New Family, New Genus, New Species of Acanthocephala (Echinorhynchida) from the Lizard, *Sphenomorphus granulatus* (Sauria: Scincidae), from Papua New Guinea

Charles R. Bursey*[,1], Stephen R. Goldberg[2] and Fred Kraus[3]

[1]*Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA*

[2]*Department of Biology, Whittier College, Whittier, California 90608, USA*

[3]*Bishop Museum, Department of Natural Sciences, 1525 Bernice Street, Honolulu, Hawaii 96817, USA*

Abstract: *Sauracanthorhynchus sphenomorphicola* n. gen., n. sp. from the intestines of the skink *Sphenomorphus granulatus* (Scincidae) from Papua New Guinea is described and illustrated. *Sauracanthorhynchus sphenomorphicola* is characterized by a subterminal, spheroid proboscis supporting 25 hooks arranged in 10 alternating longitudinal rows of 2 and 3; apical hooks slightly shorter than medial and posterior hooks. The trunk is commaform with an anterior expansion; 2 contiguous ovoid testes are located in the anterior third of the trunk. *Sauracanthorhynchus sphenomorphicola* is sufficiently different from other species assigned to the Echinorhynchida that a new family, Sauracanthorhynchidae is erected for it.

INTRODUCTION

During necropsy of specimens of *Sphenomorphus granulatus* (Boulenger, 1903), no common name, a species of Acanthocephala not assignable to any known genus was found. *Sphenomorphus granulatus* is restricted to Milne Bay Province, Papua New Guinea (Kraus and Allison, 2004) [1]. To our knowledge, there are no previous reports of helminths in S. *granulatus*. The purpose of this paper is to describe the acanthocephalan species found in *S. granulatus*.

MATERIALS AND METHODOLOGY

Three specimens of *Sphenomorphus granulatus* collected by hand 9-17 April 2002 by FK at Cloudy Mountain, Milne Bay Province, Papua New Guinea (10°30'S, 150°14'E), killed by an injection of Nembutol®, fixed in neutral buffered 10% formalin and deposited in the herpetological collection of the Bernice P. Bishop Museum, Honolulu, Hawaii (BPBM 15617, 15620, 15623) were examined for helminths. At necropsy, the body cavity was opened by a longitudinal lateral incision and the gastrointestinal tract was removed by cutting across the esophagus and rectum. The esophagus, stomach, small intestine, and large intestine of each skink were examined separately for endoparasites. Only acanthocephalans were found: 14 were cleared in cedarwood oil and 11 regressively stained in Delafield's hematoxylin, then mounted in balsam for examination as whole mounts; 5 were cut into serial sections of 12 μm thickness, mounted on glass slides, and stained with hematoxylin and eosin for examination. Illustrations were made using a microprojector; Photomicrographs were taken using a Nikon D70 digital camera/Leica ACT 2000 microscope. Measurements from cedarwood oil cleared specimens are given in micrometers as mean ± 1 SD with range in parentheses.

*Address correspondence to this author at the Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA; E-mail: cxb13@psu.edu

RESULTS

The 3 specimens of *Sphenomorphus granulatus* (BPBM 15617, 15620, 15623) were found to harbor 5, 6, 19 acanthocephalans, respectively. These acanthocephalans were not assignable to any known genus. Description of a new family, genus, and species follows.

Sauracanthorhynchidae n. fam.

Diagnosis

Palaeacanthocephala Meyer, 1931; Echinorhynchida Southwell and MacFie, 1925. Small acanthocephalans, males somewhat smaller than females; body curved ventrally, broadest anteriorly. Trunk aspinose, thick-walled, reticular lacunar system; main longitudinal lacunar canals lateral. Proboscis subterminal, first third of body, spheroid, armed with 10 longitudinal rows alternating between 2 and 3 hooks each; apical hooks slightly smaller than middle and posterior hooks. Neck short. Proboscis sheath double walled, with ganglion at base. Lemnisci longer than proboscis sheath. Testes contiguous in anterior trunk. Eggs with polar prolongation of fertilization membrane; hemiechinate embryo.

Sauracanthorhynchus n. gen.

Diagnosis

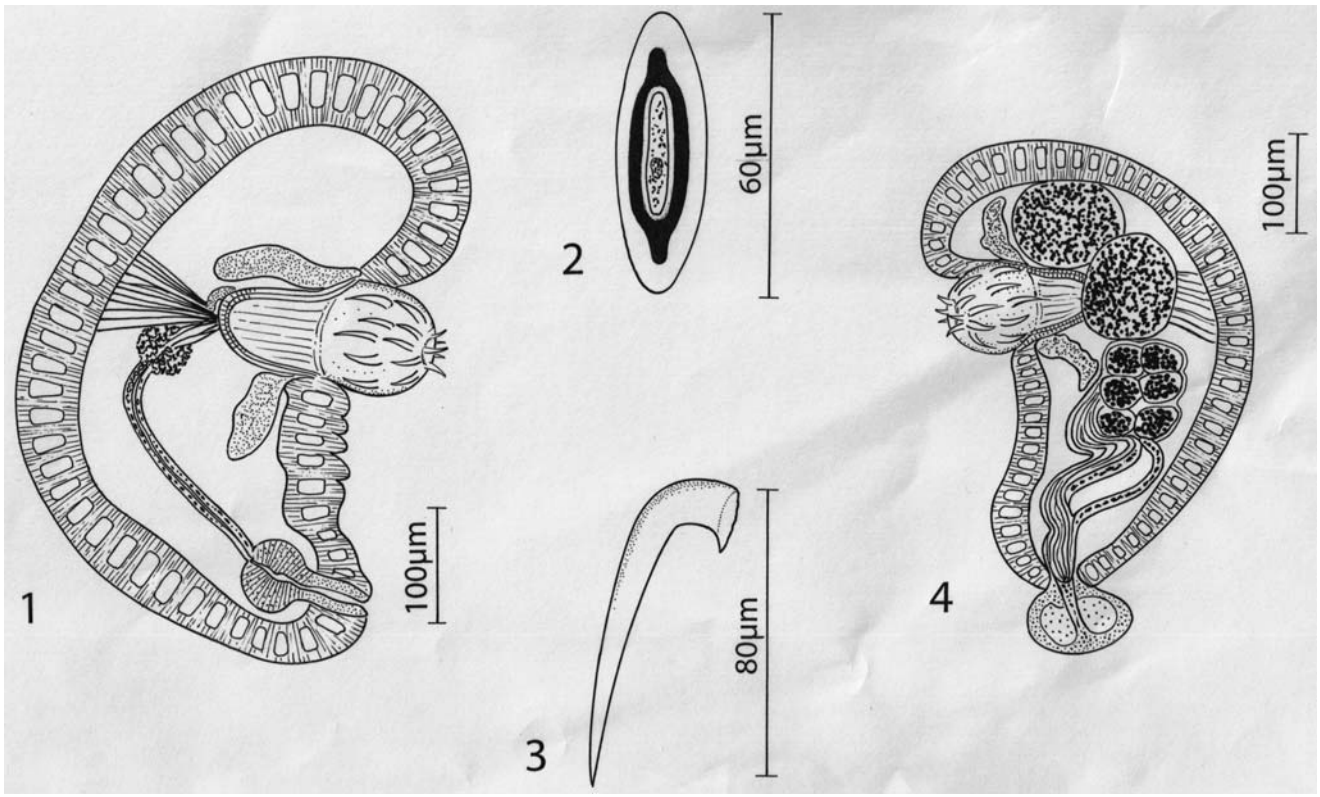
As for family. Six spheroid cement glands, tandem in 3 pairs, filling space between posterior testes and Saefftigen's pouch. Uterine bell globular; uterus much longer than uterine bell; vagina short, surrounded by large sphincter; gonopore subterminal. Parasitic in Papuan lizards.

Sauracanthorhynchus sphenomorphicola n. sp.

Male

Based on holotype and 9 paratypes. Body curved ventrally, commaform. 832 ± 106 (638-969) in length, maximum width 523 ± 38 (459-587) near anterior end of trunk, posterior end blunt. Proboscis spheroid, 132 ± 20 (102-153) long, 140 ± 19 (115-179) wide, subterminal location at end

1874-4214/07



Figs. (1-4). *Sauracanthorhynchus sphenomorphicola* n. sp. **1.** Female, entire. **2.** Egg. **3.** Hook. **4.** Male, entire.

of first third of body. Proboscis with 10 rows of hooks, 2 and 3 in number in alternating rows: apical row, thorn 59 ± 4 (55-67) in length, middle position 72 ± 5 (67-79), posterior position 75 ± 3 (73-79), root simple. Proboscis sheath cylindrical 132 ± 26 (102-179) long by 94 ± 11 (77-115) wide; double layered wall approximately 24 in thickness. Lemnisci cylindrical, 276 ± 29 (230-306). Testes ovoid, tandem, anterior testis 154 ± 17 (128-179) by 116 ± 22 (89-153), posterior testis, 148 ± 16 (128-179) by 121 ± 19 (89-153), in front of middle of trunk. Cement glands in 3 pairs, close together, bursa well developed. Genital pore terminal.

Female

Based allotype on 9 paratypes. Body plump, ventrally curved, gradually attenuated toward blunt posterior extremity, 1,088 ± 96 (970-1,220) long, 592 ± 74 (510-714) at widest point. Proboscis subterminal at end of first third of body, 128 ± 20 (102-153) long, 158 ± 18 (128-179) wide; 10 rows of hooks, 2 and 3 in number in alternating rows: apical row, thorn 66 ± 8 (55-79) in length, middle position 81 ± 5 (73-91), posterior position 84 ± 4 (79-91), root simple. Proboscis sheath 161 ± 22 (128-191), 121 ± 19 (102-153) wide; double layered wall approximately 24 in thickness. Lemnisci 253 ± 27 (217-306) long. Gonopore subterminal; vagina 114 ± 14 (98-134) surrounded by sphincter muscle; uterus 540 ± 71 (459-638) in length; uterine bell 81 ± 6 (73-92) in length, 65 ± 5 (61-73) wide. Body cavity filled with eggs and spherical, floating ovaries. Egg, elongate-oval, outer membrane 59 ± 4 (55-67), fertilization membrane with prominent poles 47 ± 3 (43-52), inner membrane 39 ± 3 (34-43); hemiechinate embryo 37 ± 3 (33-41) in length.

Taxonomic Summary

Type Host

Sphenomorphus granulatus; symbiotype, BPBM 15617; 9 April 2002.

Type Locality

Cloudy Mountains, Upaelisafupi Stream, 10°30'S, 150°14'E, 715 m elevation, Milne Bay Province, Papua New Guinea.

Site of Infection

Small intestine.

Type Specimens

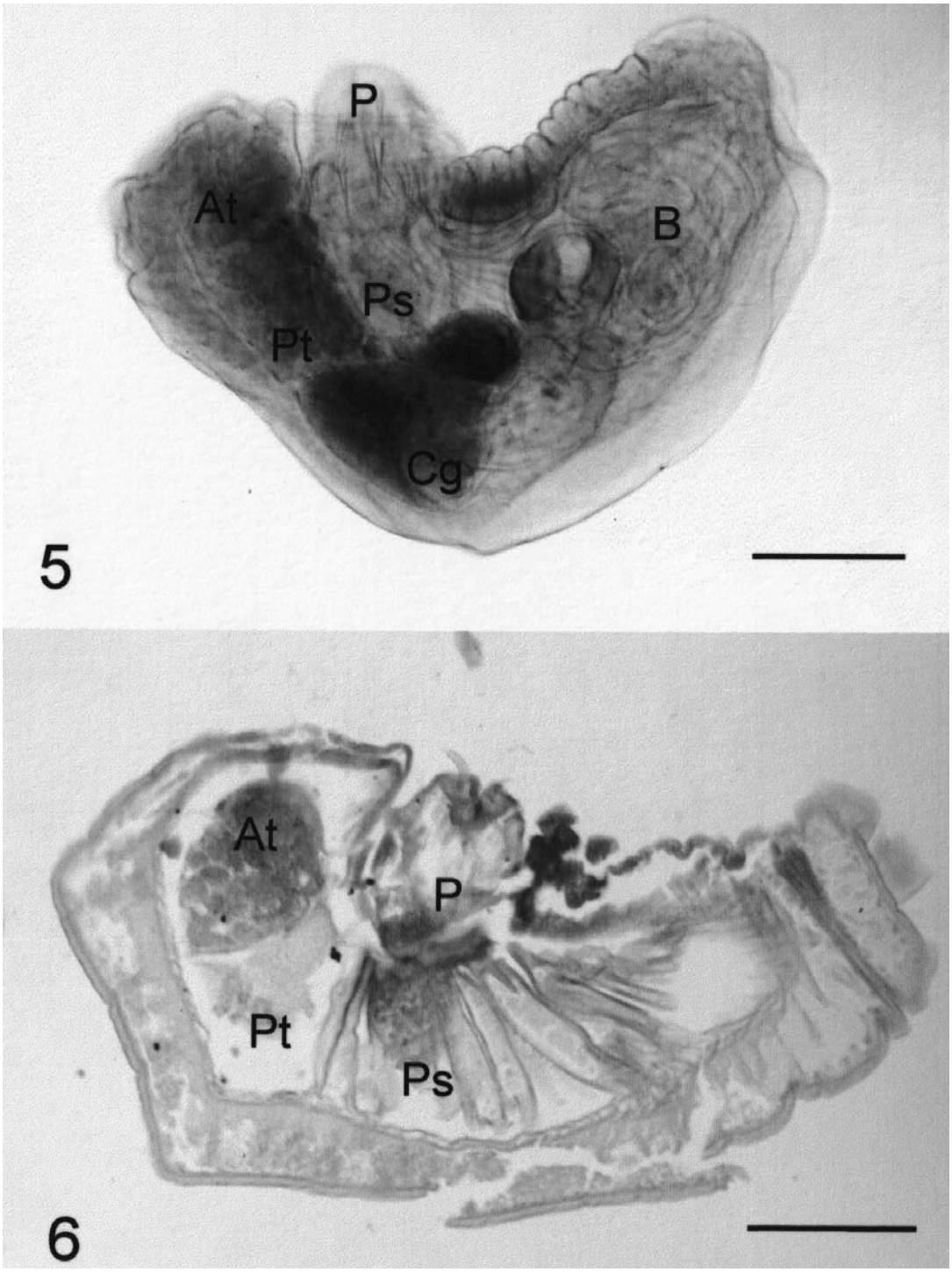
Holotype (male) and allotype (female), 1 slide, USNPC 95786; paratypes, 4 slides, USNPC 95787.

Etymology

The new genus is named for the order of its host; the new species is named in reference to the genus of its host.

DISCUSSION

The new species most closely resembles *Hypoechinorhynchus alaeopis* Yamaguti, 1939 in that both species have a subterminal, spheriod proboscis armed with 10 longitudinal rows alternating between 2 and 3 hooks each, a commaform body, and spherical contiguous testes anterior to midbody. The two species differ in that the posterior proboscis hooks are shortest in *H. alaeopis*, while in *S. sphenomorphicola* the apical hooks are shortest. Yamaguti (1939) [2]



Figs. (5,6). *Sauracanthorhynchus sphenomorphicola* n. sp. (male). 5. Entire, cedarwood oil preparation. Scale bar 125 µm. 6. Sagittal section, hematoxylin and eosin. Scale bar 125 µm. Abbreviations: At, anterior testis; B, bursa (withdrawn); Cg, cement glands; P, proboscis; Ps, proboscis sheath; Pt, posterior testis.

assigned *H. alaeopis* to the Echinorhynchidae but did not indicate a subfamily.

Petrochenko (1956) [3] created 4 subfamilies for the (at that time) 65 species and 12 genera assigned to the Echinorhynchidae; Echinorhynchinae Meyer, 1931; Heteracanthocephalinae Petrochenko, 1956; Hypoechinorhynchinae Petrochenko, 1956; and Leptorhynchoidinae Petrochenko 1956. Four genera, *Acanthocephaloides* Meyer, 1933, *Bolborhynchus* Achmerov and Dombrovskaja-Achmerova, 1941, *Paracanthocephalus* Achmerov and Dombrovskaja-Achmerova, 1941, and *Hypoechinorhynchus* Yamaguti, 1939 because of their small, almost circular, lightly armed proboscis were assigned to the Hypoechinorhynchinae. Yamaguti (1963) [4] synonymized *Paracanthocephalus* with *Acanthocephalus* Koelreuther, 1771 (thus moved to Echinorhy-

nchinae), reassigned *Acanthocephaloides* to Echinorhynchinae, added *Fresnyarhynchus* Golvan, 1960 to Hypoechinorhynchinae and because *Bolborhynchus* was preoccupied replaced it with *Bolborhynchoides* Achmerow, 1959, thus reducing Hypoechinorhynchinae to 3 genera. Golvan (1969) [5] synonymized *Fresnyarhynchus* with *Bolborhynchoides* and raised Hypoechinorhynchinae to family level. Diagnostic features of the Hypoechinorhynchidae included small body size, a spineless thick-walled trunk enlarged anteriordorsally, a spherical proboscis with few large hooks, and contiguous, tandem testes (Golvan, 1969) [5].

Amin (1985) [6] recognized two species in *Hypoechinorhynchus*, *H. alaeopis* (type) and *H. magellanicus* Szidat, 1950. Gupta and Kumar (1983) [7] described *Hypoechinorhynchus golvani* Gupta and Kumar, 1983 from a single male specimen; the description is considered to be inadequate and the validity of the species is questioned (Pichelin, 1999) [8]. Two additional species have been described, *Hypoechinorhynchus thermaceri* de Buron, 1988 and *Hypoechinorhynchus robustus* Pichelin, 1999; all are parasites of marine fishes.

Zdzitowiecki (1990) [9] in a study of *Hypoechinorhynchus magellanicus* found trunk spines on a male specimen and stated that trunk spines made this species consistent with the Arhythmacanthidae rather than the Hypoechinorynchidae. Pichelin (1999) [8] found trunk spines on material identified as *H. alaeopis* by Johnston and Edmonds (1947) [10] and illustrated trunk spines on *H. robustus*. Thus trunk spines are present in 3 of the 4 species; Pichelin (1999) [8] states that the absence of spines needs to be confirmed for *H. thermacer*. Pichelin (1999) [8] proposed because of the presence of trunk spines, a lightly armed, spherical proboscis with small basal spines and large apical hooks, six cement glands, and contiguous, tandem testes to make Hypoechinorhynchidae a junior synonym of Arhythmacanthidae. *Hypoechinorhynchus* was retained as a valid genus because of its unique proboscis armature, longitudinal rows which a middle spine occurs in alternate rows, an arrangement not seen in other genera of arhythmacanthids (Pichelin, 1999) [8]. Given the emended description of *H. alaeopis* and the changed status of Hypoechinorhynchidae proposed by Pichelin (1999) [8], there is now an additional difference between the new species (absence of trunk spines) and *H. alaeopis* (trunk spines present) that prevents the assignment of the new species to a known family.

Among the Acanthocephala, the class Palaeacanthocephala Meyer, 1931 is characterized by the presence of lateral longitudinal lacunar canals and a double-walled proboscis receptacle (Amin, 1987) [11], The presence of these 2 characters in the new species allows its assignment to the Palaeacanthocephala. Petrochenko (1956) [3] separated families assigned to this class (his subclass Echinorhynchinea Petrochenko, 1956) into 2 orders, Echinorhynchida Southwell and MacFie, 1925 and Polymorphida Petrochenko, 1956, based upon the absence of trunk spines (Echinorhynchida) or the presence of trunk spines (Polymorphida). The absence of trunk spines allows assignment of the new species to the Echinorhynchida. Because there are no families with the unique characters of the new species, i.e., subterminal, spherical proboscis with large basal hooks, aspinose trunk with expanded anterior and contiguous testes anterior to midbody, we have erected a new family, Sauracanthorhynchidae.

ACKNOWLEDGMENTS

Peggy Firth prepared illustrations 1-4. We thank A. Woolsey for assistance with dissections; I. Bigilale, F. Malesa, D. Salepuna, M. Tekwae, and B. Uruwa for field assistance; D. Mitchell and Conservation International for logistical assistance in Milne Bay Province; E. Teodoro for laboratory assistance; the PNG National Museum and Art Gallery for providing in-country collaborative assistance; and the PNG Department of Environment and Conservation, PNG National Research Institute, and Milne Bay Provincial Government for permission to work in Milne Bay Province. This work was supported by National Science Foundation grant DEB 0103794. This is contribution No. 05-012 from the Pacific Biological Survey at Bishop Museum.

REFERENCES

[1] Kraus F, Allison A. New records for amphibians and reptiles from Milne Bay Province, Papua New Guinea. Herpetol Rev 2004; 35: 413-418.

[2] Yamaguti S. Studies on the helminth fauna of Japan. Part 29. Acanthocephala, II. Japan J Zool 1939; 8: 317-351.

[3] Petrochenko VI. Acanthocephala of Domestic and Wild Animals. Vol. 1. Moscow: Izdatel'stvo Akademii Nauk SSSR 1956.

[4] Yamaguti S. Systema helminthum, Vol. V. Acanthocephala. New York: Interscience Publishers 1963.

[5] Golvan YJ. Systémaatique des acanthocéphales (Acanthocephala Rudolphi 1801). Première partie l'ordre des Palaecanthocephala Meyer 1931, première fascicule la super-famille des Echinorhynchoidea (Cobbold 1896) Golvan et Houin 1963. Mém Mus Natn Hist Nat 1969; 57: 1-373.

[6] Amin OM. Classification. In: Crompton DWT, Nickol BB. Ed. Biology of the Acanthocephala, London: Cambridge University Press 1985; pp. 27-72.

[7] Gupta PC, Kumar P. *Hypoechinorhynchus golvani* sp. nov. (Acanthocephala: Hypoechinorhynchidae) from estuarine fish, *Clarius batrachus* of Chilka Lake, Orissa. Kanpur Univ Res J 1983; 4: 85-89.

[8] Pichelin S. *Hypoechinorhynchus robustus* sp. n. from *Notolabrus parilus* (Labridae) from Western Australia with a discussion on the validity of the Hypoechinorhynchidae (Acanthocephala: Palaeacanthocephala). Folia Parasitol 1999; 46: 311-315.

[9] Zdzitowiecki, K. Reexamination of five Antarctic and subantarctic digenean and acanthocephalan species from Professor Szidat's collection. Acta Parastiol Pol 1990; 35: 31-36.

[10] Johnston TH, Edmonds SJ. Australian Acanthocephala. No. 5. Trans Roy Soc S Aust 1947; 71: 13-19.

[11] Amin OM. Key to the families and subfamilies of Acanthocephala, with the erection of a new class (Polyacanthocephala) and a new order (Polyacanthorhynchida). J Parasitol 1987; 73: 1216-1219.

Received: November 19, 2007 Revised: November 29, 2007 Accepted: December 03, 2007