Zootaxa 3264: 61–68 (2012)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

A new species of *Lagis* (Polychaeta: Pectinariidae) from Hong Kong

YANAN SUN & JIAN-WEN QIU*
Department of Biology, Hong Kong Baptist University, 224 Waterloo Road, Kowloon, Hong Kong
E-mail: qiujw@hkbu.edu.hk
** Author for correspondence*

Abstract

Lagis crenulatus sp. nov., (Pectinariidae) is described based on specimens collected from an intertidal mudflat in an estuary of Hong Kong. The specimens are small, with a body length of 6.4 mm to 15.4 mm. Among a total of 10 described species of *Lagis*, *L. crenulatus* sp. nov., and *L. abranchiata* (Fauvel, 1932) are the only two without thoracic branchiae. *Lagis crenulatus* sp. nov., can be distinguished from *L. abranchiata* by having crenulated rather than knobbed margins in the scaphe, and lacking a pair of dorsal elongated pads on the third segment.

Key words: Taxonomy, polychaete, *Lagis crenulatus*, new species, Hong Kong

Introduction

Pectinariids are commonly found in soft-bottom samples around the world. They are a family of polychaetes with several unique morphological characteristics. They live in a cone-shaped sandy tube made by them, therefore are often called “ice-cream cone worms”. Their first segment bears two bundles of stout golden chaetae (paleae) and a cephalic veil. Their posterior body section, the scaphe, bears spine-like chaetae forming an arch on both sides (Fauvel 1953; Ushakov 1955; Imajima & Hartman 1964; Day 1967).

There has been some confusion in the generic designation in this family (Hartman 1941; Hutchings, 2000). Hartman (1941) was unsure whether the species should be grouped into five genera or subgenera. Day (1967) and Holthe (1986) only recognized two genera, *Petta* Malmgren, 1866 and *Pectinaria* Savigny, 1818, with the latter genus having four subgenera (*Amphictene* Savigny, 1818, *Cistenides* Malmgren, 1866, *Lagis*, and *Pectinaria*). Fauchald (1977), Wolf (1984), and Hutchings and Peart (2002) did not accept the subgenera, and considered *Amphictene*, *Cistenides*, *Lagis*, *Pectinaria*, and *Petta* to be genera. Hutchings and Peart (2002) provided a table listing the major characters distinguishing the genera, which mainly include the smoothness of the dorsal opercular rim, smoothness of the cephalic veil and degree of attachment to the first segment, distinctness of the scaphe from the abdomen, number of biramous chaetigers, and number of rows of major teeth in uncini. This 5-genus taxonomic scheme is followed in the present study.

Lagis Malmgren, 1866 can be distinguished from other genera of Pectinariidae by having a smooth cephalic veil well-attached to the first segment, 12 biramous chaetigers, and uncini with at least two rows of teeth (Fauchald 1977; Hutchings & Peart 2002). Nine species of *Lagis* have been described (Fig. 1). The geographic distributions of most species of *Lagis* do not overlap. Although Hutchings and Peart (2002) pointed out that many of the morphological characters of *Lagis* exhibit ranges which makes it difficult for distinguishing species, one species, *L. abranchiata* (Fauvel, 1932), lacks thoracic branchiae and is therefore clearly distinguishable from other congeners. In this paper we describe *Lagis crenulatus* as a new species similar to *L. abranchiata* in lacking thoracic branchiae but different in some other morphological characters as well as geographical distribution.

Accepted by P. Hutchings: 9 Mar. 2012; published: 10 Apr. 2012

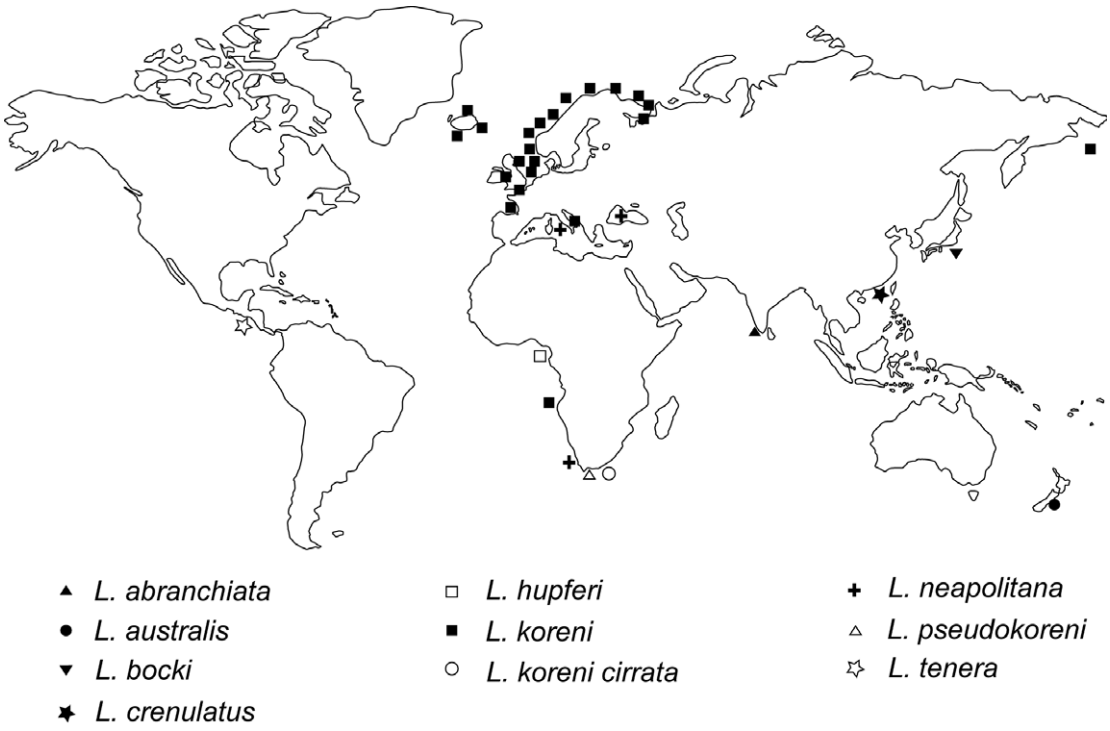

FIGURE 1. A world map showing the reported type- and non-type locations of different species of *Lagis*.

Material and methods

Samples were collected from an intertidal mudflat of the Mai Po Inner Deep Bay Ramsar Site (22°30'N 114°02'E) in February 2009 and May 2010. The mudflat is situated in Deep Bay, which receives large amount of freshwater run off from the Pearl River to the West and from the Shenzhen River to the East. Salinity at the site exhibits strong seasonal variation, ranging from around 10 psu during June to September to around 25 psu during October to May. Sediment samplings were undertaken by pushing a hand-held corer (10 cm diameter) to a depth of 10 cm. Sediment cores retrieved were washed using a 0.5 mm mesh size sieve. Specimens were picked up from the residues retained on the mesh, fixed in 10% formalin in fresh water and later transferred to 70% ethanol. Specimens were observed under dissecting and compound microscopes, and scaled photographs of the body structures were taken using a Nikon Digital Sight DS-SM camera. Based on these photographs, line-drawings were made using Adobe Illustrator CS 4. Three paratypes were dehydrated with graded concentrations of ethanol, critical point dried using a BAL-TEC CPD 030 Critical Point Dryer, and observed under a LEO 1530 FESEM scanning electron microscope. Types are deposited in Institute of Oceanology, Chinese Academy of Science (IOCAS), Qingdao, China, and Australian Museum (AM), Sydney, Australia (Table 1). Characters defined by Hutchings and Peart (2002) are used for describing the species. Description is mainly based on the holotype, with supplementary information from SEM micrographs in order to show the structural details of the chaetae, and measurements of some morphological characters in the paratypes to show their variations among the types.

Results

FAMILY Pectinariidae de Quatregafes, 1865

GENUS *Lagis* Malmgren, 1866

Type species. *Lagis koreni* Malmgren, 1866

***Lagis crenulatus* sp. nov.**
(Figs. 2–4, Table 1)

Material examined. 22 type specimens, all specimens were collected from a mud flat in the Mai Po Inner Deep Bay Ramsar Site, Hong Kong (22°30'N 114°02'E). **Holotype:** IOCAS MBM119742, February 2009 (1 complete specimen with tube). **Paratypes:** IOCAS MBM119743 (1 complete specimen with tube fragments), IOCAS MBM119744 (1 complete specimen with tube fragments), IOCAS MBM119745 (1 specimen with anterior end only), IOCAS MBM119746 (1 specimen with anterior end only), IOCAS MBM119747 (1 specimen with anterior end only), IOCAS MBM119748 (1 complete specimen), IOCAS MBM119749 (1 complete specimen), IOCAS MBM119750 (1 complete specimen), IOCAS MBM119751 (1 complete specimen), IOCAS MBM119752 (1 complete specimen with tube, worm prepared for SEM), AM W38672 (1 complete specimen), AM W38673 (1 complete specimen), AM W38674 (1 complete specimen), AM W38675 (1 complete specimen with tube fragment), AM W38676 (1 complete specimen), AM W38677 (1 specimen with anterior end only), AM W38678 (1 complete specimen with tube, worm prepared for SEM), AM W38679 (1 complete specimen with tube), AM W.38680 (1 complete specimen with tube fragments), February 2009; AM W38681 (1 complete specimen), AM W38682 (1 specimen with tube, posterior end of worm prepared for SEM), May 2010.

Etymology. The specific name *crenulatus* is derived from the Latin word *crena*, which describes the notched margins of the scaphe.

Diagnosis. Rim of cephalic veil partially fused to operculum, with numerous short cirri. Raised operculum margin smooth. Chaetigerous/Uncinigerous formula 16/12. Thoracic branchiae absent. Notochaetae capillary of two types; long ones with numerous short hairs on one side from shaft to tip; short ones with numerous short hairs subdistally on one side of shaft and pectinated distally. Uncini with major teeth in 4 vertical rows. Scaphe with crenulated margins. Scaphal hooks curved with a sharp tip.

Description based on holotype. Tube conical, straight, friable, composed of sand grains held by yellowish cement (Fig. 2). Length 12 mm, width 2.5 mm. Specimens in alcohol pale white. Body wall transparent with sediment contents inside gut clearly seen.

FIGURE 2. *Lagis crenulatus* sp. nov., tube of holotype IOCAS MBM119742. Bar scale = 2 mm.

Body short, conical, tapering towards scaphe. Length 11.8 mm, width 2.14 mm. Rim of cephalic veil with 14 short digitiform papillae (Fig. 3A). Cephalic veil partially fused to operculum, funnel-shaped, surrounding peristomial palps. Peristomial palps numerous, grooved.

Opercular margin raised, smooth. Operculum with 11 pairs of golden paleae fan-shaped on each side, with middle ones longer than lateral ones (Figs 3A, 4A). Each palea pointed gradually, tapering to a fine rolled-in tip. First pair of tentacular cirri inserted on anterior edge of segment 1. Second pair of tentacular cirri arising from connecting ridge running across venter of segment 2. Anterior margin of connecting ridge incised, forming glandular lobes. Segment 2 without postero-dorsal lobe. Anteroventral edge of segments 3–5 slightly protruded forward to cover posterior part of previous segment. Segments 3–4 without branchiae. Midventral glandular

patches present on segments 2–5. Segment 6 with a narrow, thin, slightly glandular anteroventral lobe with smooth anterior margin.

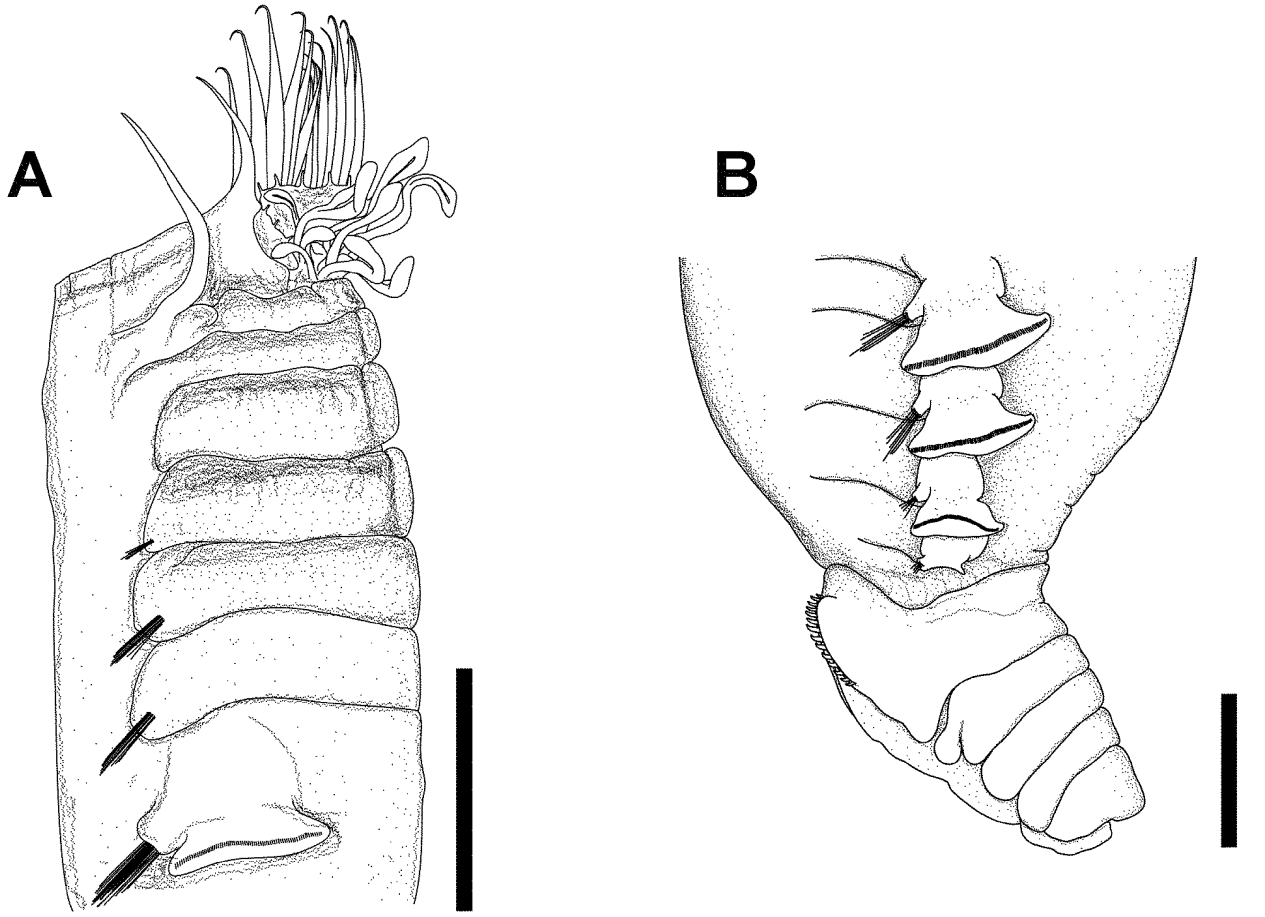

FIGURE 3. *Lagis crenulatus* sp. nov., drawn from holotype IOCAS MBM119742. A. lateral view of anterior end. Bar scale = 1 mm. B, lateral view of posterior end. Bar scale = 0.5 mm.

Chaetigers 1–3 and chaetiger 16 with notopodia and notochaetae only. Chaetigers 4–15 biramous with notopodia and neuropodia. Notopodia and notochaetae of chaetigers 13 and 16 reduced in size compared to those of chaetigers 4–15. Notochaetae capillary of two types; long ones with numerous short hair on one side from shaft to tip; short ones with numerous short hair subdistally on one side of shaft and pectinated distally (Fig. 4B, C). Neuropodia wedge-shaped, erect tori bearing numerous uncini. Uncini with major teeth arranged in four vertical rows, each row with 7–9 teeth (Fig. 4D, E).

Scaphe formed by fusion of 5 posterior segments, distinctly separated from abdomen, longer than broad (Figs 3B, 4G). Scaphe with crenulated margins (Figs 3B, 4G, H). Scaphal hooks 14 pairs, short, pointed, with curved tips (Fig. 4I). Anal tongue oval, broader than long with smooth edge. Anal cirrus lacking.

Variation among type specimens. Several morphological parameters show variations among the type specimens (Table 1). The body length and width vary from 4.2 mm to 15.4 mm, and 1.0 mm to 2.3 mm, respectively. The number of cirri on the cephalic veil, the number of pairs of paleae, and the number of scaphal hooks ranges from 10–20, 10–15, and 9–14, respectively. Both body width and body length have significant positive correlation with two other morphological parameters (number of cirri on cephalic veil, number of pairs of paleae), but the correlation coefficient was higher for body width, probably due to more data available (Table 1). Specifically, there was significant linear correlation between the body width (X1 in mm) or body length (X2) and the number of cirri on the cephalic veil (Y1) (Y1 = 3.66X1 + 7.75, r = 0.610, P = 0.0026, n = 22; Y1 = 0.69X2 + 8.20, r = 0.592, P = 0.0077, n = 19) or the number of pairs of paleae (Y2) (Y2 = 1.88X1 + 8.97, r = 0.606, P = 0.0028, n = 22; Y2 = 0.28X2 + 9.87, r = 0.458, P = 0.0497, n = 19). However, there was no significant correlation between the body size and the number of pairs of scaphal hooks (Y3) (Y3 = 1.37X1 + 8.15, r = 0.441, P = 0.0588, n = 19; Y3 = 0.22X2 + 8.70, r = 0.344, P = 0.1493, n = 19).

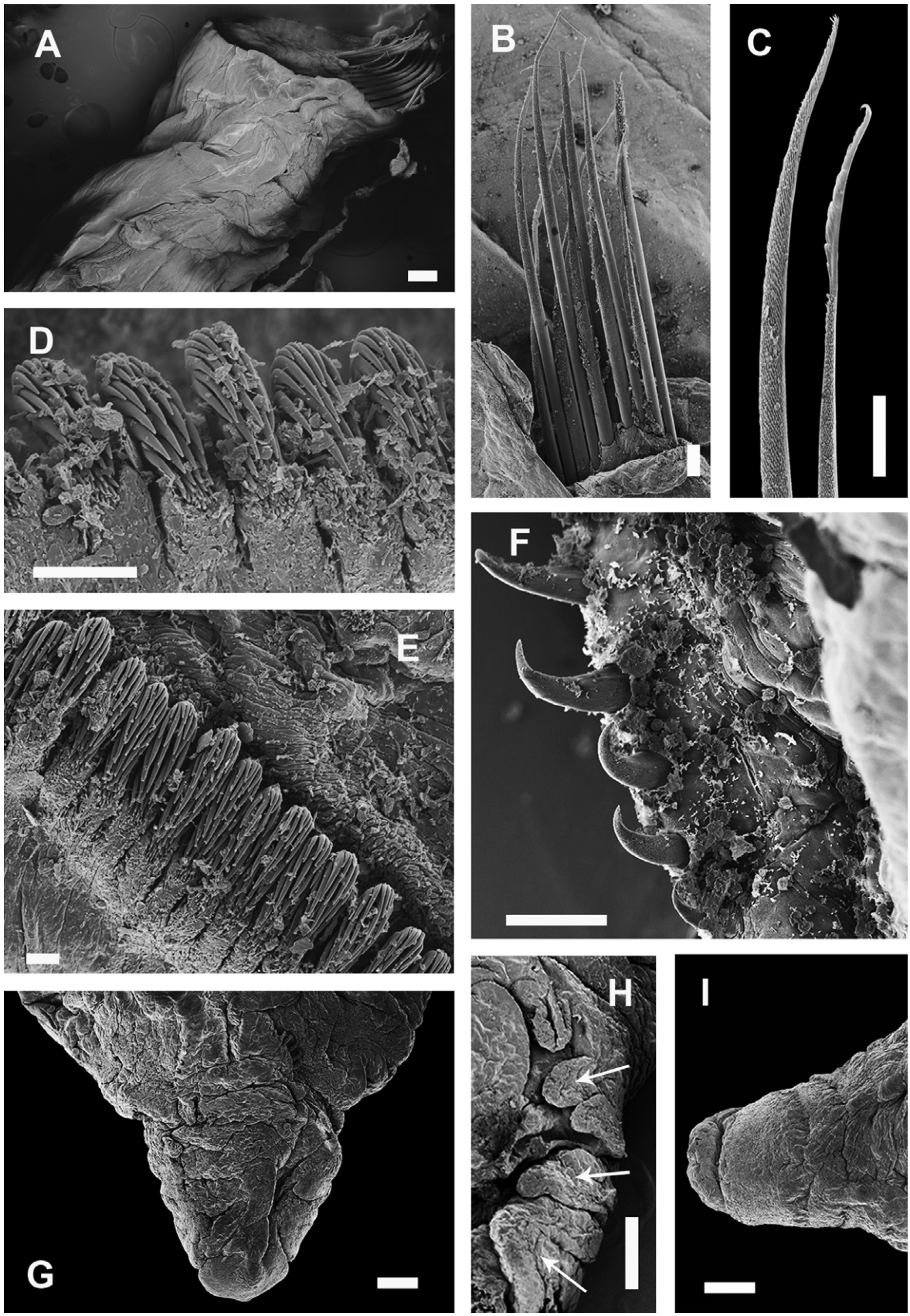

FIGURE 4. *Lagis crenulatus* sp. nov. Scanning electron micrographs of paratypes IOCAS MBM119752 (A, G), AM W38678 (B–F, H) and AM W38682 (I). A. lateral view of anterior end, showing the absent of branchial and posterior dorsal lobe, Bar scale = 100 µm. B, C. notochaetae from chaetiger 5, Bar scale = 20 µm. D, neurochaetae from chaetiger 8, Bar scale = 20 µm. E, neurochaetae from chaetiger 15, Bar scale = 20 µm. F, some of the scaphal hooks, Bar scale = 20 µm. G. dorsal view of scaphe, Bar scale = 100 µm. H, details of scaphal margin, Bar scale = 100 µm. I. ventral view of scaphe, Bar scale = 100 µm.

Type locality and distribution. Currently only known from the Mai Po Inner Deep Bay Ramsar Site of Hong Kong.

TABLE 1. Major quantitative morphological parameters in *Lagis crenulatus*.

Catalogue number	Body length (mm)	Anterior body width (mm)	Number of cirri on cephalic veil	Number of pairs of paleae	Number of pairs of scaphal hooks
Holotype					
IOCAS MBM119742	11.8	2.14	14	11	14
Paratype					
IOCAS MBM119743	15.38	2.31	20	14	11
IOCAS MBM119744	9.00	1.91	13	13	10
IOCAS MBM119745	6.83	1.59	14	13	*n.r.*
IOCAS MBM119746	6.75	1.74	11	12	*n.r.*
IOCAS MBM119747	4.16	1.56	16	11	*n.r.*
IOCAS MBM119748	5.53	1.34	12	11	12
IOCAS MBM119749	9.24	1.94	14	10	9
IOCAS MBM119750	6.43	0.98	10	11	10
IOCAS MBM119751	11.58	2.19	16	15	12
IOCAS MBM119752	7.33	1.47	10	13	10
AM W38672	9.86	2.15	18	13	10
AM W38673	5.63	0.88	10	10	8
AM W38674	8.37	2.96	17	15	13
AM W38675	9.64	2.05	14	14	10
AM W38676	8.55	1.75	15	12	10
AM W38677	6.35	1.65	19	13	*n.r.*
AM W38679	7.85	1.46	14	12	10
AM W38680	8.09	2.08	14	11	9
AM W38681	11.54	1.67	16	13	13
AM W38682	9.40	2.02	13	12	14

n.r. character not recorded due to loss of the posterior part.

Discussion

Although a global review of the genus has not been conducted and some of the characters used for distinguishing species have not been well-studied, *L. crenulatus* sp. nov., is distinct from all described species in the genus by a combination of characters. First, *L. abranchiata* and *L. crenulatus* are the only two species of *Lagis* that lack thoracic branchiae. All other species of *Lagis* have a pair of prominent branchiae on segments 3 and 4 respectively. The lack of branchiae is not an artifact of handling during or after collection. Some of the specimens were still in their tube before being extracted for observation and there were no wounds or scars on the positions corresponding to branchiae of the body wall in their congeners. Fauvel (1932) also stated that, for *L. abranchiata*, some of the specimens were "still enclosed in their tube, testifies to their integrity", supporting the lack of thoracic branchiae in that species is not an artifact. Second, although the type specimens of *L. abranchiata* were not available for loan and comparison with our specimens, Fauvel's description clearly shows that at least two characters distinguish *L. abranchiata* from *L. crenulatus*. The scaphal margins of *L. abranchiata* bear "short ovate knobs", but those of *L. crenulatus* are flat, crenulated and clearly not ovate. *Lagis abranchiata* has a pair of dorsal elongated pads on segment 3 but none of the type specimens of *L. crenulatus* have these structures. Furthermore, the reported localities of the two species are more than 4000 km apart, and are in different water bodies (Indian Ocean, South China Sea) separated by the land mass of Southeast Asia and known to have distinct marine faunal composition (Renema 1998).

Hutchings and Peart (2002) pointed out that it is difficult to distinguish the species of *Lagis* because many diagnostic characters, such as the number of cirri on the cephalic veil and the numbers of pairs of paleae and scaphal hooks, exhibit ranges. Our study of *L. crenulatus* sp. nov., has provided quantitative data to support this view because the variations are positively correlated with body size, with larger specimens having more cirri on the cephalic veil, and more paleae on the first segment. Therefore, a review of the ranges of these variations in different species of *Lagis* may help identify morphological characters that can be used to better distinguish them. Before such a review is available, however, based on literature search with an emphasis on the presence/absence a character or the shape of a structure, several characters appear useful for species identification in this genus. These characters include the presence/absence of thoracic branchiae, the relative smoothness of the scaphal margins, shape of ventral ridge of segment 2, the number of pairs of scaphal papillae, and the presence/absence and shape of the anal cirrus. Based on these morphological characters, a key to *Lagis* spp. is given.

Taxonomic key to *Lagis* species

1	Branchiae absent	2
-	Branchiae present	3
2 (1)	Scaphal margins with ovate knobs	*L. abranchiata* (Fauvel, 1932)
-	Scaphal margins flat, crenulated	*L. crenulatus* sp. nov.
3 (1)	Margins of anal flap with long fringes	*L. bocki* (Hessle, 1917)
-	Margins of anal flap without fringes	4
4 (3)	Scaphal anal flap without cirrus	*L. hupferi* (Nilsson, 1928)
-	Scaphal anal flap with cirrus	5
5 (4)	Cirrus on scaphal anal flap finger-shaped, as long as 2/3 length of the anal segment	*L. tenera* Hartmann-Schröder, 1959
-	Cirrus on scaphal anal flap small papilla	6
6 (5)	Antero-ventral lobe of chaetiger 2 absent or smooth	7
-	Antero-ventral lobe of chaetiger 2 forming glandular lobes	8
7 (6)	Ventral ridge of segment 2 with 15–20 long cirri	*L. koreni cirrata* (Day, 1963)
-	Ventral ridge of segment 2 with blunt lobes	*L. australis* (Ehlers, 1904)
8 (6)	Scaphe with 3 pairs of club-shaped papillae	*L. koreni* Malmgreni, 1866
-	Scaphe without club-shaped papillae	9
9 (8)	Scaphe wide oval with lobed margin	*L. neapolitana* (Claparède, 1868)
-	Scaphe long oval with crenulated margin	*L. pseudokoreni* (Day, 1955)

Acknowledgements

The samples were collected when working on Mai Po Inner Deep Bay Ramsar Site Baseline Ecological Monitoring

Project from Agriculture, Fisheries and Conservation Department (AFCD), Hong Kong SAR Government. We thank the Director of AFCD for permission to publish the paper, Dr. Stanley Lau (The Hong Kong University of Science and Technology) for collecting the sediment samples, Wetland and Fauna Conservation Division of AFCD for providing logistic support, and Drs. Pat Hutchings, Mario Londoño Mesa and Brigitte Ebbe for critical comments on the manuscript, and Drs Ruiping Sun and Stephen Keable for help with deposition of the types.

References

Claparède, E. (1868) Les Annélides Chétopodes du Golfe de Naples. Seconde partie. Annelides sedentaires. *Memoirs de la Société de Physique et d'Histoire Naturelle de Genève*, 20, 1, 1–225.

Day, J.H. (1955) The Polychaeta of South Africa. Part 3. Sedentary species from Cape shores and estuaries. *Zoological Journal of the Linnean Society*, 42, 407–452.

Day, J.H. (1963) The polychaetes fauna of South Africa. Part 8. New species and records from grab samples and dredgings. *Bulletin of the British Museum (Natural History), Zoology*, 10, 381–445.

Day, J.H. (1967) *A monograph on the Polychaeta of Southern Africa. Part 2. Sedentaria.* Trustees of the British Natural History, London, 878 pp.

Ehlers, E. (1904) Neuseeländische Anneliden. *Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen. Mathematisch-Physikalische Klasse. Neue Folge*, 3, 1–80.

Fauchald, K. (1977) The polychaete worms. Definitions and keys to the orders, families and genera. *Natural History Museum of Los Angeles County*, 28, 1–188.

Fauvel, P. (1932) The Annelida Polychaeta of the Indian Museum, Calcutta. *Memoirs of the Indian Museum*, 12, 1, 1–262.

Fauvel, P. (1953) *The fauna of India, including Pakistan, Ceylon, Burma and Malaya. Annelida, Polychaeta.* The Indian Press, Allahabad, 507 pp.

Hartman, O. (1941) Polychaetous annelids. Part IV. Pectinariidae. *Allan Hancock Pacific Expeditions*, 7, 5, 325–345.

Hartmann-Schröder, G. (1959) Zur Ökologie der Polychaeten des Mangrove-Estero-Gebietes von El Salvador. *Beiträge zur neotropischen Fauna*, 1, 2, 69–183.

Hessle, C. (1917) Zur Kenntnis der terebellomorphen Polychaeten. *Zoologiska Bidrag från Uppsala*, 5, 39–258.

Holthe, T. (1986) *Polychaeta Terebellomorpha*. Norwegian University Press, Oslo, 194 pp.

Hutchings, P. (2000) Family Pectinariidae. *In*: Beesley, P.L., Ross, G.J.B. & Glasby, C.J. (Eds.) *Polychaetes & Allies: The Southern Synthesis. Fauna of Australia. Vol. 4A. Polychaeta, Myzostomida, Pogonphora, Echiura, Sipuncula.* CSIRO. Melbourne, Australia. pp. 219–222.

Hutchings, P. & Peart, R. (2002) A review of the genera of Pectinariidae (Polychaeta) together with a description of the Australian fauna. *Records of the Australian Museum*, 54, 99–127.

Imajima, M. & Hartman, O. (1964) The polychaetous annelids of Japan, Part II. *Allan Hancock Foundation Publications Occasional Paper*, 26, 239–452.

Malmgren, A.J. (1866) Nordiska Hafs-Annulater. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar, Stockholm*, 22, 355–410.

Nilsson, D. (1928) Neue und alte Amphicteniden. *Götheborgs Kongl. Vetenskaps och Vitterhets Samhälles Handlingar*, 33, 1–96.

Renema, W. (1998) *Biogeography, time and place: Distributions, barriers and islands.* Springer, A.A. Dordrecht, The Netherlands.

Savigny, J.C., 1818. Annélides. In Lamarck, 1818 (q.v.).

Ushakov, P.V. (1955) Polychaetous annelids of the Far East Seas of the USSR. *Akademii Nauk SSSR, Keys to the fauna of the SSSR*, 56, 1–433.

Wolf, P.S. (1984) Family Pectinariidae Quatrefages, 1865. Chapter 50. *In*: Uebelacker, J.M. & Johnson, P.G. (Eds.), *Taxonomic guide to the polychaetes of the northern Gulf of Mexico. Volume VII*. Barry A Vittor and Associates, Mobile, Alabama, pp. 50–1 to 50–10.