

Descriptions of two new species of *Quasithelazia* Maplestone, 1932 (Spirurida: Acuariidae) and a redescription of *Alinema sturni* Jögis, 1968 from birds in Australia

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Abstract *Quasithelazia minuta* n. sp. and *Quasithelazia pearsoni* n. sp. (Spirurida: Acuariidae) are described from *Todiramphus sanctus* (Vigors & Horsfield) (Coraciiformes: Alcedinidae) in Australia. *Alinema sturni* Jögis, 1968 from *Sturnus vulgaris* (L.) (Passeriformes: Sturnidae) in Europe, is considered to belong in the subfamily Schistorophinae Travassos, 1918 (and not in the Seuratiinae Chitwood & Wehr, 1932, where it has previously been placed) on the basis of the number of the pairs of precloacal papillae. The latter species, known from its original record only, is found as parasitic in diverse passerine birds in Australia, namely *Psophodes olivaceus* (Latham) (Psophodidae), *Falcunculus frontatus* (Latham) (Pachycephalidae), *Colluricincla harmonica* (Latham) (Pachycephalidae), *Malurus cyaneus* (Ellis) (Maluridae) and *Ptilotula penicillata* (Gould) (Meliphagidae). *Alinema sturni* is considered an alien species for Australia that has been introduced with its host (starling) and subsequently adapted to a wide range of native avian hosts.

Introduction

Nematodes of *Quasithelazia* Maplestone, 1932 can be distinguished from the other genera within the subfamily Schistorophinae Travassos, 1918 (Spirurida: Acuariidae) by the lack of specific cephalic structures, such as horns, plates, lappets or leaf-like appendages (Chabaud, 1975; Bain et al., 2014). Mutafchiev et al. (2014) recognised eight valid species within *Quasithelazia*, all being parasites of kingfishers and Old World flycatchers in Africa and Asia only. I was able to examine nematode samples from Australian birds deposited in the collection of the South Australian Museum and identified as members of the genus *Schistogendra* Chabaud & Rousselot, 1956, a junior synonym of *Quasithelazia*. Their examination revealed the presence of two new species of the genus *Quasithelazia* as well as the first record in Australia of an alien species of the genus *Alinema* Jögis, 1968. The aim of the present paper is to provide descriptions of these three species.

Materials and methods

Material deposited as ethanol samples and microscopic slides in the Parasitology Collection of the South Australian Museum, Adelaide (SAM), was studied. Details of the collection data and number of specimens are given in the text for each species. For light-microscopy, specimens stored in ethanol were

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cleared and examined as temporary mounts in glycerine. Specimens used for scanning electron microscopy (SEM) were transferred from 70% ethanol, dehydrated in an ethanol series, immersed in hexamethyldisilazane for 20 min, air-dried, coated with gold in a JEOL JFS 1200 coater and examined using a JEOL JSM 5510 microscope at 10 kV.

Metrical data are given as the range, with the mean and the number of measurements taken (n) in parentheses. Measurements are in micrometres except where otherwise indicated. The following indices were used: $I_{mOE/gOE}$, length of muscular oesophagus/length of glandular oesophagus; $I_{OE/BL}$, length of oesophagus/body length; $I_{LSP/RSP}$, length of left spicule/length of right spicule; $I_{LSB/LSH}$, length of left spicule blade/length of left spicule handle; $I_{V/BL}$, distance from anterior extremity to vulva/body length.

Quasithelazia minuta n. sp.

Type-host: *Todiramphus sanctus* (Vigors & Horsfield) (Coraciiformes: Alcedinidae).

Type-locality: Cudlee Creek, South Australia, Australia.

Site in host: No data.

Type-material: Holotype: SAM 12171 (1 male). Paratypes: SAM 12171 (25 males and 34 females), fragments of 1 male and 5 females were mounted on an SEM stub; SAM 21710, slide (3 males); SAM 21711, slide (1 male and 1 female); SAM 11975 (2 males and 6 females).

Intensity: The material, deposited in four samples without collection date, contained 2, 3, 8 and 60 specimens.

Etymology: The name of the new species refers to its small size (*minuta* = small).

Description (Figs. 1, 2)

General. Small-sized acuariid nematode. Anterior end with 2 rounded pseudolabia with pointed apex, each bearing single amphid and pair of papillae (Figs. 1A, B1, 2A, B); pair of plate-like teeth present, situated on internal side of each pseudolabium (Figs. 1B3, 2B). Sublabia present, in form of pair of plates between pseudolabia (Figs. 1B2, 2A). Anterior cuticular ornamentation in form of cordons, collarette or ptilina

absent. Buccal cavity long, with cross-striations. Muscular and glandular oesophagus distinct, wider at posterior part. Intestine similar in width to glandular oesophagus (Fig. 2G). Nerve-ring situated at anterior portion of muscular oesophagus. Deirids simple, *c.* 1 long, situated anterior to nerve-ring (Figs. 1A, 2D). Cuticle up to 4 thick, with conspicuous external transverse striations 5–7 apart (Fig. 2C, F, G). Lateral alae in form of longitudinal cuticular band-like swellings, extending from region posterior to deirids along anterior body (Fig. 2C). Excretory pore posterior to nerve-ring (Fig. 1A). Phasmids subterminal (Fig. 1D, G).

Male [Based on the holotype and nine paratypes.] Body 3.28–3.98 (3.63) mm long. Maximum body width 36–42 (38), measured at level of oesophago-intestinal junction. Body width at level of cloaca 33–35 (34). Tail 59–78 (70) long. Deirids and excretory pore at 77–100 (86) and 118–145 (128) from anterior extremity, respectively. Buccal cavity 84–105 (93) long, 3–4 wide. Muscular oesophagus 275–430 (358) long, 6–11 (8) wide. Glandular oesophagus 500–780 (662) long, with maximum width 14–17 (16). Nerve-ring at 92–111 (101) from anterior extremity. Testis reflection 1,270–1,880 (1,562) from anterior extremity. Caudal alae 190–237 (207) long. Precloacal papillae represented by 8 pairs of subventral pedunculate papillae arranged equidistantly and single ventral precloacal papilla (Fig. 1C). Postcloacal papillae 6 pairs: 5 subventral pedunculate pairs and 1 sessile pair situated between bases of last pair of subventral papillae; most posterior 2 pairs of papillae very small; papillae arranged in 2 groups each consisting of 3 pairs (Figs. 1D, 2E). Left spicule 274–320 (294) long, composed of handle 126–161 (152) long and blade 127–162 (143) long. Right spicule robust, 61–81 (73) long (Fig. 1E). $I_{mOE/gOE} = 0.49\text{--}0.58$ (0.54); $I_{OE/BL} = 0.22\text{--}0.32$ (0.28); $I_{LSP/RSP} = 3.57\text{--}4.75$ (4.08); $I_{LSB/LSH} = 0.82\text{--}1.18$ (0.96).

Female [Based on ten paratypes, except where otherwise indicated.] Body 7.68–9.36 (8.48) mm long, with maximum body width 60–77 (67), in region of vulva. Body width at level of anus 29–40 (35). Tail straight, 68–93 (75) long, with rounded tip (Fig. 1G). Deirids and excretory pore at 81–101 (90) and 122–155 (135) from anterior extremity, respectively. Buccal cavity 92–105 (98) long, 3–4 wide. Muscular oesophagus

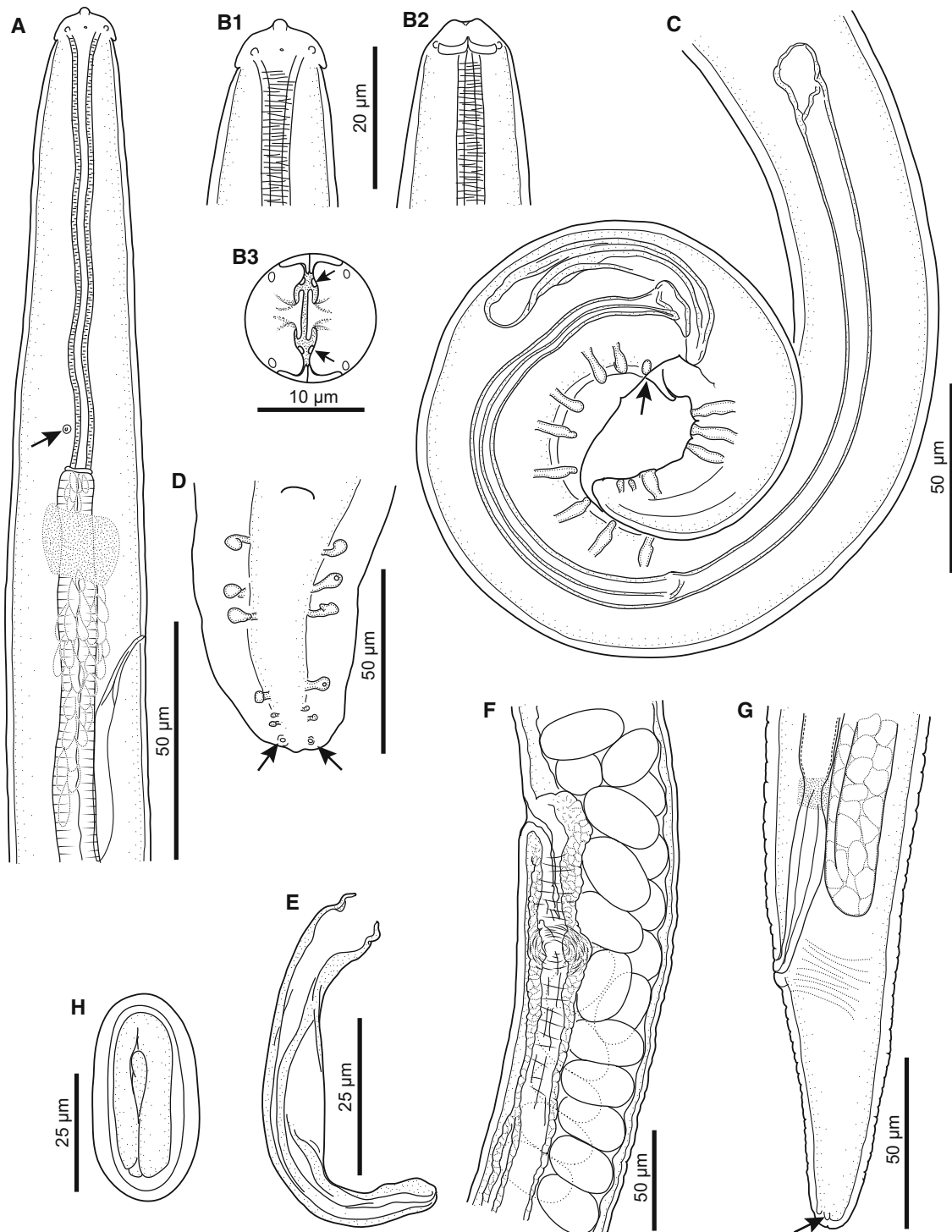


Fig. 1 *Quasithelazia minuta* n. sp. A, Anterior end, female, lateral view, note deirid (arrow); B, Cephalic region, female, lateral (B1), dorsoventral (B2) and apical (B3) view; note plate-like teeth (arrows); C, Posterior end, male, sinistral view, note ventral preclonal papilla (arrow); D, Male tail, ventral view, note phasmids (arrows); E, Right spicule, dextral view; F, Region of vagina, lateral view; G, Female tail, lateral view, note phasmid (arrow); H, Egg

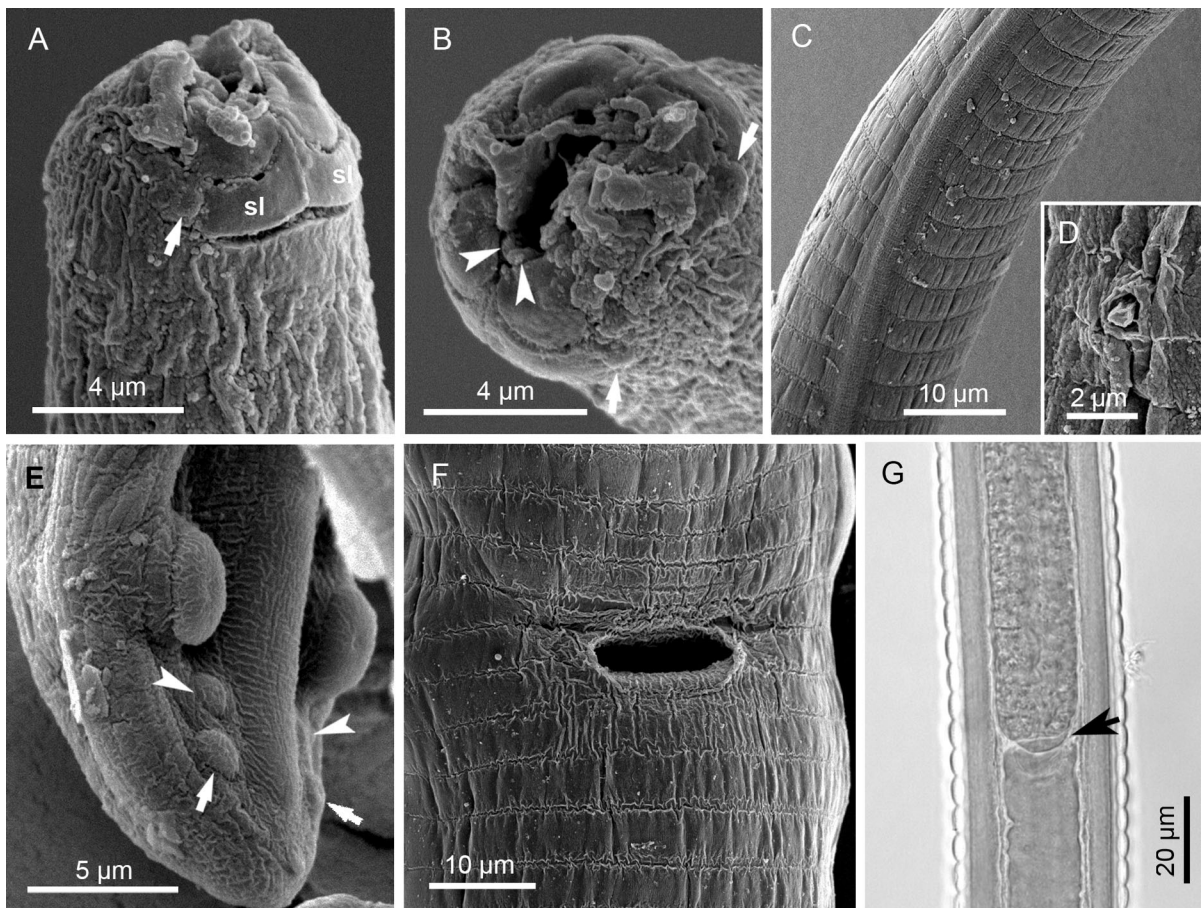


Fig. 2 *Quasithelazia minuta* n. sp. A–F, SEM. A, Anterior end, male, sublateral view, note cephalic papilla (arrow) and sublabia (sl); B, Cephalic region, male, apical view, note cephalic papillae (arrows) and teeth (arrowheads); C, Lateral alae, anterior body part of male; D, Deirid; E, Male tail, subventral view, last pair of pedunculate papillae (arrows) and sessile papillae (arrowheads); F, Vulva; G, Body at level of oesophago-intestinal junction (arrow), male, light microscopy

355–423 (399) long, with maximum width 7–11 (9). Glandular oesophagus 640–794 (726) long, with maximum width 18–23 (20). Nerve-ring at 100–113 (106) from anterior extremity. Vulva at 4.15–4.95 (4.49) mm from anterior extremity (Fig. 2F). Vagina directed posteriorly, composed of *vagina vera* 62–76 (69; n = 7) long (measured following its lumen), separated by valves and circular musculature from *vagina uterina*; *vagina uterina* 77–85 (81; n = 4) long (Fig. 1F). Didelphic, amphidelphic. Reproductive system extending anteriorly to about mid-length of glandular oesophagus. Eggs oval, with developed first-stage larva, 40–44 × 20–22 (42 × 21) (Fig. 1H). $I_{mOE/gOE} = 0.50–0.63$ (0.55); $I_{OE/BL} = 0.13–0.14$; $I_{V/BL} = 0.51–0.54$ (0.53).

Remarks

The morphology of the species described above corresponds to the generic diagnosis of *Quasithelazia*. Males of *Quasithelazia minuta* n. sp. can be distinguished from all their congeners by their (i) very small body, 3.3–4.0 mm long, compared to the known range of 4.7–11.8 mm; (ii) eight pairs of precloacal papillae vs 10 to 16 pairs in the other species (Mutafchiev et al., 2014; present study).

Females of *Q. minuta* have a small body corresponding in length only to that of *Q. halcyoni* (Ryzhikov & Khokhlova, 1964), a parasite of *Halcyon smyrnensis* (L.) and *Halcyon pileata* (Boddaert) (see Mutafchiev et al., 2014). Females of these two species also exhibit

similarities in the length of the buccal cavity and muscular and glandular oesophagus, the shape of the tail and relatively large eggs compared to those of other species of *Quasithelazia*. *Quasithelazia minuta* n. sp. can be distinguished from *Q. halcyoni* by its thinner body (60–77 vs 76–120 μm), shorter tail (68–93 vs 96–190 μm) and equatorial vulva vs post-equatorial one.

Quasithelazia pearsoni n. sp.

Type-host: *Todiramphus sanctus* (Vigors & Horsfield) (Coraciiformes: Alcedinidae).

Type-locality: Queensland, Australia, date of collection unknown.

Site in host: No data.

Type-material: Holotype: SAM 11973 (1 male). Paratypes: SAM 11974 (1 female and 1 fourth stage female larva).

Etymology: The new species is named after the late Prof. J.C. Pearson who collected the material.

Description (Figs. 3, 4)

General. Medium-sized acuariid nematode. Anterior end with 2 rounded pseudolabia, each bearing single amphid and pair of papillae (Figs. 3A, B1, 4A, B). Sublabia in form of pair of plates situated between pseudolabia (Fig. 3B2). Anterior cuticular ornamentation in form of cordons, collarette or ptilina absent. Buccal cavity long, with cross-striations. Muscular and glandular oesophagus distinct, wider at mid-length. Intestine similar in width to glandular oesophagus. Nerve-ring situated at anterior portion of muscular oesophagus. Deirids simple, $c.1$ long, situated at level of posterior half of buccal cavity (Fig. 3A). Lateral alae absent. Body cuticle with fine external transverse striations, 6–7 μm apart. Excretory pore at level of nerve-ring. Phasmids subterminal (Fig. 3D, G).

Male [Based on the holotype.] Body 12.39 mm long. Maximum body width 139, measured at level of oesophago-intestinal junction. Body width at level of cloaca 74. Tail 120 long. Cuticle up to 6 thick. Deirids and excretory pore at 100 and 154 from anterior extremity, respectively. Buccal cavity 127 long, 9 wide. Muscular oesophagus 560 long, 19 wide.

Glandular oesophagus 1,100 long, 43 wide. Nerve-ring at 147 from anterior extremity. Testis reflection 5,460 from anterior extremity. Caudal alae 510 long. Precloacal papillae represented by 14 pairs of subventral pedunculate papillae arranged equidistantly (Fig. 3C) and single ventral sessile precloacal papilla present (Fig. 3D). Postcloacal papillae 6 pairs: 5 subventral pedunculate pairs, arranged equidistantly, and 1 small sessile pair, situated between bases of last pair of subventral papillae (Figs. 3D, 4C). Left spicule 582 long, composed of handle 234 long and blade 348 long. Right spicule robust, 149 long, with rounded tip and 2 subapical cusps (Fig. 3E). $I_{\text{mOE/gOE}} = 0.51$; $I_{\text{OE/BL}} = 0.13$; $I_{\text{LSP/RSP}} = 3.90$; $I_{\text{LSB/LSH}} = 1.49$.

Female [Based on a one paratype.] Body 13.52 mm long, with maximum body width 168 near region of vulva. Body width at level of anus 68. Tail conical, straight, 114 long, with bluntly-pointed tip (Fig. 3G). Cuticle up to 10 thick. Deirids and excretory pore at 128 and 177 from anterior extremity, respectively. Buccal cavity 136 long, 9 wide. Muscular oesophagus 888 long, 18 wide. Glandular oesophagus 1,475 long, 46 wide. Nerve-ring at 175 from anterior extremity. Vulva at 7.53 mm from anterior extremity. Vagina directed posteriorly, composed of *vagina vera* 133 long (measured following its lumen), separated by valves and circular musculature from *vagina uterina*; *vagina uterina* 141 long (Fig. 3F). Didelphic, amphidelphic. Genital system not extending anterior to level of oesophago-intestinal junction. Eggs oval, with developed first-stage larva, 35–38 \times 22–24 (37 \times 23, $n = 10$) (Fig. 3H). $I_{\text{mOE/gOE}} = 0.60$; $I_{\text{OE/BL}} = 0.17$; $I_{\text{V/BL}} = 0.56$.

Fourth-stage female larva [Based on one paratype.] Anterior end with 2 rounded pseudolabia (Fig. 4D). Body 10.90 mm long, with maximum body width 166. Body width at level of anus 65. Tail conical, 87 long, with abrupt tip (Fig. 4E). Cuticle up to 10 thick. Deirids and excretory pore at 100 and 159 from anterior extremity, respectively. Buccal cavity 113 long. Muscular oesophagus 750 long, 21 wide at mid-length. Glandular oesophagus 1,310 long, with maximum width 46, at mid-length. Nerve-ring at 143 from anterior extremity. Developing vulva at 6.40 mm from anterior body end. $I_{\text{mOE/gOE}} = 0.57$; $I_{\text{OE/BL}} = 0.19$.

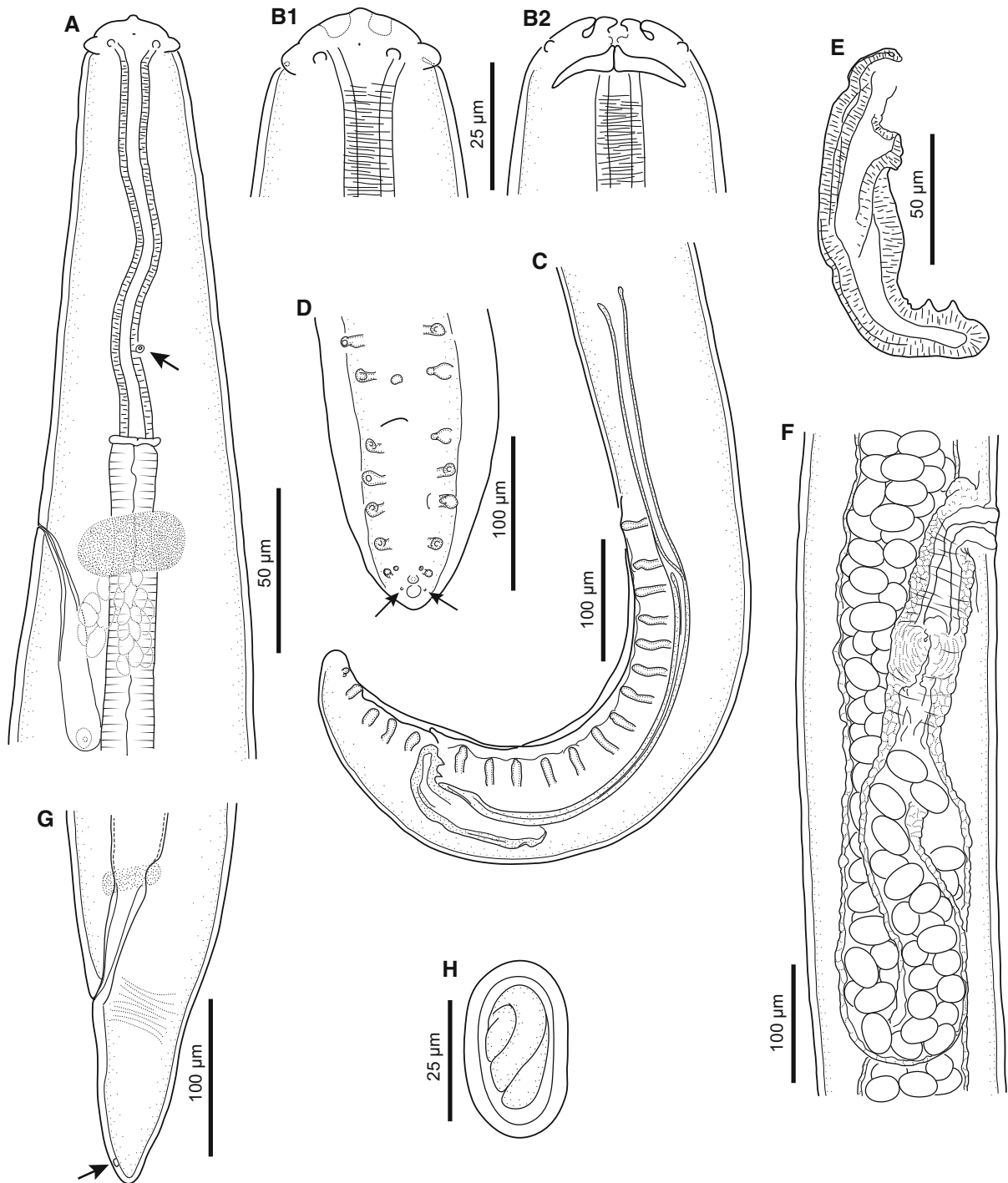


Fig. 3 *Quasithelazia pearsoni* n. sp. A, Anterior end, male, lateral view, note deirid (*arrow*); B, Cephalic region, female, lateral (B1) and dorsoventral view (B2); C, Posterior end, male, sinistral view; D, Male tail, ventral view, note phasmids (*arrows*); E, Right spicule, dextral view; F, Region of vagina, lateral view; G, Female tail, lateral view, note phasmid (*arrow*); H, Egg

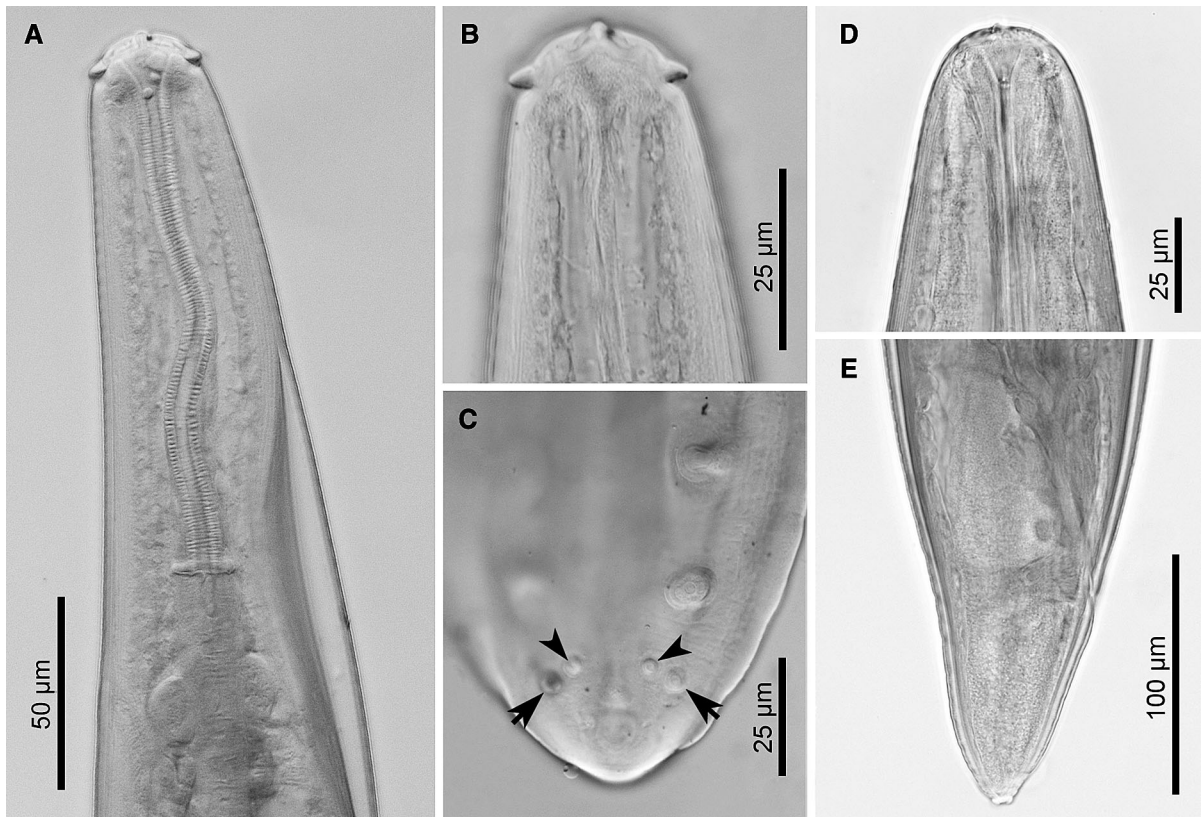


Fig. 4 *Quasithelazia pearsoni* n. sp., light microscopy. A, Anterior end, male, lateral view; B, Cephalic region, male, lateral view; C, Posterior end, male, ventral view, note last pair of pedunculate papillae (arrows) and sessile papillae (arrowheads); D, Cephalic end of fourth stage larva, lateral view; E, Posterior end of fourth stage larva, lateral view

Remarks

The male of *Quasithelazia pearsoni* n. sp., by having 14 pairs of precloacal papillae, resembles males of *Q. tenuis* Maplestone, 1932, *Q. halcyoni* and *Q. microcordonis* (Schmidt & Kuntz, 1971), parasitic in kingfishers in India, Vietnam, Taiwan and the Russian Far East (see Mutafchiev et al., 2014). However, the new species can be distinguished from *Q. tenuis* by its longer body (12.4 vs 4.7–9.5 mm), longer right spicule (149 vs 89–120 µm), excretory pore situated at the level of the nerve-ring instead of anterior to it, and the left spicule with blade longer than handle vs spicule with blade shorter than handle (I_{LSB}/L_{SH} 1.49 vs 0.73). *Quasithelazia halcyoni* and *Q. microcordonis* are characterised by shorter bodies (7.0–7.5 and 7.0–8.5 mm, respectively), shorter left spicules (360 and 370–440 µm, respectively) and shorter right spicules (80 and 85–100 µm, respectively), when compared to those of *Q. pearsoni* n. sp.

The female of *Q. pearsoni* n. sp. resembles those of *Q. tenuis* and *Q. microcordonis* in body length, shape and length of tail and position of vulva at mid-body. The new species can be distinguished from both congeners by its excretory pore situated at the level of the nerve-ring instead of anterior to it (Schmidt & Kuntz, 1971; Mutafchiev et al., 2014). In addition, *Q. pearsoni* n. sp. differs from *Q. microcordonis* by its longer muscular (888 vs 400–500 µm) and glandular oesophagus (1,475 vs 800–960 µm). The female of the new species is similar in length to *Q. incisa* (Chabaud & Rousselot, 1956), *Q. rostrata* Mutafchiev, Mariaux & Georgiev, 2014 and *Q. alata* Mutafchiev, Mariaux & Georgiev, 2014 (see Mutafchiev et al., 2014; present study). However, they can be distinguished from *Q. pearsoni* by other morphological characters. *Quasithelazia incisa* possesses a sharply-pointed tail, postequatorial vulva and short muscular and glandular oesophagus (540 and 800 µm, respectively). *Quasithelazia rostrata* differs with its unique pseudolabia

bearing prominent rostrum-like anterior apices; in addition, it has a rounded tail tip and a postequatorial vulva.

Alinema sturni Jögis, 1968

Material studied

ex *Psophodes olivaceus* (Latham) (Passeriformes: Psophodidae), Queensland, Australia, coll. date unknown, SAM 11979 (1 male and 1 female);

ex *Falcunculus frontatus* (Latham) (Passeriformes: Pachycephalidae), Hatherleigh, South Australia, Australia, April 1964: SAM 21713, slide (anterior fragment of one unfertilised female) and SAM 11971 (one fragmented female, cephalic extremity mounted on an SEM stub);

ex *Colluricincla harmonica* (Latham) (Passeriformes: Pachycephalidae), Central Mount Wedge, Northern Territory, Australia, June 1968, SAM 11978 (one unfertilised female);

ex *Malurus cyaneus* (Ellis) (Passeriformes: Maluridae), Garden Island, South Australia, Australia, March 1973, SAM 11976 (one unfertilised female);

ex *Ptilotula penicillata* (Gould) (Passeriformes: Meliphagidae), Belair, South Australia, Australia, June 1965, SAM 11972 (one 1 unfertilised female).

Description (Figs. 5, 6)

General. Small-sized acuariid nematodes. Two rounded pseudolabia and sublabia extending on lateral sides posterior to pseudolabia, forming helmet-like cephalic extremity (Fig. 5A–C). Each pseudolabium bearing single amphid, pair of cephalic papillae and pair of lobes each armed with 3 teeth. Anterior cuticular ornamentation in form of cordons, collarette or ptilina absent. Buccal cavity long, with cross striations. Muscular and glandular oesophagus distinct (Fig. 6C), wider at their bases. Intestine near oesophago-intestinal junction, similar in width to glandular oesophagus or thinner (Fig. 6D). Nerve-ring at 15 μ m from anterior end of muscular oesophagus. Deirids simple, *c.*1 long, situated anterior to nerve-ring (Figs. 5A, 6A). Lateral alae, extended posterior to deirids (Fig. 6B). Body cuticle with fine transverse striations 3–4 apart. Excretory pore posterior to nerve-ring (Fig. 5A). Phasmids subterminal (Fig. 5G).

Male [Based on one specimen.] Cephalic extremity, formed by pseudolabia and sublabia, 17 long, 26 wide in lateral view. Body 5.79 mm long. Maximum body width 78, measured at level of oesophago-intestinal junction. Body width at level of cloaca 42. Tail 83 long. Cuticle *c.*3 thick. Deirids at 10 μ m anterior to nerve-ring. Excretory pore at 209 μ m from anterior extremity. Buccal cavity 115 long, 5 wide. Muscular oesophagus 226 long, 22 wide. Glandular oesophagus 468 long, 35 wide. Testis reflection 1,372 from anterior end. Caudal alae 272 long. Precloacal papillae represented by 6 pairs of subventral pedunculate papillae arranged equidistantly and single ventral precloacal papilla (Fig. 5D). Postcloacal papillae 6 pairs: 5 subventral pedunculate pairs and 1 small sessile pair situated between bases of last pair of subventral papillae. Left spicule 236 long, composed of handle 82 long and blade 154 long (Fig. 5E). Right spicule robust, 83 long, with well-defined rounded head and complex tip (Fig. 5F). $I_{mOE/gOE} = 0.48$; $I_{OE/BL} = 0.12$; $I_{LSP/RSP} = 2.84$; $I_{LSB/LSH} = 1.87$.

Female [Samples studied here comprised of non-gravid to fully developed gravid females, which resulted in an extensive range of morphometric variability, see Table 1.] Maximum body width at mid-body. Tail conical, slightly bent ventrally, with rounded tip (Fig. 5G). Cuticle up to 6 thick. Buccal cavity 6–8 wide. Vulva situated slightly posterior to mid-body. Vagina simple, 285 long in a specimen 6.86 mm long (Fig. 5J, H). Reproductive system didelphic, amphidelphic, extending anterior to oesophago-intestinal junction (Fig. 6D). Eggs oval, with developed first-stage larva (Fig. 5I). $I_{mOE/gOE} = 0.44–0.57$ (0.50, *n* = 6); $I_{OE/BL} = 0.07–0.12$ (0.09, *n* = 4); $I_{V/BL} = 0.53–0.59$ (0.56, *n* = 4).

Remarks

The classification of the family Acuariidae Railliet, Henry & Sisoff, 1912 is mainly based on the morphology of anterior cuticular ornamentations (cordons, collarette or ptilina) used to distribute the genera amongst the three recognised subfamilies, i.e. the Acuariinae Railliet, Henry & Sisoff, 1912, Seuratiinae Chitwood & Wehr, 1932 and Schistorophinae (see Chabaud, 1975; Bain et al., 2014). Although such

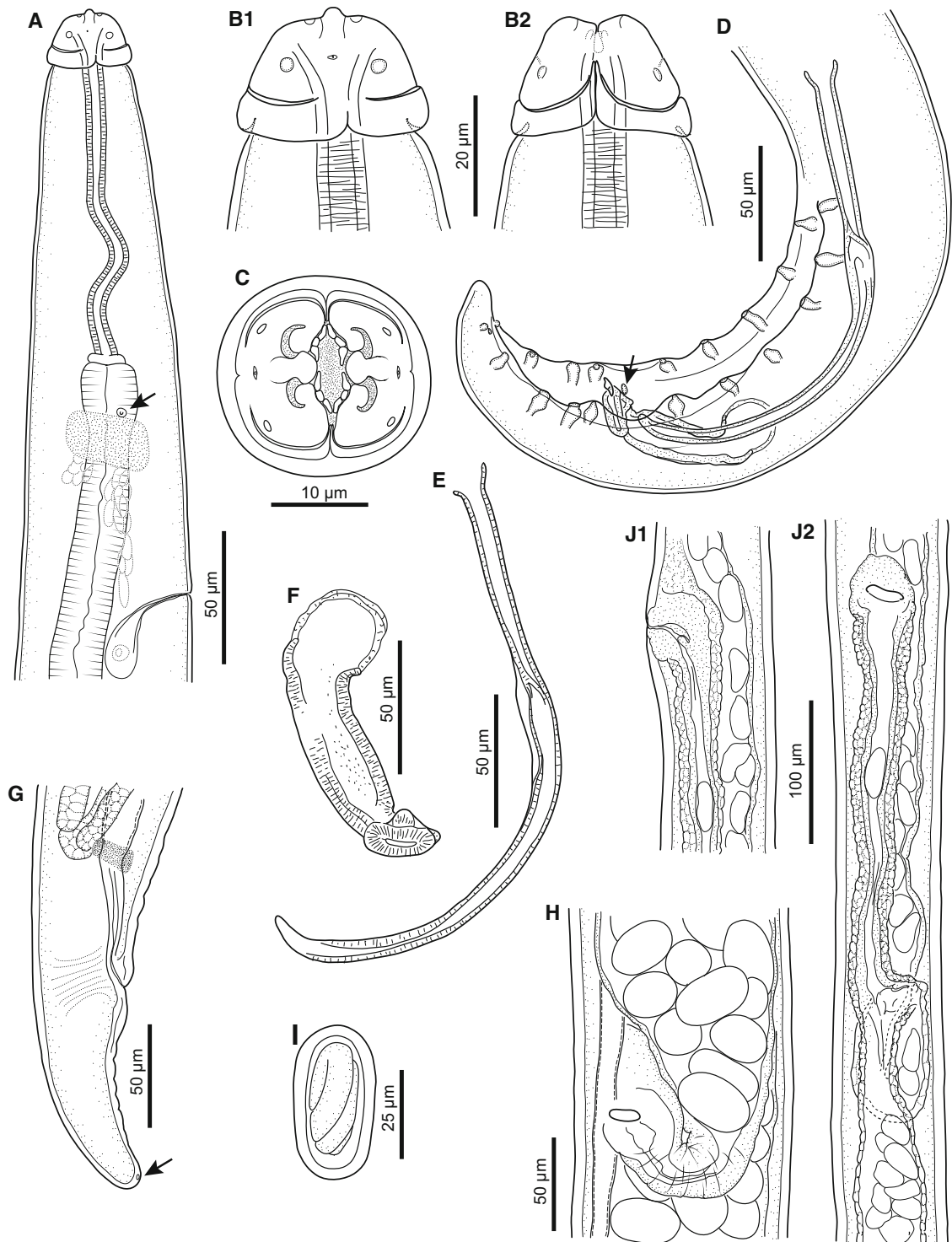


Fig. 5 *Alinema sturni*, A–I from *Psophodes olivaceus*. A, Anterior end, female, lateral view, note deirid (arrow); B, Cephalic region, female, lateral (B1) and dorsoventral view (B2); C, Anterior extremity, female, apical view, diagrammatic reconstruction based on SEM images; D, Posterior end, male, lateral view, note ventral precloacal papilla (arrow); E, Left spicule, sinistral view; F, Right spicule, dextral view; G, Female tail, lateral view, note phasmid (arrow); H, Region of vagina, subventral view; I, Egg; J, Region of vulva of unfertilised female from *Malurus cyaneus*, lateral (J1) and ventral view (J2)

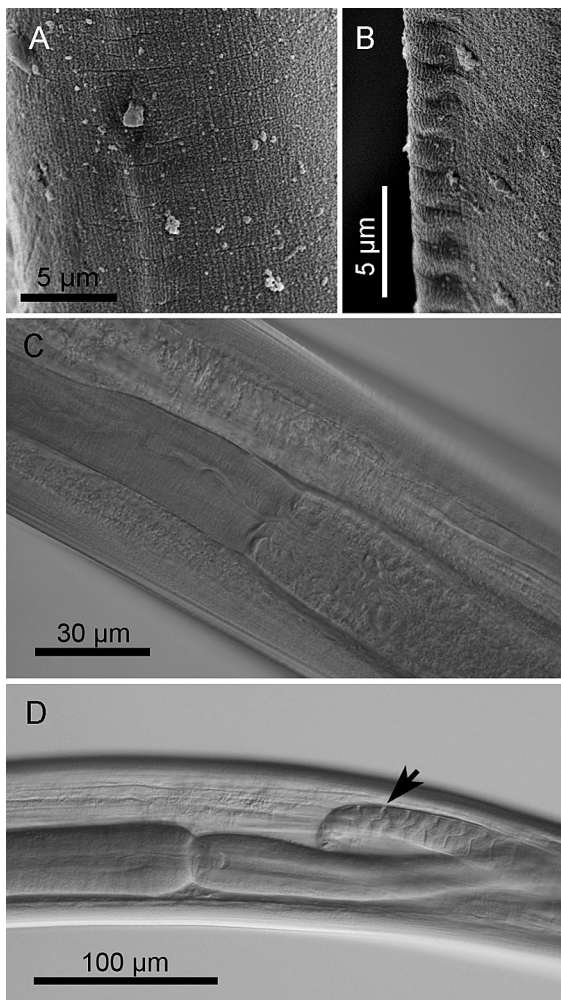


Fig. 6 *Alinema sturni*, female. A, Deirid, SEM; B, Lateral ala posterior to deirid, SEM; C, Junction between the muscular and glandular oesophagus, light microscopy; D, Oesophago-intestinal junction, light microscopy, note ovary (arrow)

structures are lacking in some taxa, their systematic position is inferred on the basis of the morphology of their deirids, buccal cavity and tail extremity (Gibson, 1968; Bain et al., 2014; Mutafchiev et al., 2014).

Jögis (1968) erected the monotypic genus *Alinema* for *Alinema sturni* Jögis, 1968, a parasite described from *Sturnus vulgaris* L. (Passeriformes: Sturnidae) on the Curonian Spit, Kaliningradskaya Oblast', Russia (Jögis, 1968). This genus was originally classified within the Streptocaridae Skrjabin, 1941 (Acuarioidea), a family that is not considered valid and its members have been generally recognised as belonging to the subfamily Seuratiinae Chitwood & Wehr, 1932 (see Chabaud, 1975; Bain et al., 2014).

Chabaud (1975) allocated *A. sturni* to the genus *Rusguniella* Seurat, 1919 (Seuratiinae). However, the nematodes within Seuratiinae are characterised by males with four pairs of precloacal papillae (Bain et al., 2014), whereas those of *A. sturni* possess six pairs (Jögis, 1968; this study). The affiliation of *A. sturni* to the subfamily Schistorophinae is supported by the number of precloacal papillae and the mouth armed with teeth (Bain et al., 2014; Mutafchiev et al., 2014). The species resembles *Quasithelazia* spp. by the absence of any particular cephalic ornamentation in the form of horns, lappets, blades or leaf-like structures called “ptilina”, but can be distinguished from them by its helmet-like cephalic extremity with sublabia extending on the lateral sides posterior to pseudolabia, the six pairs of precloacal papillae vs 8–16 pairs and the simple vagina without distinct *vagina vera* and *vagina uterina*. Based on current knowledge, I propose the validation of the genus *Alinema* within the subfamily Schistorophinae.

The females studied above exhibit a similar morphology of the head region, reproductive system and tail. The range of morphometric variability observed between them is due to their stage of development. Therefore, they are all considered conspecific. Their morphology and the measurements of the only gravid female, collected from *P. olivaceus*, correspond to the original description of *A. sturni* (Table 1). The male from *P. olivaceus* and the two males of *A. sturni*, as described by Jögis (1968), have a similar morphology, i.e. length of body (5.8 vs 6.0–6.5 mm), length of buccal cavity (115 vs 120–130 µm), length of muscular and glandular oesophagus (226 vs 270–280 µm and 468 vs 430 µm, respectively), length of tail (83 vs 80 µm), length left and right spicule (236 vs 240–250 µm and 83 vs 83–90 µm, respectively); both samples are characterised by six pairs of precloacal papillae. The membranous expansion of the distal extremity of the left spicule of the type-material was not observed in the male studied here, as the spicule was not protruding from the body. On the basis of the above comparisons, the samples from Australia are considered conspecific with *A. sturni*. This is the second record of the species since its original description.

After the intentional introduction of *S. vulgaris* in Australia during the second half of the 19th Century, this species has established populations in

Table 1 Metrical data of females of *Alinema sturni* from various hosts and localities

Source	Jögis (1968)	Present study				
	Host	<i>Psophodes olivaceus</i> (Latham)	<i>Falcunculus frontatus</i> (Latham)	<i>Colluricincla harmonica</i> (Latham)	<i>Ptilotula penicillata</i> (Gould)	<i>Malurus cyaneus</i> (Ellis)
Family	Sturnidae	Psophodidae	Pachycephalidae	Pachycephalidae	Meliphagidae	Maluridae
Locality	Kaliningradskaya Oblast', Russia	Queensland, Australia	South Australia, Australia	Northern Territory, Australia	South Australia, Australia	South Australia, Australia
	n = 3	n = 1	n = 2	n = 1	n = 1	n = 1
Body, length (mm)	11.30–12.00	11.43	–	9.88	8.70	6.86
Maximum body width	120–150	122	–	100	90	85
Body width at level of vulva	–	120	–	100	86	85
Tail length	130–190	106	96*	90	102	96
Body width at anus	–	45	46*	34	42	39
Deirids, distance from anterior extremity	–	149	138*	–	–	124
Excretory pore, distance from anterior end	–	219	162–200	–	206	158
Cephalic extremity width in lateral view	–	32	33–35	28	28	27
Cephalic extremity length in lateral view	–	19	19–23	18	19	18
Nerve-ring, distance from anterior extremity	110	148	138–166	144	–	–
Buccal cavity length	110–120	125	136–157	127	123	123
Muscular oesophagus length	280–330	253	228–296	300	253	300
Muscular oesophagus maximum width	–	24	26–31	26	23	26
Glandular oesophagus length	450–500	523	516–613	610	498	523
Glandular oesophagus maximum width	–	40	50–54	37	32	36
Vulva, distance from anterior extremity (mm)	–	6.27	–	5.85	5.02	3.61
Eggs	44–50 × 25–28	43–45 × 20–25 (44 × 24)	–	–	–	–

*n = 1

Queensland, New South Wales, Victoria, Tasmania and South Australia (Woolnough et al., 2005). Thus, its parasite *A. sturni* may have been introduced in Australia, followed by successful adaptations to native bird species. The intermediate hosts of *A. sturni* are unknown.

Discussion

The subfamily Schistorophinae comprises seven genera, parasites exclusively of birds (Bain et al., 2014). Four species of three of the genera had been reported in Australia, namely *Schistorophus longicornis*

(Hemprich & Ehrenberg in Schneider, 1866) and *Sciadiocara umbellifera* (Molin, 1860) from *Calidris canutus* (L.), and *Schistorophus limosae* Mawson, 1968 and *Viktorocara limosae* Mawson, 1968 from *Limosa lapponica* (L.) (Charadriiformes: Scolopaciidae) (Mawson, 1968). This is the first study to report species of *Quasithelazia* and *Alinema* in Australia.

At present, ten valid species are assigned to *Quasithelazia* (Mutafchiev et al., 2014; present study), i.e. *Q. tenuis* Maplestone, 1932 (type-species), *Q. incisa* (Chabaud & Rousselot, 1956), *Q. caproni* (Bain & Chabaud, 1965), *Q. halcyoni* (Ryzhikov & Khokhlova, 1964), *Q. microcordonis* (Schmidt & Kuntz, 1971), *Q. rostrata* Mutafchiev, Mariaux & Georgiev, 2014, *Q. minuta* n. sp. and *Q. pearsoni* n. sp., all parasitic in kingfishers of the subfamilies Halcyoninae and Alcedininae (Coraciiformes: Alcedinidae) in Africa, Madagascar, Asia and Australia, while *Q. multipapillata* (Zhang, 1993) and *Q. alata* Mutafchiev, Mariaux & Georgiev, 2014 occur in Muscicapidae (Passeriformes) in Asia.

Males of *Q. minuta* n. sp. described here are characterised by possessing eight pairs of preloacal papillae. This extends the previously known range of variability of *Quasithelazia* spp. parasitic in kingfishers having from 10 to 14 pairs. The two species of *Quasithelazia* parasitising passerine birds possess 16 pairs.

The samples studied here had no site of infection specified on the labels. It is very likely that they were collected, like their congeners, from the stomach of their host.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This study is based on museum material and does not require ethical approval.

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