species, therefore it is unknown whether these structures will provide synapomorphies for the genus *Travisia* or assist with discrimination of species within the genus. In this study we employed SEM to investigate the fine structure of epidermal papillae for the two new species described here. As described in the Methods, above, we provide mean values of two dimensions, length and width, for 10 papillae per species, for evaluating possible taxonomic value in comparisons with other *Travisia* species.

Pre-pygidial segment ornamentation. In addition to the crenellations seen, for example, in *T. kerguelensis* McIntosh, 1885, pre-pygidial segments may be ornamented with one or more circlets of papillae forming a complete ring around the segment. States observed thus far in *Travisia* are: without circlet of papillae (e.g. *T. lithophila* Kinberg, 1866); with a single ring of papillae encircling last segment (e.g. *T. japonica* Fujiwara, 1933) or with the last four segments each encircled with a ring of papillae (e.g. *T. doellojuradoi* Rioja, 1944).

Number of pygidial lobes. In most *Travisia* species the pygidium is a ring divided into a number of lobes, which we refer to as anal lobes. These are the same as the "pygidial papillae" of some authors, but using the term lobes helps to distinguish smaller papilla-like structures that we term terminal anal cirri, here treated as a separate character (see below). The pygidial lobes are digitiform and usually barely longer than wide, but wider and narrower lobes may also be present, sometimes on a single specimen. Pygidial lobes typically range in number from five to about 15 (exceptionally up to 22, in *T. una* sp. nov.).

Terminal anal papillae. Pygidial lobes may have much narrower terminal extensions. These we refer to as terminal anal papillae (the "subterminal papillae" of Elias and Bremec (2003) which is a misnomer, since they are clearly terminal). Other authors have used a range of other terms. Terminal anal papillae, if present, may number from one to seven.

Internal pygidial cirri. Within the ring of pygidial lobes there may also be a second ring of smaller cirriform structures. These have apparently not been distinguished from pygidial lobes by earlier researchers; we refer to them as internal pygidial cirri. It is not clear if the internal rings of internal pygidial cirri are really distinct from the (outer ring of) pygidial lobes. Internal pygidial cirri are often partly hidden within the ring of pygidial lobes and are difficult to count; if present (or observable – they are perhaps fragile or retractile or both), they apparently number from one to ten, but due to the variable visibility of these structures, values from the literature are probably not reliable and this character probably occurs more widely than we are aware. For this study, we have documented the presence of internal pygidial cirri in four species: *T. amoyanus* Yang, Wu, Wang, Zhao, Hwang and Cai, 2022, *T. araciae* Rizzo and Salazar Vallejo, 2020, *T. glandulosa* McIntosh, 1879 and *T. tribus* sp. nov.

Staining pattern. Patterns due to selective take-up of stain by epidermal tissue have been used to seek additional features for discriminating *Travisia* species, including shirlastain (Vodopyanov et al., 2014; Wiklund et al., 2019) and methyl green (Maciolek and Blake, 2006; Kobayashi and Kojima, 2021). Schiaparelli and Jirkov (2021) found methylene blue (already in use in our laboratory) to be more effective than methyl green, and we report methylene blue staining pattern here.

Systematic account

Family Travisiidae Hartmann-Schröder, 1971

Genus *Travisia* Johnston, 1840

Description. Body stout, pointed at both ends, fusiform, or grub-like, with or without lateral or ventral grooves. Peristomium not annulated. Subsequent segments annulated, with posterior segments forming folds ending in dorsal lappets. Epidermis papillated. Prostomium small, smooth, rounded, conical or truncate, without eyes; nuchal organs present. First chaetiger anterior to mouth. Parapodia reduced, small, smooth, or entirely absent. Branchiae usually present, rarely absent or unobservable, when present from chaetigers 2 or 3, cirriform or branched, sometimes annulated. Interramal pores present; lateral eyes absent. Chaetae simple capillaries, sometimes hispid. Pygidium small, cylindrical, longitudinally furrowed, with ring of stout equal or unequal pygidial lobes, with or without terminal anal papillae and internal pygidial cirri.

Type species. *Travisia forbesii* Johnston, 1840.

Remarks. The description above follows Rizzo and Salazar-Vallejo (2020), with terminology slightly modified in accordance with the above character list and addition of statement that the peristomium is not annulated.

Travisia novaezealandiae Benham, 1927 new status

Material examined. New Zealand "North coast … stomach of Schnapper", NHMUK 1928.2.29.53 holotype Terra Nova Expedition.

Diagnosis. Body comprising 37–39 chaetigers; annulation pattern changes at chaetigers 14–15; posterior-most segments crenellated; branchiae present on 35–38 chaetigers.

Description. Body comprising 38–40 segments; 37–39 chaetigers; 0–2 achaetous posterior segment(s) (cannot determine exactly, but no more than two achaetous posterior segments).

Prostomium shorter than maximum width. Mid-ventral groove absent. Mouth located on chaetiger 1.

Chaetiger 1 biannulate; 2 triannulate; subsequent anterior chaetigers triannulate; annulation pattern changes at chaetigers 14–15; posterior chaetigers biannulate (annulations much more obvious than on anterior segments).

Branchiae about as long as diameter of body. Branchiae first present on chaetiger 2; present on 35–38 chaetigers (apparently, although many posterior branchiae are lost/damaged – the number of posterior abranchiate segments is in the range 0–2).

Parapodial lobes present; notopodial lobes commence chaetiger 6; neuropodial lobes commence chaetiger 3. Nephridiopores first present chaetiger 3; last present chaetiger 14. Posterior-most segments crenellated.

Pygidial lobes at least 6, the holotype is too damaged to determine exact number of lobes.

Remarks. *Travisia olens novaezealandiae* Benham, 1927 (type locality north coast of New Zealand) is here raised to species status on the basis of the following differences from *T. olens* Ehlers, 1897 (type locality Strait of Magellan): in *T. novaezealandiae* the annulation pattern changes at chaetigers 14–15 (at about chaetiger 20 in *T. olens*); in *T. novaezealandiae* the pre-pygidial segments lack a circlet of papillae (in *T. olens* a single ring of papillae encircles the last segment); *T. novaezealandiae* has at least six pygidial lobes (12–15 in *T. olens*). There are other apparent differences, for example, in the chaetigers on which branchiae and parapodial lobes occur, but these may be subject to observational errors, especially of *T. olens novaezealandiae* Benham, 1927, the holotype of which was collected from a fish gut and is damaged.

Travisia tribus sp. nov.

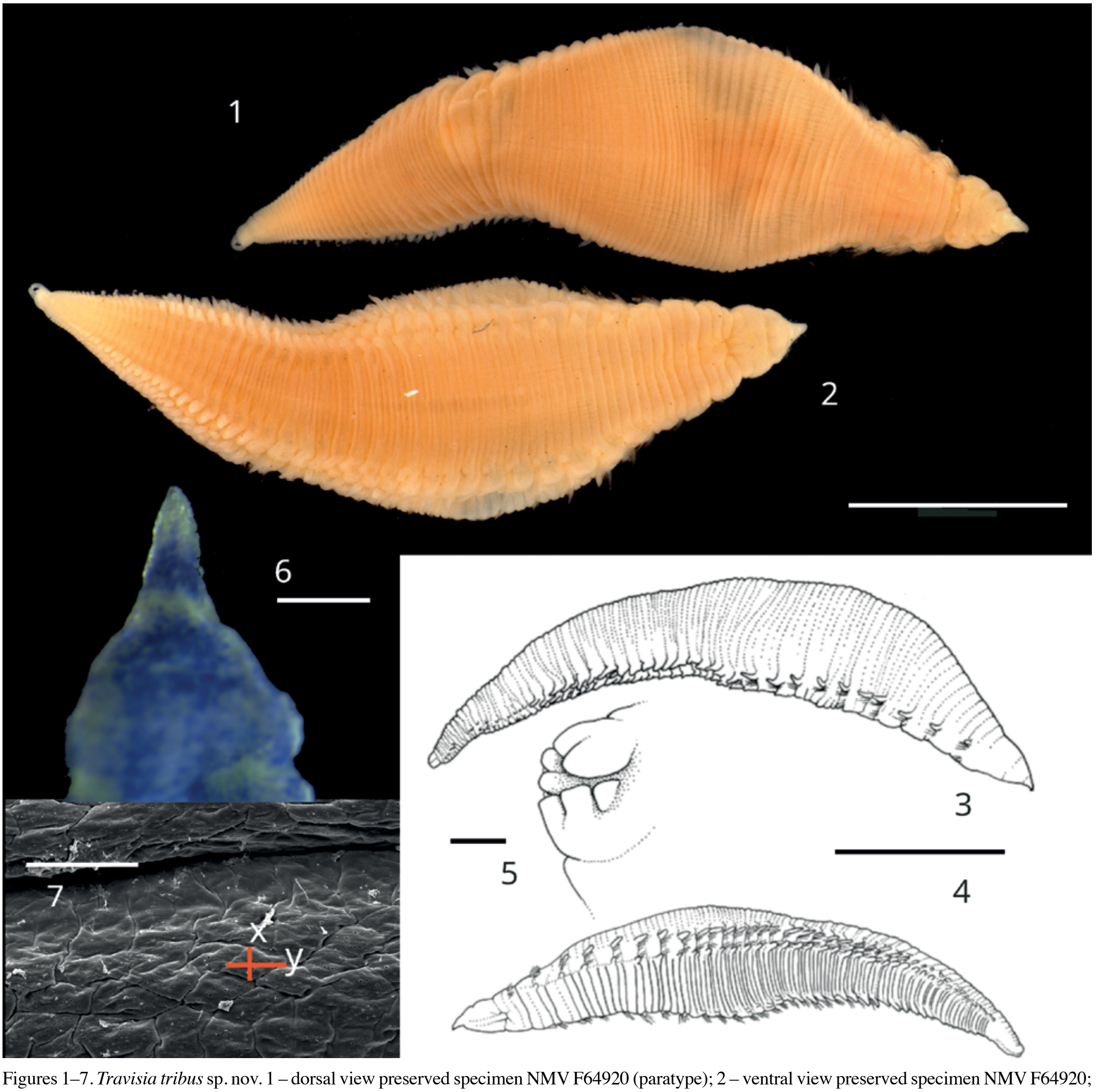
https://zoobank.org/urn:lsid:zoobank.org:act:5CC5BBDC-CF22-4D80-9ED3-ED16F1DDC17B

Figures 1–7

Material examined. Holotype: Australia. Victoria: Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 T8, 38° 14' S 147° 22' E, 29 Aug 1990, 15.4 m, NMV F64973.

Paratypes: Australia. Bass Strait, 1 km off Delray Beach, Stn MSL-LV 5 D8, 38° 14' S 147° 22' E, 29 Aug 1990, 16.5 m, 1, NMV F64952; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 T3, 38° 14' S 147° 22' E, 29 Aug 1990, 14.8 m, 1, NMV F64961; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 1 T6, 38° 14' S 147° 22' E, 1 Mat 1989, 15 m, 1, NMV F64967; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 5 W5, 38° 33' S 146° 57' E, 25 Aug 1990, 14.5 m, 1, NMV F64920; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 1 T2, 38° 14' S 147° 22' E, 1 Mar 1989, 16.5 m, 1, AM W54586.

Non-type material: Australia. Victoria: Bass Strait, 1 km off Delray Beach, Stn MSL-LV 5 D8, 38° 14' S, 147° 22' E, Jan 1990, 16.5 m, 3, NMV F271084-271086; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 1 D1, 38° 14' S, 147° 22' E, 24 Jan 1989, 16.1 m, 1, NMV F64930; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 1 D4, 38° 14' S, 147° 22' E, Jan 1989, 16 m, 1, NMV F64940; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 1 D6, 38° 14' S, 147° 22' E, Jan 1989, 15.8 m, 1, NMV F64946; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 1 T8, 38° 14' S, 147° 22' E, Jan 1989, 15.4 m, 1, NMV F64971; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 2 D3, 38° 14' S, 147° 22' E, Jan 1989, 16 m, 1, NMV F64935; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 2 T7, 38° 14' S, 147° 22' E, Jan 1989, 14.8 m, 4, NMV F64968; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 D2, 38° 14' S, 147° 22' E, Jan 1989, 16 m, 1, NMV F64931; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 D3, 38° 14' S, 147° 22' E, Jan 1989, 16 m, 2, NMV F64936; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 D4, 38° 14' S, 147° 22' E, Jan 1989, 16 m, 1, NMV F64941; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 D5, 38° 14' S, 147° 22' E, 17 Jan 1989, 16 m, 6, NMV F64944; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 D6, 38° 14' S, 147° 22' E, Jan 1989, 15.8 m, 1, NMV F64947; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 D8, 38° 14' S, 147° 22' E, Jan 1989, 16.5 m, 2, NMV F64951; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 T1, 38° 14' S, 147° 22' E, Jan 1989, 16.6 m, 4, NMV F64954; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 T3, 38° 14' S, 147° 22' E, 24 Jan 1989, 14.8 m, 1, NMV F64958; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 T4, 38° 14' S, 147° 22' E, Jan 1989, 14.8 m, 1, NMV F64962; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 3 T5, 38° 14' S, 147° 22' E, Jan 1989, 15 m, 1, NMV F64964; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 D2, 38° 14' S, 147° 22' E, 17 Jan 1989, 16 m, 2, NMV F64932; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 D3, 38° 14' S, 147° 22' E, 17 Jan 1989, 16 m, 9, NMV F64937; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 D4, 38° 14' S, 147° 22' E, Jan 1989, 16 m, 1, NMV F64942; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 D5, 38° 14' S, 147° 22' E, 17 Jan 1989, 16 m, 11, NMV F64945; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 D6, 38° 14' S, 147° 22' E, 17 Jan 1989, 15.8 m, 1, NMV F64948; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 D7, 38° 14' S, 147° 22' E, 11 Jan 1989, 15.5 m, 1, NMV F64949; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 T1, 38° 14' S, 147° 22' E, 24 Jan 1989, 16.6 m, 8, NMV F64955; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 T2, 38° 14' S, 147° 22' E, 24 Jan 1989, 16.5 m, 1, NMV F64957; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 T3, 38° 14' S, 147° 22' E, Jan 1989, 14.8 m, 1, NMV F64959; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 T4, 38° 14' S, 147° 22' E, Jan 1989, 14.8 m, 2, NMV F64963; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 T5, 38° 14' S, 147° 22' E, Jan 1989, 15 m, 2, NMV F64965; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 T7, 38° 14' S, 147° 22' E, Jan 1989, 14.8 m, 1, NMV F64969; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 4 T8, 38° 14' S, 147° 22' E, Jan 1989, 15.4 m, 2, NMV F64972; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 5 D2, 38° 14' S, 147° 22' E, 29 Jan 1990, 16 m, 1, NMV F64933; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 5 D3, 38° 14' S, 147° 22' E, Jan 1990, 16 m, 1, NMV F64938; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 5 D7, 38° 14' S, 147° 22' E, Jan 1990, 15.5 m, 3, NMV F64950; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 5 T3, 38° 14' S, 147° 22' E, Jan 1990, 14.8 m, 3, NMV F64960; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 D2, 38° 14' S, 147° 22' E, 29 Jan 1990, 16 m, 1, NMV F64934; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 D3, 38° 14' S, 147° 22' E, 29 Jan 1990, 16 m, 1, NMV F64939; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 D4, 38° 14' S, 147° 22' E, Jan 1990, 16 m, 1, NMV F64943; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 D8, 38° 14' S, 147° 22' E, 29 Jan 1990, 16.5 m, 3, NMV F64953; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 T5, 38° 14' S, 147° 22' E, Jan 1990, 15 m, 1, NMV F64966; Bass Strait, 1 km off Delray Beach, Stn MSL-LV 6 T7, 38° 14' S, 147° 22' E, Jan 1990, 14.8 m, 1, NMV F64970; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 2 W7, 38° 33' S, 146° 57' E, Jan 1989, 15.1 m, 2, NMV F64923; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 3 W1, 38° 33' S, 146° 57' E, Jan 1989, 15.1 m, 2, NMV F64910; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 3 W2, 38° 33' S, 146° 57' E, Jan 1989, 15 m, 2, NMV F64913; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 3 W3, 38° 33' S, 146° 57' E, Jan 1989, 14.3 m, 2, NMV F64916; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 3 W4, 38° 33' S, 146° 57' E, Jan 1989, 15 m, 3, NMV F64918; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 3 W7, 38° 33' S, 146° 57' E, Jan 1989, 15.1 m, 7, NMV F64924; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 4 W3, 38° 33' S, 146° 57' E, Jan 1989, 14.3 m, 2, NMV F64917;



Figures 1–7. *Travisia tribus* sp. nov. 1 – dorsal view preserved specimen NMV F64920 (paratype); 2 – ventral view preserved specimen NMV F64920; 3 – lateral view NMV F64973(holotype); 4 – ventral view NMV F64973 (holotype); 5 – pygidium detail NMV F64973 (holotype); 6 – methylene blue staining pattern prostomium ventral view NMV F64952 (paratype); 7– SEM epidermal papillae from dorsum chaetiger 6 NMV F64920 (paratype). Image credits 1, 2, 6 Robin Wilson; 3–5 Kate Nolan; 7 Stepan Vodopyanov. Scale bar figs 1-4: 5 mm; 5: 0.2 mm; 6: 0.2 mm; 7: 50 µm; papilla measurements: x – dimension on papilla oriented with length of worm, y – dimension on papilla oriented with circumference of worm.

Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 4 W7, 38° 33' S, 146° 57' E, Jan 1989, 15.1 m, 4, NMV F64925; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 4 W8, 38° 33' S, 146° 57' E, Jan 1989, 15 m, 1, NMV F64927; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 5 W1, 38° 33' S, 146° 57' E, Jan 1990, 15.1 m, 3, NMV F64911; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 5 W2, 38° 33' S, 146° 57' E, Jan 1990, 15 m, 1, NMV F64914; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 5 W4, 38° 33' S, 146° 57' E, Jan 1990, 15 m, 1, NMV F64919; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 5 W6, 38° 33' S, 146° 57' E, Jan 1990, 15.5 m, 4, NMV F64921; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 5 W7, 38° 33' S, 146° 57' E, Jan 1990, 15.1 m, 1, NMV F64926; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 5 W8, 38° 33' S, 146° 57' E, Jan 1990, 15 m, 4, NMV F64928; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 6 W1, 38° 33' S, 146° 57' E, Jan 1990, 15.1 m, 7, NMV F64912; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 6 W2, 38° 33' S, 146° 57' E, Jan 1990, 15 m, 1, NMV F64915; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 6 W6, 38° 33' S, 146° 57' E, Jan 1990, 15.5 m, 1, NMV F64922; Bass Strait, 1 km off Woodside Beach, Stn MSL-LV 6 W8, 38° 33' S, 146° 57' E, Jan 1990, 15 m, 1, NMV F64929; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 1 S2, 38° 22' S, 147° 12' E, 9 Jan 1989, 16 m, 2, NMV F64892; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S1, 38° 22' S, 147°12' E, 9 Jan 1989, 15.5 m, 1, NMV F64889; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S2, 38° 22' S, 147° 12' E, 9 Jan 1989, 16 m, 1, NMV F64893; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S3, 38° 22' S, 147° 12' E, Jan 1989, 16 m, 1, NMV F64895; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S6, 38° 22' S, 147° 12' E, 9 Jan 1989, 16 m, 1, NMV F64902; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S7, 38° 22' S, 147° 12' E, Jan 1989, 16 m, 2, NMV F64905; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S1, 38° 22' S, 147° 12' E, 23 Jan 1989, 15.5 m, 1, NMV F64890; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S2, 38° 22' S, 147° 12' E, Jan 1989, 16 m, 1, NMV F64894; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S3, 38° 22' S, 147° 12' E, Jan 1989, 16 m, 1, NMV F64896; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S4, 38° 22' S, 147° 12' E, Jan 1989, 14.5 m, 2, NMV F64897; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S5, 38° 22' S, 147° 12' E, Jan 1989, 15.5 m, 1, NMV F64899; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S8, 38° 22' S, 147° 12' E, Jan 1989, 15.3 m, 1, NMV F64908; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S1, 38° 22' S, 147° 12' E, 23 Jan 1989, 15.5 m, 3, NMV F64891; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S4, 38° 22' S, 147° 12' E, Jan 1989, 14.5 m, 1, NMV F64898; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S5, 38° 22' S, 147° 12' E, 23 Jan 1989, 15.5 m, 1, NMV F64900; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S7, 38° 22' S, 147° 12' E, Jan 1989, 16 m, 1, NMV F64906; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S5, 38° 22' S, 147° 12' E, 28 Jan 1990, 15.5 m, 1, NMV F64901; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S6, 38° 22' S, 147° 12' E, 28 Jan 1990, 16 m, 1, NMV F64903; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S7, 38° 22' S, 147° 12' E, 28 Jan 1990, 16 m, 2, NMV F64907; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S8, 38° 22' S, 147° 12' E, 28 Jan 1990, 15.3 m, 3, NMV F64909; Bass Strait, near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 6 S6, 38° 22' S, 147° 12' E, 28 Jan 1990, 16 m, 1, NMV F64904.

South Australia: Great Australian Bight, Stn SS2013_RC07 13, 33° 20.316' S, 130° 15.72' E, 13 Jan 2013, 200 m, 1, SAM; Great Australian Bight, SZ12, Stn IN2017_C01 216, 35° 40.504' S, 135° 38.964' E, 25 Jan 2017, 141 m, 2, NMV F2425602.

Tasmania: off Bicheno, 41° 50.23' S, 148° 16.52' E, Apr 2020, 50 m, 1, NMV F305298.

Diagnosis. Body comprising 26–54 chaetigers, mouth located between chaetigers 1 and 2; branchiae present on 37–38 chaetigers; chaetiger 1 biannulate; chaetiger 2 triannulate; 6–8 posterior abranchiate segments.

Description. Body comprising 26–62 segments; 26–59 chaetigers; 0–3 achaetous posterior segments; 9–90 mm long, 2–5 mm wide (holotype 21 mm long, 4 mm wide, 45 chaetigers plus three posterior achaetigerous segments). Fusiform, yellowish in alcohol [figs 1, 2]). Prostomium length about equal to maximum width; a pointed cone, often retracted or distorted in preservation. Mid-ventral groove absent (fig. 3). Mouth located between chaetigers 1 and 2. Chaetiger 1 biannulate, subsequent chaetigers until chaetigers 25–28 triannulate, transition to biannulate posterior chaetigers occurs incompletely over chaetigers 25–28 (24–25 in the holotype) (figs 1–4). Segments minutely papillate with raised ridge of slightly larger papillae on posterior-most part of each annulus. Branchiae present from chaetiger 2, 37–54 pairs (39 in the holotype), 6–9 posterior abranchiate segments (nine in the holotype), branchiae initially short, becoming longer by chaetiger 8 but always much shorter than body diameter, most smooth several branchiae minutely annulate on mid-body chaetigers. Neuropodial and notopodial lappets present from chaetiger 1, initially minute flattened lobes, becoming progressively larger triangular finely papillate lappets from chaetiger 14–16 (15 in the holotype), neuropodial lobes commence chaetiger 12–14 (14 in the holotype) developed into prominent lappets enclosing deep lateral grooves over 10–15 posterior-most segments (12 in the holotype). Interramal pores first present chaetiger 1; last present chaetiger 26–40. Nephridiopores first present chaetiger 3 (but not visible on many specimens). Capillary chaetae smooth. Anal tube equal to length of two posterior segments. Pygidial lobes 5–7 (five in the holotype). Two or three internal pygidial cirri (two in the holotype) (fig. 5).

Epidermal papillae comprising irregular, barely raised polygons, each with 15–25 pores. Papillae width (~30 μm) about two times length (~15 μm) (width measured in circumferential direction around the worm, dimension y in fig. 7, length along the worm, dimension x in fig. 7). Prostomium mid-section darkly stained with methylene blue, tip and basal region unstained (fig. 6). Remainder of body uniformly stained, fading to only posterior-most annulation stained.

Etymology. The species name of *T. tribus* sp. nov. is taken from the Latin word for three, reflecting the division of the anterior segments of the new species, which comprise three annuli.

Remarks. Ten species and subspecies of *Travisia* have chaetiger 1 biannulate, chaetiger 2 triannulate and mouth in the usual position between chaetigers 1 and 2: *T. amoyanus* Yang, Wu, Wang, Zhao, Hwang and Cai, 2022; *T. araciae* Rizzo and Salazar Vallejo, 2020; *T. brevis* Moore, 1923; *T. carnea* Verrill, 1873; *T. forbesii intermedia* Annenkova, 1937; *T. japonica* Fujiwara, 1933; *T. monroi* Maciolek and Blake, 2006; *T. nigrocincta* Ehlers, 1913; *T. olens* Ehlers, 1897. In all of these the transition to posterior annulation pattern occurs before chaetiger 21, excepting *T. tribus* sp. nov. (transition to biannulate pattern on chaetigers 25–28) and *T. japonica* Fujiwara, 1933 (transition occurring chaetigers 20–29). *Travisia tribus* sp. nov. can be distinguished from *T. japonica* by having deep lateral grooves on pre-pygidial segments and in lacking crenellations and papillae on posterior-most segments (*T. japonica* has crenellations on posterior-most segments and a ring of papillae encircling the last segment).

Distribution, habitat. Known from 89 locations in southeastern Australia from the Great Australian Bight in the west, to eastern Australia at ~31–42° S. Depth range 14–200 m.

Travisia una sp. nov.

https://zoobank.org/ urn:lsid:zoobank.org:act:60C33D9B-979A-41DB-A7A6-9E4F5736A8ED

Figures 8–15

Material examined. Holotype: Australia: Eastern Bass Strait, 15.5 km SW of Pt Ricardo, Stn MSL-EG 80, 37° 53.133' S, 148° 28.933' E, 4 Jan 1991, 45 m, NMV F271088.

Paratypes: Australia: Victoria: Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 116, 37° 52.65' S, 148° 42.15' E, Feb 1991, 49 m, 3, NMV F271081-F271083; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 115, 37° 52.65' S, 148° 42.15' E, Feb 1991, 49 m, NMV F60672; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 116, 37° 52.65' S, 148° 42.15' E, Feb 1991, 49 m, 1, NMV F60673; Eastern Bass Strait, 15.5 km SW of Pt Ricardo, Stn MSL-EG 80, 37° 53.133' S, 148° 28.933' E, 4 Jun 1991, 45 m, 1, NMV F63841; Eastern Bass Strait, 2.9 km SE of Cape Conran, Stn MSL-EG 112, 37° 50' S, 148° 38.9' E, Feb 1991, 29 m, 1, NMV F200619; Eastern Bass Strait, 15.5 km SW of Pt Ricardo, Stn MSL-EG 80, 37° 53.133' S, 148° 28.933' E, 4 Jan 1991, 45 m, 1, AM W54587.

Non-type material: Victoria: Western Port, WBES 1733, 38° 23.0833' S 145° 27.3167' E, 29 Nov 1973, 10 m, 1, NMV F60031.

Victoria: Eastern Bass Strait, 13.3 km E of eastern edge of Lake Tyers, Stn MSL-EG 67, 37° 51.7' S, 148° 14.6' E, 4 Jan 1991, 37 m, 1, NMV F60667; Eastern Bass Strait, 4.6 km S of Cape Conran, Stn MSL-EG 58, 37° 51.43' S, 148° 43.73' E, 28 Jan 1990, 50 m, 1, NMV F63838; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 117, 37° 52.65' S, 148° 42.15' E, Jan 1991, 49 m, 4, NMV F60674; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 61, 37° 52.667' S, 148° 42.067' E, 28 Jan 1990, 48 m, 5, NMV F63842; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 62, 37° 52.67' S, 148° 42.067' E, 28 Jan 1990, 48 m, 3, NMV F63837; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 88, 37° 52.65' S, 148° 42.15' E, 4 Jan 1991, 49 m, 5, NMV F60668; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 89, 37° 52.65' S, 148° 42.15' E, 4 Jan 1991, 49 m, 4, NMV F60669; Eastern Bass Strait, 7.3 km SSW of Cape Conran, Stn MSL-EG 90, 37° 52.65' S, 148° 42.15' E, 4 Jan 1991, 49 m, 4, NMV F60670; Eastern Bass Strait, Stn VC 41 A3, 37° 31.25' S, 148° 2.533' E, 8 Jan 1998, 10 m, 5, NMV F139260; Eastern Bass Strait, Stn VC 45 A1, 37° 28.3' S, 149° 2.567' E, 9 Jan 1998, 10 m, 1, NMV F139390.

Diagnosis. Branchiae first present on chaetigers 3–6, 8–14 branchiate segments; all chaetigers uniannulate.

Description. Body comprising 20–25 segments; 19–24 chaetigers; 0–3 achaetous posterior segment(s), 3.6–11 mm long, 1.5–3.6 mm maximum width at chaetiger 12; holotype 24 chaetigers, no achaetous posterior segments; 8.2 mm long, 2.3 mm maximum width at chaetiger 12. Body fusiform, evenly papillated, reaching greatest diameter chaetigers at chaetigers 15–20 (figs 8–11)

Prostomium longer than maximum width; a pointed cone (fig. 10) although often partially contracted. Mid-ventral groove absent. Peristomium undivided. Mouth located between chaetigers 1 and 2.

Chaetiger 1 and all subsequent chaetigers uniannulate without ridges; no posterior annulation pattern change. Branchiae present (but minute and difficult to observe); much shorter than body diameter; smooth. Branchiae first present on chaetiger 3–6; present on 8–14 chaetigers (8 in the holotype) and are longest in median chaetigers; number of posterior abranchiate segments: 3–8 (7 in the holotype).

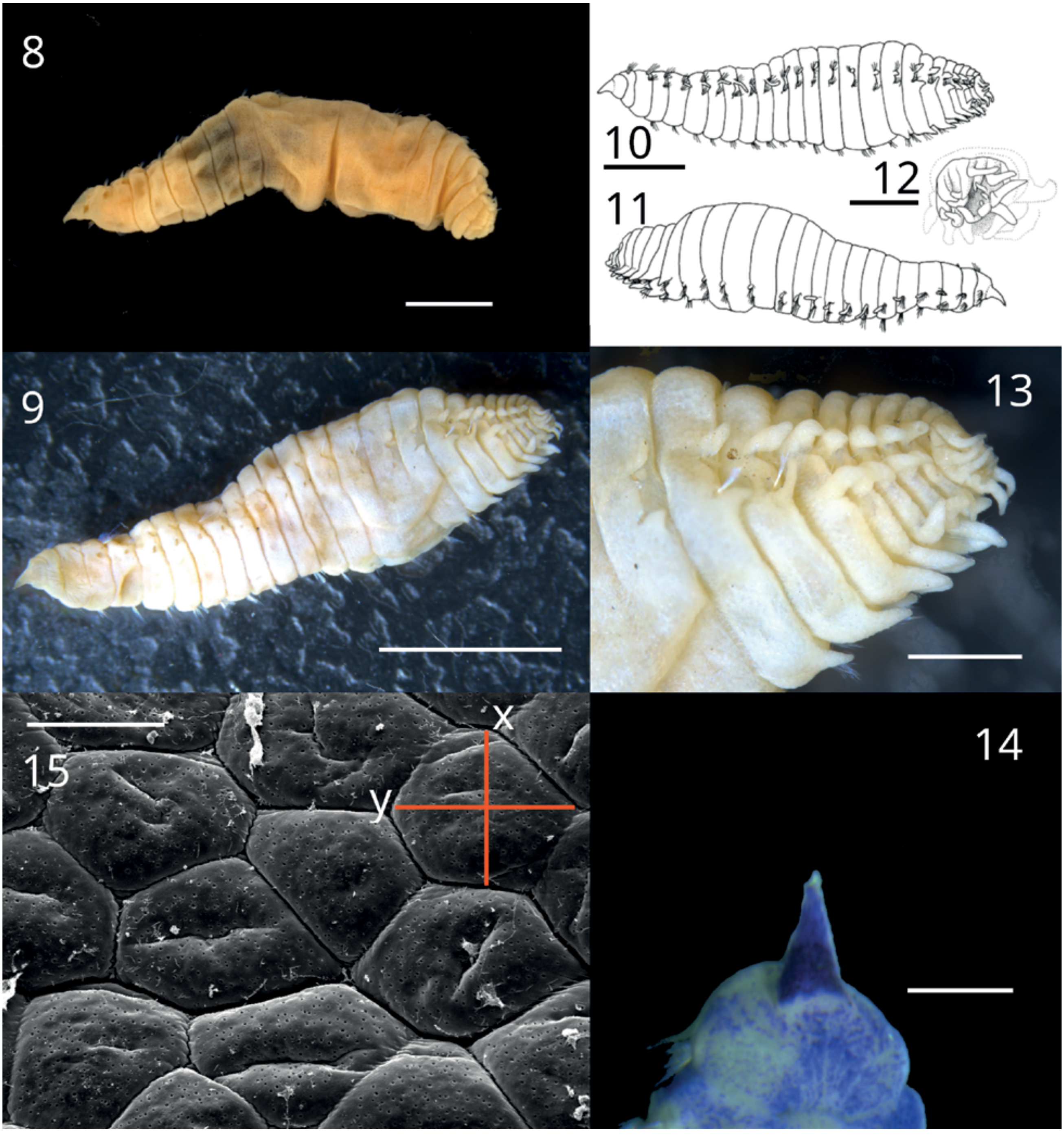
Epidermal papillae forming a regular cover of raised polygons, each with 125–155 pores. Papillae width about equal to length (~60 μm) (width measured in circumferential direction around the worm, dimension y in fig. 15, length along the worm, dimension x in fig. 15). Parapodial lobes present; notopodial lobes commence chaetiger 15–17 (16 in the holotype); neuropodial lobes commence chaetiger 15–17 (16 in the holotype), present as prominent roughly triangular lappets over posterior-most 8–10 segments. Interramal pores when visible first present chaetiger 1, last present chaetiger 13–15 (not observable in the holotype). Nephridiopores first present chaetiger 3 (but not visible on many specimens including the holotype). Capillary chaetae smooth. Anal tube equal to length of 2 posterior segments. Pygidial lobes 9–22 (10 in the holotype), digitiform and unequal in width (figs 12, 13).

Staining pattern. Prostomium darkly stained uniformly with methylene blue (fig. 14), body, parapodial lobes and pygidial lobes uniform dark stain, only chaetigers 2 and 3 incompletely stained, branchiae unstained.

Remarks. *Travisia una* sp. nov. is readily recognised: it is the only species in the genus known in which all segments, both anterior and posterior, are without annulations. The presence of at most 14 pairs of branchiae commencing on chaetiger 3 or later and a short body of 19–24 chaetigers is also distinctive. *Travisia una* sp. nov. is also easily distinguished from the other known Australian species of *Travisia*: it is the only one with branchiae commencing on chaetiger 3 (all other Australian *Travisia* have branchiae first present on chaetiger 2), the only one with 14 or fewer pairs of branchiae (the others all have at least 23 pairs) and the only one with uniannulate segments throughout.

Etymology. The species name of *Travisia una* sp. nov. is taken from the Latin word for one, reflecting the segments of the new species, which comprise a single undivided annulus.

Distribution, ecology. South-eastern Australia: far-eastern Bass Strait. Depth range 10–50 metres.



Figures 8–15. *Travisia una* sp. nov. 8 – dorsal view preserved specimen NMV F200619 (paratype); 9 – ventral view preserved specimen NMV F271088 (holotype); 10 – ventral view NMV F200619 (paratype); 11 – lateral view NMV F200619; 12 – pygidium detail NMV F200619 (paratype); 13 – posterior detail ventral view preserved specimen NMV F271088 (holotype); 14 – methylene blue staining pattern prostomium ventral view NMV F271081 (paratype); 15 – SEM epidermal papillae from dorsum chaetiger 6 NMV F200619 (paratype). Image credits 8, 9, 13, 14 – Robin Wilson; 10–12 – Kate Nolan; 15 – Stepan Vodopyanov. Scale bar figs 8-11: 2 mm; 9-11: 2 mm; 12-14: 0.5 mm; 15: 50 µm; papilla measurements: x – dimension on papilla oriented with length of worm, y – dimension on papilla oriented with circumference of worm.

Key to Australian species of *Travisia*

1. Posterior parapodia similar to anterior parapodia; capillary chaetae hirsute .... *T. lithophila* Kinberg, 1856
- Posterior parapodia developed into prominent lateral lappets; capillary chaetae smooth 2
2. All chaetigers uniannulate; branchiae first present chaetigers 3–6 .... *T. una* sp. nov.
- Most chaetigers bi- or triannulate; branchiae first present chaetiger 2 3
3. Chaetiger 1 uniannulate or weakly biannulate; annulation pattern changes from triannulate to biannulate at chaetigers 19–20; 0–4 posterior abranchiate segments .... *T. oksae* Hartmann-Schröder and Parker, 1995
- Chaetiger 1 biannulate; annulation pattern changes from triannulate to biannulate at chaetigers 25–28; 6–9 posterior abranchiate segments .... *T. tribus* sp. nov.

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