POMPHORHYNCHUS HERONENSIS SP. NOV. (ACANTHOCEPHALA: POMPHORHYNCHIDAE) FROM *LUTJANUS CARPONOTATUS* (LUTJANIDAE) FROM HERON ISLAND, AUSTRALIA

SYLVIE PICHELIN

PICHELIN, S. 1997. *Pomphorhynchus heronensis* sp. nov. (Acanthocephala: Pomphorhynchidae) from *Lutjanus carponotatus* (Lutjanidae) from Heron Island, Australia. *Records of the South Australian Museum* **30**(1): 19–27.

Pomphorhynchus heronensis sp. nov. is described from *Lutjanus carponotatus* (Lutjanidae) from Heron Island, Australia. The new species can be distinguished easily from all other species of the genus by the combination of the following characters: a relatively short neck with a symmetrical bulb (bulb/total neck length ratio = 1: 0.5), 15–17 longitudinal rows with 13–16 hooks per row of which the apical hooks (7–8 per row) have roots and are larger than the basal hooks and are arranged in slightly spiral rows whereas the basal hooks (6–8 per row) have no roots and are arranged in straight rows, a proboscis receptacle that does not extend beyond the bulb and atypical cement glands. This is the first species of *Pomphorhynchus* described from Australia and represents one of the few species of that genus known from a marine host.

S. Pichelin, South Australian Museum, North Terrace, Adelaide, South Australia 5000.
Manuscript received 29 April 1996.

There are four genera of Pomphorhynchidae: *Pomphorhynchus* Monticelli, 1905, *Longicollum* Yamaguti, 1935, *Tenuiproboscis* Yamaguti, 1935 and *Paralongicollum* Amin, Bauer and Sidorov, 1991. Of these, only species of *Longicollum* have been recorded in Australia (Edmonds 1989, Roubal 1993). There are about 25 species of *Pomphorhynchus* (see Amin 1985, Ortubay *et al.* 1991, Wang & Guo 1983). This study describes a new species of *Pomphorhynchus* from *Lutjanus carponotatus* (Lutjanidae) from Heron Island, Australia.

Materials And Methods

Twelve *Lutjanus carponotatus* were collected using handlines in the Wistari Channel, Heron Island and dissected for parasites. Acanthocephalans were removed from the intestine; host tissue surrounding the neck including the bulb of the worms was removed using micropins and forceps. Specimens were placed in a cavity block in tap water and refrigerated to encourage the eversion of the proboscis and then fixed in Berland's fluid and stored in 70% alcohol. Specimens were stained with Mayer's haematoxylin and mounted in Canada balsam. Lactophenol was used to clear specimens temporarily for description and measurement. Some worms were critical point dried, gold sputter-coated and examined under a scanning electron microscope operating at 5–10kV. Some worms were serially sectioned and stained with Mayer's haematoxylin and eosin. Drawings were made with the aid of a *camera lucida* and added to by hand. Measurements, presented as the range with the mean followed by the standard deviation in parenthesis, are given in micrometres; where measurements are presented in paired sets separated by a multiplication sign, the first figure is length, the second width. Sample size is given after each measurement. Type material has been deposited in the Australian Helminthological Collection (AHC), South Australian Museum.

Systematics

Class PALAEACANTHOCEPHALA

Family POMPHORHYNCHIDAE Yamaguti, 1939

Genus *Pomphorhynchus* Monticelli, 1905

Pomphorhynchus heronensis sp. nov.
(Figs 1–7)

Type host: *Lutjanus carponotatus* (Lutjanidae).
Other hosts: two specimens from intestine of 1 of

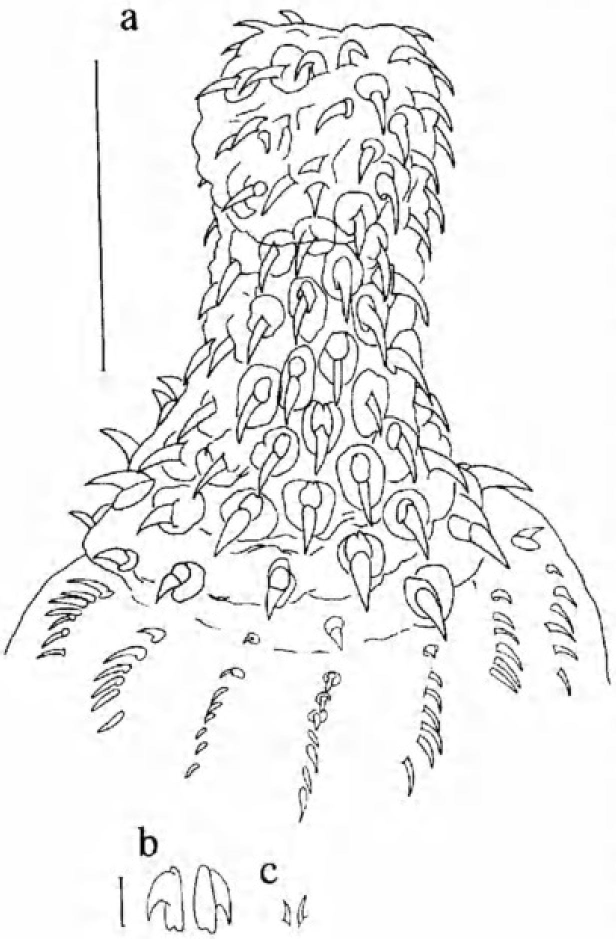

FIGURE 1. **a**, Proboscis showing two distinct hook types, **b**, apical hooks, and **c**, basal hooks on proboscis. Scale bars: a = 200, b and c = 20.

5 *Cheilinus trilobatus* (Labridae) from Heron I., Qld, Aust.
Type site: Rectum – neck and proboscis of parasites bulging through rectal wall into body cavity of host; infections easily diagnosed from outside gut.
Type locality: Heron I. (23°27' S, 151°55' E), Qld, Aust.
Material: holotype (male) AHC 30345; paratypes AHC 27665–27683, 30346.
Infection rate: 9 of 12 infected.

Description

General

Proboscis cone to pear shaped with slight anterior swelling; 2 distinct types of hooks (Figs 1a–c, 2) present. Apical proboscis hooks large 29.5–51.0 (43.2 ± s.d. 6.6) (n=19) (Fig. 1b); root 25.3–48.5 (39.6 ± s.d. 4.7) (n=15) with slight indentation of base; hooks arranged in 15–17 slightly spiralling rows of 7–8 hooks per row. Basal proboscis hooks small 14.8–23.5 (18.2 ± s.d. 2.3) (n=10) (Fig. 1c), slender with vestigial or no roots arranged in 15–17 straight rows of 6–8 hooks per row. Neck short (neck length: trunk length = 1: 0.32–0.61 (1: 0.44 ± s.d. 0.09) (n=20)), uniformly cylindrical from trunk level until abruptly swells to form symmetrical bulb encircling neck; bulb without protrusions or other irregularities, may be either spherical or slightly wider than long. Proboscis receptacle 923–1307 (1100 ± s.d. 123) x 161–231 (188 ± s.d. 23) (n=10) (Fig. 3) double walled, extends from base of proboscis to base of bulb; does not extend into trunk. Trunk widest anteriorly, tapering posteriorly. Lemnisci 2, slender, 980–2674 (1696 ± s.d. 702) (n=6) long.

Males

Total length 7780–13500 (10724 ± s.d. 2213) (n=15) (Fig. 4). Trunk 5520–10000 (7409 ± s.d. 1426) x 1000–2120 (1572 ± s.d. 357) (n=11) at widest point. Neck length including bulb 2250–3440 (2735 ± s.d. 522) (n=6); neck width excluding bulb 280–620 (392 ± s.d. 100) (n=10); bulb 950–1900 (1362 ± s.d. 369) (n=6) x 1360–2500 (1856 ± s.d. 441) (n=5); bulb/total neck length ratio 1: 0.42–0.59 (1: 0.5) (n=6). Lemnisci do not extend beyond anteriormost testis. Testes 2, ovoid, 360–840 (609 ± s.d. 124) x 246 520 (377 ± s.d. 90) (n=14), in tandem or diagonal, in anterior third of trunk. Cement glands number undetermined, probably 2 (Figs 5a–c); glands pyriform at level of seminal vesicle but become tubular and convoluted as they extend to posteriormost margin of testis. Proximal part of cement glands, seminal vesicle and Säfftigen's pouch contained within genital sheath (Fig. 5a); ligament sac envelops convoluted tubular part of cement glands, sperm duct and testes. Säfftigen's pouch pyriform, widest part measures 538 (n=1), thick-walled, partly enveloped by cement glands. Sperm duct emerges from seminal vesicle, runs anteriorly to testes; union of sperm duct and testes not seen. Seminal vesicle small, obscured by proximal part of cement glands. Bursa with pointed digitiform rays and 2 concentric rings of circumbursal receptors (Fig. 6).

Females

Total length 6630–14000 (9593 ± s.d. 2317) (n=21) (Fig. 7a). Trunk 4300–8540 (6157 ± s.d. 1194) x 1200–2960 (1761 ± s.d. 310) (n=16) at widest point. Neck length including bulb, 2000–3700 (2703 ± s.d. 445) (n=14); neck width

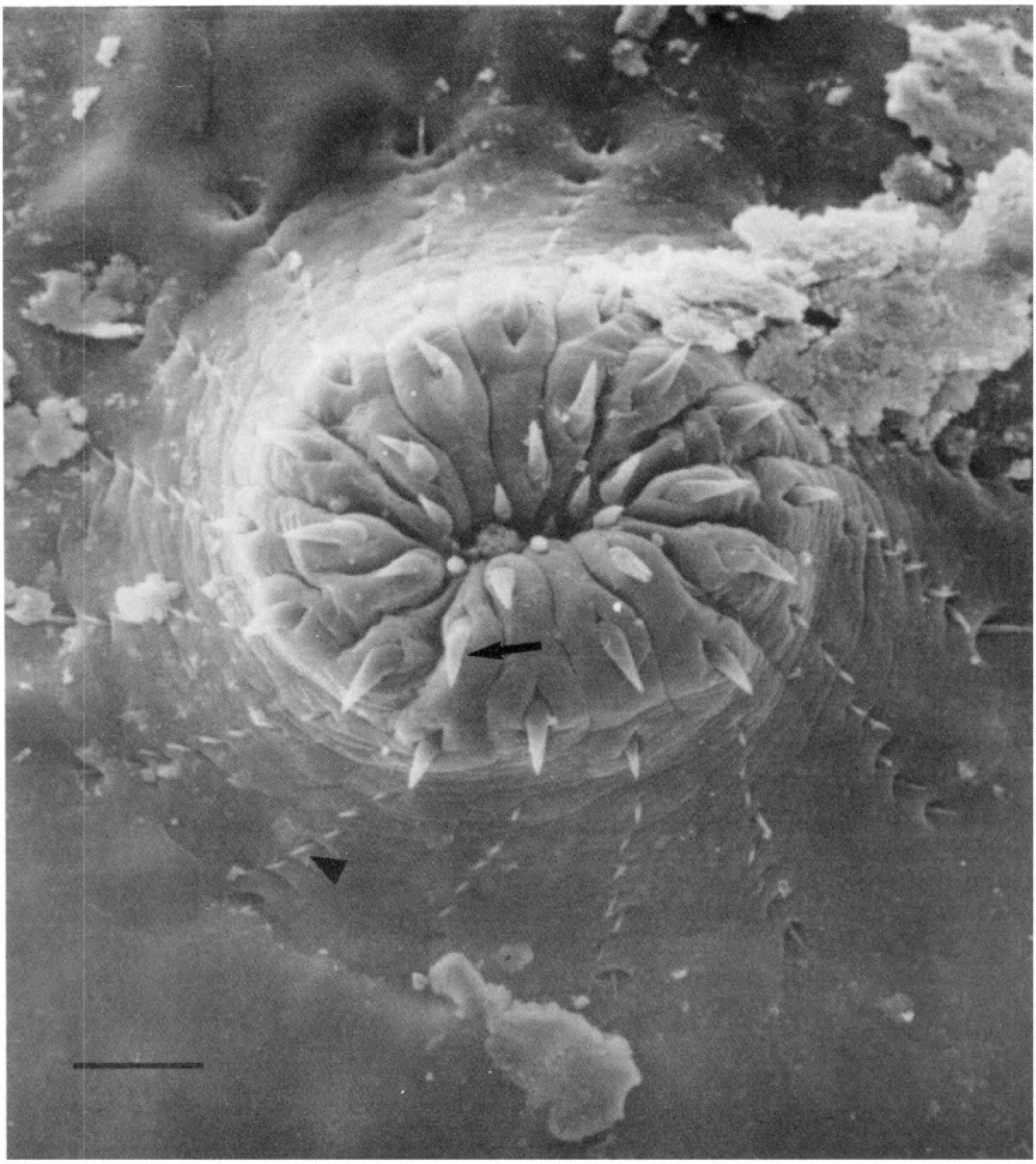

FIGURE 2. SEM of proboscis showing apical hook (arrow) and basal hook (arrowhead). Scale bar = 50.

excluding bulb 300–500 (373 ± s.d. 42) (n=14); bulb 900–1900 (1333 ± s.d. 350) x 1250–2400 (1699 ± s.d. 444) (n=16); bulb/total neck length 1: 0.41–0.59 (1: 0.50) (n=14). Female reproductive system consists of ovarian balls, ligament sac, uterine bell, uterus, well formed vaginal funnel, 2 consecutive vaginal sphincters and bulb (Fig. 7b); ligament sac broken in all specimens examined. Eggs ovoid to fusiform with small polar prolongations of middle membrane (Fig. 7c), 98–129 (112 ± s.d. 7) x 27–35 (33 ± s.d. 3) (n=15); eggs may be present in neck and bulb.

Discussion

The present specimens belong to the genus *Pomphorhynchus* according to acanthocephalan keys by Amin (1987a) and Amin *et al.* (1991) because they have a neck with a true bulb anteriorly and lack the spirally twisted neck which is characteristic of *Longicollum*.

The number of rows of hooks and the number of hooks per row are similar in most species of *Pomphorhynchus* including *Pomphorhynchus heronensis* sp. nov. However, all species of *Pomphorhynchus* except *P. heronensis* appear to

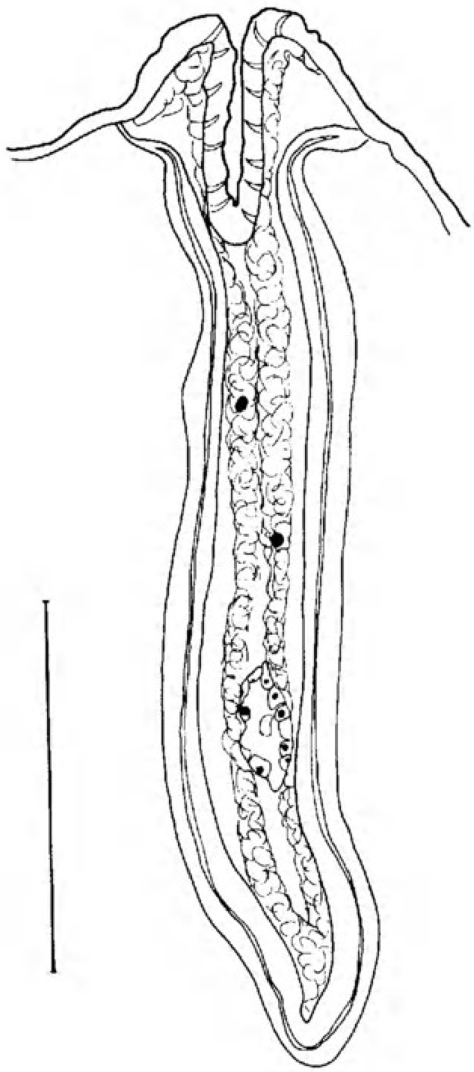

FIGURE 3. Horizontal section through the proboscis receptacle. Scale bar = 500.

have a proboscis receptacle that extends well beyond the bulb and, in many instances, into the trunk. The atypical shape and number of the cement glands in *P. heronensis* (see below) also distinguishes it from all other pomphorhynchid species. Further features that can differentiate this new species from other similar species of *Pomphorhynchus* are given below. The new species can further be differentiated from *P. patagonicus* Ortubay, Ubeda, Semenas and Kennedy, 1991, *P. sebastichthydis* Yamaguti, 1939 and *P. yamagutii* Schmidt and Hugghins, 1973 because they possess asymmetrical bulbs (Ortubay *et al.* 1991, Schmidt & Hugghins 1973, Yamaguti 1939). *Pomphorhynchus yunanensis* Wang, 1981 differs by having 12 rows of hooks with only 5–6 proboscis hooks per row (Wang 1981). *P. lucyi* Williams and Rogers, 1984 differs by having a considerably longer neck (Williams & Rogers 1984) relative to that of *P. heronensis*. *Pomphorhynchus cylindericus* Wang and Guo, 1983 and *P. bosniacus* Kiskároly and Čankovic, 1969 have fewer than 15 rows of proboscis hooks with 9 or fewer hooks per row (Wang and Guo 1983, Kiskároly & Čankovic 1969); also the testes of *P. cylindericus* are more posterior than those of *P. heronensis*. *Pomphorhynchus laevis* (Zoega in Müller, 1776) and *P. intermedius* Engelbrecht, 1957 have the last basal hooks on the proboscis

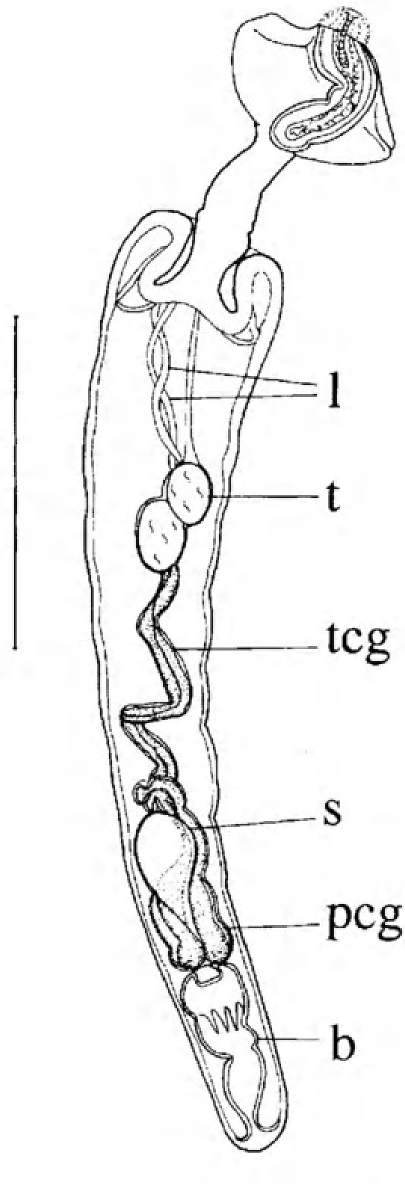

FIGURE 4. Male specimen (holotype), bulb slightly collapsed. Scale bar = 2000. Legend: l, lemnisci; t, testis; tcg, tubular part of cement glands; s, Säfftigen's pouch; pcg, posterior part of cement glands; b, bursa with bursal rays.

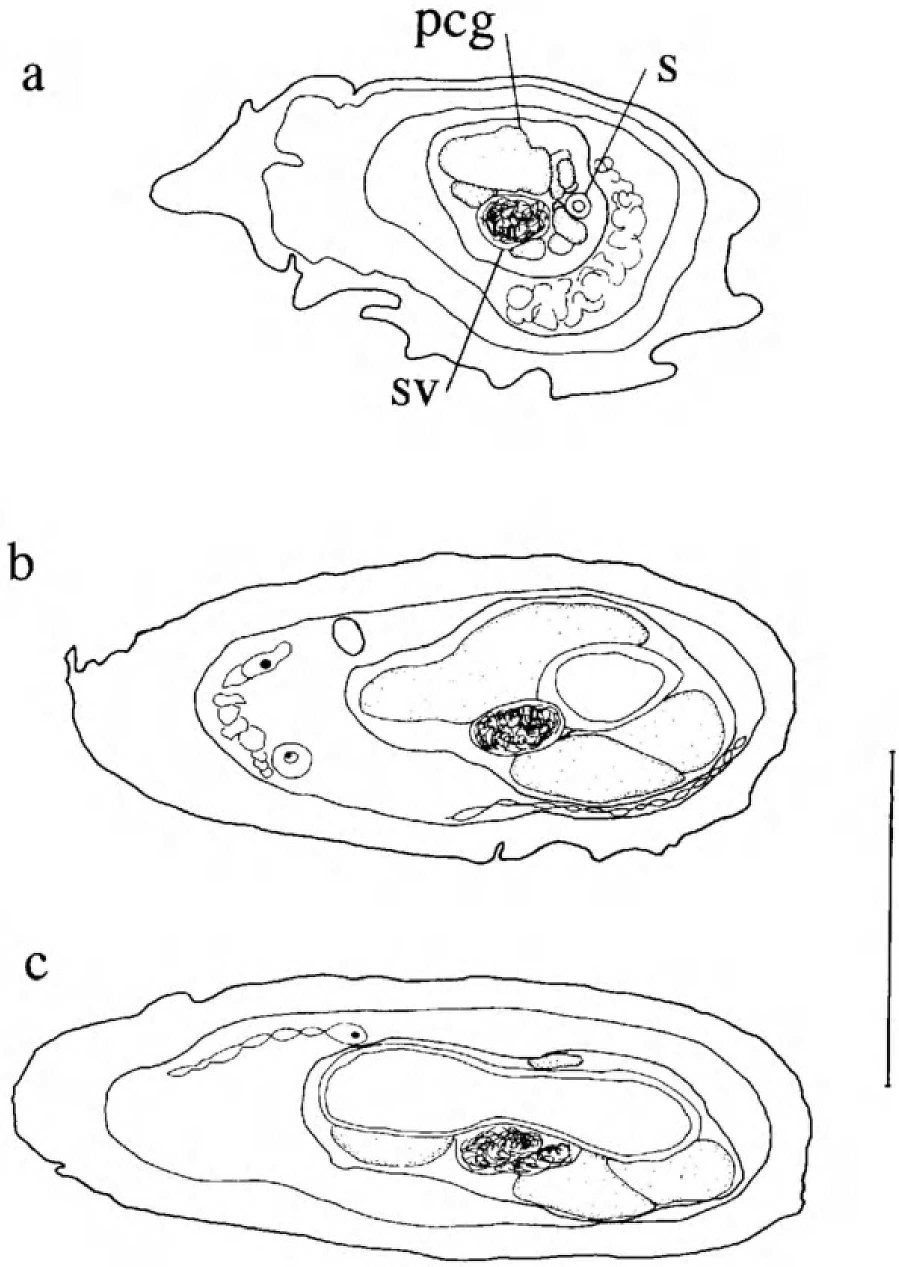

FIGURE 5. Transverse sections through a male specimen showing: **a**, the proximal ends of Säfftigen's pouch, cement glands and seminal vesicle; **b**, the cement glands partially enveloping Säfftigen's pouch (160μ further anterior from previous section); **c**, the widening of Säfftigen's pouch (70μ from previous section). Fig. 5a–c drawn to same scale. Scale bar = 500. Legend: s, Säfftigen's pouch; pcg, posterior part of cement glands; sv, seminal vesicle.

larger than those immediately preceding (Golvan 1969). *P. heronensis* does not have this feature; the last basal hook only appears longer when the other hooks of *P. heronensis* are not fully exposed. *P. intermedius*, like many other species of the genus, does not appear to possess the two very distinct sizes of hooks on the proboscis seen in the new species. Two distinct sizes of hooks can be seen on the proboscis of *P. laevis* as shown in Brown *et al.* (1986, Fig. 5) but in addition to the differences mentioned above *P. laevis* has fewer hooks per row (13–20 rows with 8–13 hooks) (Brown *et al.* 1986) than *P. heronensis*. Thus, the new species can be distinguished easily from all other species of the genus by the combination of the following characters: a relatively short neck with a symmetrical bulb (bulb/total neck length ratio 1:0.5; neck including bulb/trunk length ratio

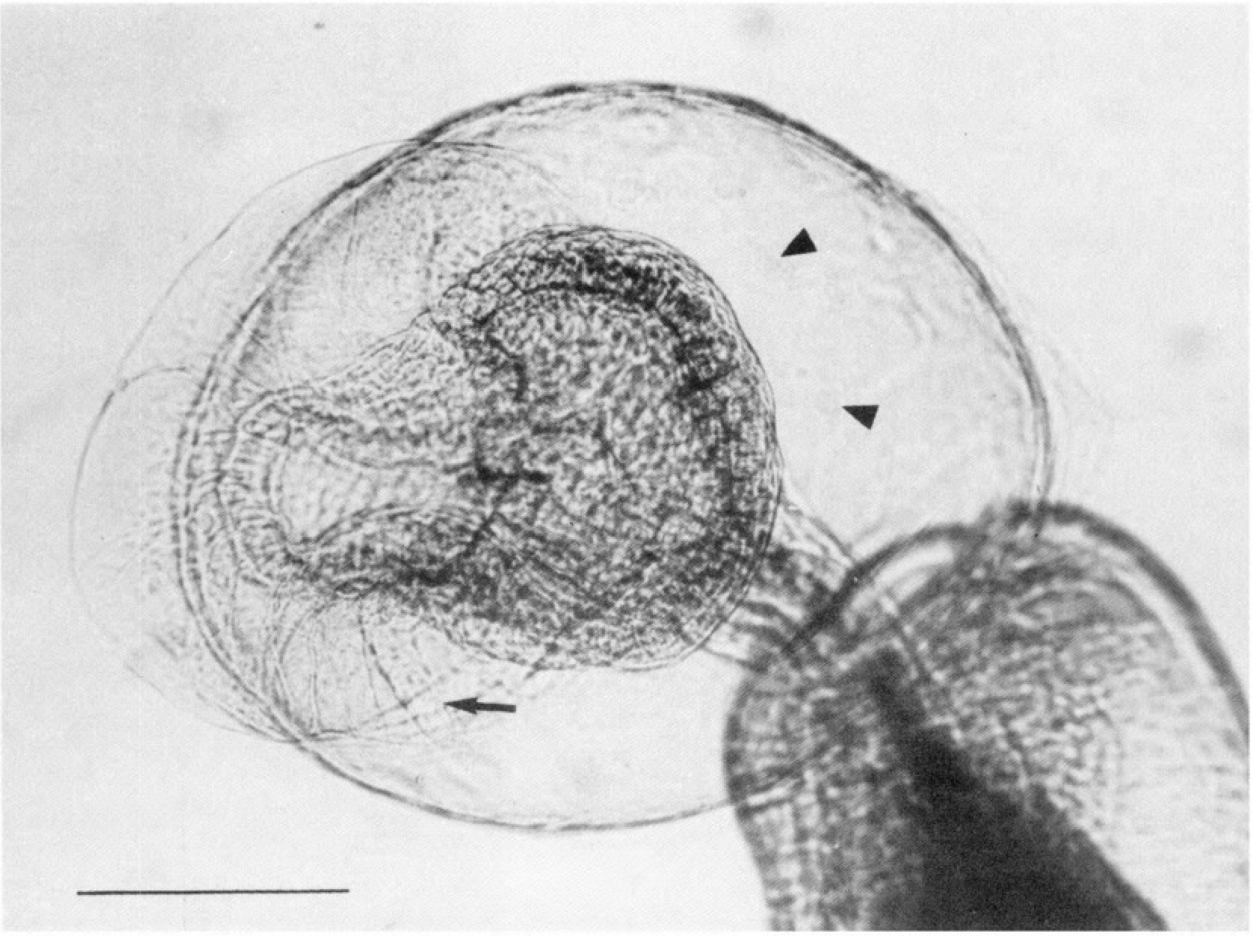

FIGURE 6. Light photomicrograph of cloacal bursa showing bursal rays (arrow) and two circles of circumbursal receptors (arrowheads). Scale bar = 250.

1:0.44), 15–17 longitudinal rows with 13–16 hooks per row of which the apical hooks (7–8 per row) have roots and are larger than the basal hooks and are arranged in slightly spiral rows whereas the basal hooks (6–8 per row) have no roots and are arranged in straight rows, a proboscis receptacle that does not extend beyond the bulb and atypical cement glands.

Some females, but not males, of the new species show deformities similar to those described by Amin *et al.* (1991) for specimens of *Paralongicollum nemacheili* Amin *et al.*, 1991. Other than the enlarged dorsal trunk region, deformed females did not appear to differ from normal females. Both normal and deformed females had eggs that were dispersed throughout the trunk and occasionally into the bulb; no eggs were present in the deformed part of the gravid female. The presence of eggs in the bulb seems uncommon in other pomphorhynchids but has been reported in *P. kashmirensis* Kaw, 1941 by Kaw (1941) and in *P. sebastichthydis* by Yamaguti (1939). The presence of eggs may well be an artefact of the method of fixing or preserving and is certainly not a useful taxonomic character.

The cement glands of *P. heronensis* appear atypical for the family. Normally, pomphorhynchids are said to have six cement glands. In this species however, there appear to be only two very long glands. A study of serial sections showed that the proximal part of the glands are pyriform and closely surround Säfftigen's pouch and the seminal vesicle. The glands then narrow out and run alongside the sperm duct up to the testes. Monorchic specimens of *P. heronensis* (n=2) appear to have the same arrangement of cement glands as normal males. Cement glands in species of *Pomphorhynchus* are not usually long but there is at least one other species, *Filisoma longcementglandatus* Amin and Nahhas, 1994, that has cement glands that may reach up to 16.00 mm in length (Amin & Nahhas,

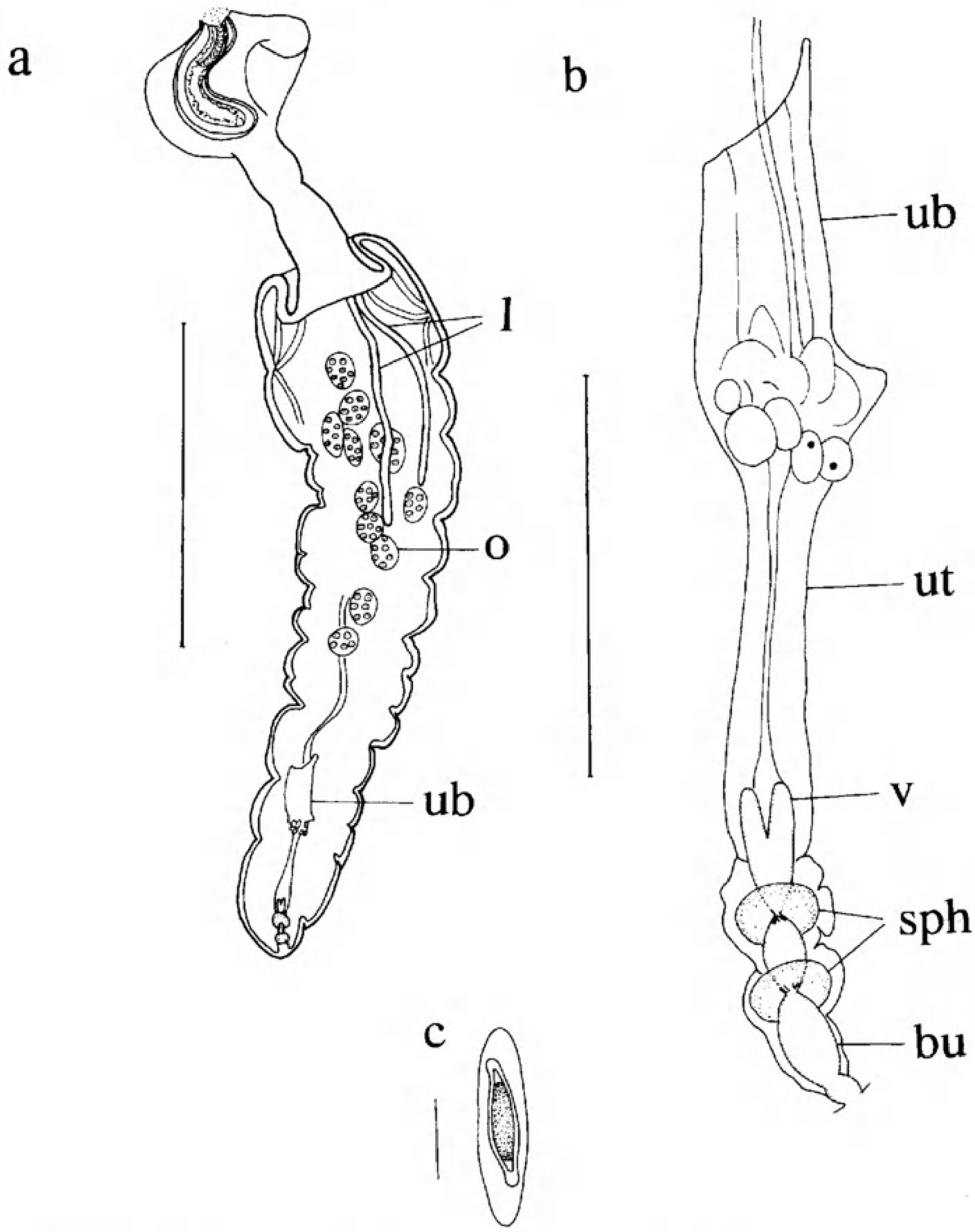

FIGURE 7. **a**, Female specimen, bulb slightly collapsed, **b**, uterine bell, **c**, egg. Scale bars: a = 2000, b = 500, c = 50. Legend: l, lemnisci; o, ovarian ball; ub, uterine bell; ut, uterus; v, vaginal funnel; sph, sphincters, bu, bulb.

1994). Why *P. heronensis* should have cement glands so different from other pomphorhynchids is unknown. It is proposed here that the generic diagnosis be amended to include the variable nature of the cement glands seen in *P. heronensis*.

Two circles of circumbursal receptors similar to those described by Brown (1987) were seen in one male specimen. Bursal rays were also noted in the same specimen. Neither circumpenial receptors nor muscular suckers in the bursa as those described by Brown (1987) and Doyle and Gleason (1991) could be seen in the new species. Although Brown (1987) considered the receptors may be useful taxonomically, these structures were not used as such in this paper because they were difficult to see. Brown (1987, Fig. 3) also showed the presence of vesicles in the bursa. However, Doyle and Gleason (1991) reported muscular suckers on the inner bursal surface and suggested that the vesicles noted by Brown (1987) could have been a ballooning out of the muscular suckers caused by the method of preparation. A male with an hyperextended bursa would probably not be able to hold the female in position and thus fail to copulate.

Many acanthocephalans show size dimorphism; noteworthy is that both males and females of *P. heronensis* appear to be the same length. Also, there appeared to be an absence of very young stages. Although some juvenile pomphorhynchids appear able to detach from the gut, move and reattach to another region (Amin 1987b) no pomphorhynchids in the present study were found other than in the rectum. The lack of juvenile stages may indicate that hosts are not continuously infected throughout the year or that there is some mechanism restricting establishment of new parasites. Brown (1986) provided evidence to show that populations of *P. laevis* could reach a ceiling level and that parasite establishment could be density-dependent. However, in some cases it appears that this ceiling level is not reached because the critical resource, e.g. space, is only limited briefly (Bates & Kennedy 1991).

Pomphorhynchids have been recorded from a wide range of teleosts (see Golvan & de Buron 1988). Amin (1987c) recognised three categories of hosts for *P. bulbocolli* Linkins in Van Cleave, 1919: principal, accessory and occasional hosts. In this study, *L. carponotatus* is considered as a principal host for *P. heronensis* because female pomphorhynchids with ovarian balls, immature and mature shelled acanthors were regularly recovered, all parasites were firmly attached and none were found extraintestinally. This is consistent with the findings by Brown *et al.* (1986) and Amin (1987c) who considered the regular presence of mature gravid females as an indication that the parasite is in its preferred definitive host. It is also consistent with the observations made by Kennedy (1984) that *P. laevis* in its non-preferred hosts were smaller, immature, weakly attached and many were recovered in extraintestinal sites.

Most species of *Pomphorhynchus* occur in freshwater fishes. Some exceptions such as *Pomphorhynchus laevis* have been recorded from both freshwater and marine fishes (see, for example, Kennedy 1984). Although, it has been suggested that the freshwater *P. laevis* is a different strain from the marine *P. laevis* and that each strain has a preferred host (see Kennedy 1984); currently there is thought to be three strains (see Kennedy *et al.* 1989, Kennedy 1996). The preferred position in the preferred marine host of *P. laevis* is the rectum whereas the preferred position in freshwater host is more anterior (see Kennedy 1984). All the specimens of *P. heronensis* recovered for this study were found in the rectum of its host, *L. carponotatus. Lutjanus carponotatus* is not known from freshwater habitats (Allen & Talbot 1985) and thus the posterior position of the parasite cannot be correlated with a response to changing salinity as shown by Kennedy (1984) for *P. laevis* under certain circumstances.

Specimens of *Pomphorhynchus heronensis* were also recovered from one of five *Cheilinus trilobatus* in the present study and from one of five from another study of helminths in fishes of Heron Island (Cribb *pers. comm.*). In these specimens the parts of the worms that had penetrated the gut wall (i.e. the neck including the bulb) were decayed. Had this deterioration resulted from the worms being reproductively exhausted followed by death *in situ*, then worms in similar condition should have been found in *L. carponotatus*; none were. It may be that *C. trilobatus* is an unsuitable or at best an occasional host for *P. heronensis* but further material is needed to negate the possibility of other factors influencing the presence or absence of these parasites, such as the distribution of intermediate hosts and seasonality.

Acknowledgments

I am grateful to Dr T. H. Cribb for donating specimens of this species and reading this manuscript.

References

ALLEN, G. R. & TALBOT, F. H. 1985. Review of the snappers of the genus *Lutjanus* (Pisces: Lutjanidae) from the Indo-Pacific, with the description of a new species. *Indo-Pacific Fishes* **11**: 1–87.

AMIN, O. M. 1985. Classification. Pp. 27–72 *in* 'Biology of the Acanthocephala'. Eds. D. W. T. Crompton & B. B. Nickol. Cambridge: Cambridge University Press.

AMIN, O. M. 1987a. Key to the families and subfamilies of Acanthocephala, with the erection of a new class

(Polyacanthocephala) and a new order (Polyacanthorhynchida). *Journal of Parasitology* **73**: 1216–1219.

AMIN, O. M. 1987b. Acanthocephala from lake fishes in Wisconsin: morphometric growth of *Pomphorhynchus bulbocolli* (Pomphorhynchidae). *Journal of Parasitology* **73**: 806–810.

AMIN, O. M. 1987c. Acanthocephala from lake fishes in Wisconsin: ecology and host relationships of *Pomphorhynchus bulbocolli* (Pomphorhynchidae). *Journal of Parasitology* **73**: 278–289.

AMIN, O. M., BAUER, O. N. & SIDOROV, E. G. 1991. The description of *Paralongicollum nemacheili* n. gen., n. sp. (Acanthocephala: Pomphorhynchidae) from freshwater fishes in Kazakh S.S.R. *Journal of Parasitology* **77**: 26–31.

AMIN, O. M. & NAHHAS, F. M. 1994. Acanthocephala of marine fishes off Fiji islands, with descriptions of *Filisoma longcementglandatus* n. sp., *Neorhadinorhynchus macrospinosus* n. sp. (Cavisomidae), and gravid females of *Rhadinorhynchus johnstoni* (Rhadinorhynchidae); and keys to species of the genera *Filisoma* and *Neorhadinorhynchus*. *Journal of Parasitology* **80**: 768–774.

BATES, R. M. & KENNEDY, C. R. 1991. Site availability and density-dependent constraints on the acanthocephalan *Pomphorhynchus laevis* in rainbow trout, *Oncorhynchus mykiss* (Walbaum). *Parasitology* **102**: 405–410.

BROWN, A. F. 1986. Evidence for density-dependent establishment and survival of *Pomphorhynchus laevis* (Müller, 1776) (Acanthocephala) in laboratory-infected *Salmo gairdneri* Richardson and its bearing on wild populations in *Leuciscus cephalus* (L.). *Journal of Fish Biology* **28**: 659–669.

BROWN, A. F. 1987. Anatomical variability and secondary sexual characteristics in *Pomphorhynchus laevis* (Müller, 1776) (Acanthocephala). *Systematic Parasitology* **9**: 213–319.

BROWN, A. F., CHUBB, J. C. & VELTKAMP, C. J. 1986. A key to the species of Acanthocephala parasitic in British freshwater fishes. *Journal of Fish Biology* **28**: 327–334.

DOYLE, L. R. & GLEASON, L. N. 1991. Suckers and other bursal structures of *Pomphorhynchus bulbocolli* and *Acanthocephalus dirus* (Acanthocephala). *Journal of Parasitology* **77**: 437–440.

EDMONDS, S. J. 1989. A list of Australian Acanthocephala and their hosts. *Records of the South Australian Museum* **23**: 127–133.

GOLVAN, Y. J. 1969. Systématique des Acanthocéphales (Acanthocephala Rudolphi 1801). Première Partie. L'Ordre des Palaecanthocephala Meyer 1931. Premier fascicule. La Super-famille des Echinorhynchoidea (Cobbold 1876) Golvan et Houin 1963. *Mémoires du Muséum National d'Histoire Naturelle, Série A* **57**: 1–373.

GOLVAN, Y. J. & DE BURON, I. 1988. Les hôtes des Acanthocéphales. II. – Les hôtes définitifs. 1. Poissons. *Annals de Parasitologie et Humaine Comparée* **63**: 349–375.

KAW, B. L. 1941. Studies on the helminth parasites of Kashmir. Part I. Description of some new species of the genus, *Pomphorhynchus* Monticelli (1905). *Proceedings of the Indian Academy of Sciences* **13**: 369–378.

KENNEDY, C. R. 1984. The status of flounders, *Platichthys flesus* L., as hosts of the acanthocephalan *Pomphorhynchus laevis* (Müller) and its survival in marine conditions. *Journal of Fish Biology* **24**: 135–149.

KENNEDY, C. R. 1996. Colonization and establishment of *Pomphorhynchus laevis* (Acanthocephala) in an isolated English river. *Journal of Helminthology* **70**: 27–31.

KENNEDY, C. R. BATES, R. M. & BROWN, A. F. 1989. Discontinuous distributions of fish acanthocephalans *Pomphorhynchus laevis* and *Acanthocephalus anguillae* in Britain and Ireland: an hypothesis. *Journal of Fish Biology* **34**: 607–619.

KISKÁROLY, M. & ČANKOVIĆ, M. 1969. *Pomphorhynchus bosniacus* nov. sp. aus Barben *Barbus barbus* (L.) des Save-Gebietes. *Zoologischer Anzeiger* **182**: 69–74.

ORTUBAY, S., UBEDA, C., SEMENAS, L. & KENNEDY, C. 1991. *Pomphorhynchus patagonicus* n. sp. (Acanthocephala: Pomphorhynchidae) from freshwater fishes of Patagonia, Argentina. *Journal of Parasitology* **77**: 353–356.

ROUBAL, F. R. 1993. Comparative histopathology of *Longicollum* (Acanthocephala: Pomphorhynchidae) infection in the alimentary tract and spleen of *Acanthopagrus australis* (Pisces: Sparidae). *International Journal for Parasitology* **23**: 391–397.

SCHMIDT, G. D. & HUGGHINS, E. J. 1973. Acanthocephala of South American fishes. Part 2. Palaeacanthocephala. *Journal of Parasitology* **59**: 836–838.

WILLIAMS, E. H. JR. & ROGERS, W. A. 1984. *Pomphorhynchus lucyi* sp. n. (Acanthocephala) from fresh and brackish waters fishes of the southeastern U.S. Gulf Coast. *Journal of Parasitology* **70**: 580–583.

WANG, P. 1981. Notes on some species of Acanthocephala from fishes of China. (In Chinese). *Acta Zootaxonomica Sinica* **6**: 121–130.

WANG, P. & GUO, Q. 1983. Studies on some species of helminths from freshwater fishes in Yunnan, China. (In Chinese). *Oceanologia et Limnologia Sinica* **14**: 92–103.

YAMAGUTI, S. 1939. 16. Studies on the helminth fauna of Japan. Part 29. Acanthocephala, II. *Japanese Journal of Zoology* **8**: 317–351.