J. Parasitol., 94(6), 2008, pp. 1305–1310

ON A NEW ACANTHOCEPHALAN FAMILY AND A NEW ORDER, FROM BIRDS IN VIETNAM

Omar M. Amin and Nguyen Van Ha*
Institute of Parasitic Diseases, P.O. Box 28372, Tempe, Arizona 85285. *e-mail: omaramin@aol.com*

ABSTRACT: During November 2000, a collection of acanthocephalans from birds in Quang Ninh Province, Vietnam, included a new genus and species in a new family and order. *Pyrirhynchus heterospinus* n. gen., n. sp. (Pyrirhynchidae n. fam.: Heteramorphida: new order) is described from *Actitis hypoleucos* (Linnaeus, 1758) (common sandpiper). The new family combines characters from Polymorphidae and Heteracanthocephalidae, and it includes new features. Specimens of the new species are distinguished from those of Heteracanthocephalidae and/or Polymorphidae by their long cylindrical trunk with anterior swelling, pyriform proboscis with hooks much larger ventrally, brain at the anterior end of the receptacle, specialized tubular cement glands, and elliptoid eggs with concentric shells. A detailed analysis of proboscis and trunk armature is included, and specimens of several species of *Arhythmorhynchus* Lühe, 1911 (Polymorphidae) were studied for comparative purposes. The proboscis of *P. heterospinus* is armed with 17 to 20 rows of 17 to 19 hooks each, with anterior 9–11 hooks rooted and posterior 6–10 spines rootless.

The Institute of Ecology and Biological Sciences (IEBS), Hanoi, Vietnam, has been under taking a large Faunistic Research Program (FRP) over the past few years. The parasitology component of this program included the examination of a variety of vertebrate hosts for helminth parasites in the various provinces of Vietnam. One of us (N.V.H.) was instrumental in conducting the FRP under which the reported specimens of acanthocephalans from birds were collected and made available. Other collections of acanthocephalans from amphibians, reptiles, and mammals were also obtained under the same program and have been reported previously (Amin et al., 2008b, 2008c). Most of the hosts were examined for the first time, and several of the acanthocephalans studied proved to represent new taxa. Among these, 4 new species are reported from other birds in Vietnam by Amin et al. (2008a). Several other acanthocephalans were also reported from Vietnam, e.g., Amin et al. (2000, 2004). In total, 28 species of Acanthocephala (17 Echinorhynchida, 7 Gyracanthocephala, and 4 Neoechinorhynchida) have been reported from Vietnamese fishes to date (Arthur and Te, 2006), but those from birds are unknown.

MATERIALS AND METHODS

The reported materials were collected during a study of the ecology and biology of birds in the Quang Ninh Province of Vietnam (106°15′–107°00′N, 20°15′–21°15′W) in November, 2000. Two birds were necropsied and their viscera were placed in 70% ethanol. Both birds were infected with 18 worms of which 13 were made available for this study; the remaining 5 specimens were deposited in the Hanoi IEBS collection. Upon the receipt of specimens in our Arizona laboratory, 2 worms were sent for a phylogenetic analysis; the remaining 11 worms were punctured with a fine needle and then stained in Mayer's acid carmine, destained in 4% HCl in 70% ethanol, dehydrated in ascending concentrations of ethanol (24 hr each), cleared in graduated (increasing) concentrations of terpineol in 100% ethanol to 100% terpineol, then 50% terpineol and 50% Canada balsam (24 hr each), and finally whole mounted in Canada balsam.

Measurements are in micrometers, unless otherwise stated. The range is followed by the mean (in parentheses). Length measurements are given before the width; the latter refers to maximum width. Trunk length does not include the neck, proboscis, or bursa. Eggs refer only to fully developed ripe eggs removed from the body cavity. Specimens were deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland, and the Harold W. Manter Laboratory Collection (HWMLC), Lincoln, Nebraska

Specimens of 9 species of *Arhythmorhynchus* were examined for comparative purposes. These specimens were loaned from the USNPC and from the HWMLC. They included the following: *Arhythmorhynchus comptus* Van Cleave and Rausch, 1950 (USNPC 37584, 97965, 97966; HWMLC 34572); *Arhythmorhynchus duocinctus* Chandler, 1935 (USNPC 97935); *Arhythmorhynchus eroliae* (Yamaguti, 1939) Van Cleave and Rausch, 1950 (USNPC 80789); *Arhythmorhynchus frassoni* (Molin, 1858) Lühe, 1911 (USNPC 97962; HWMLC 34766); *Arhythmorhynchus frontospinosus* (Tubangui, 1935) Yamaguti, 1963 (USNPC 65272); *Arhythmorhynchus jeffreyi* Schmidt, 1973 (HWMLC 33925); *Arhythmorhynchus longicollis* (Villot, 1875) Lühe, 1912 (HWMLC 34411); *Arhythmorhynchus pumilirostris* Van Cleave, 1916 (USNPC 2076; HWMLC 34002); and *Arythmorhynchus uncinatus* (Leuckart, 1876 in Kaiser, 1893) Lühe, 1911 (USNPC 97967).

RESULTS

The new worms described in this work include one new species in a new genus belonging to a new family and new order of acanthocephalans from 2 individuals of 1 species of birds collected in the Quang Ninh Province in November 2000. All 18 specimens collected from *Actitis hypoleucos* (Linnaeus, 1758) (=*Tringa hypoleucos* Linnaeus, 1758), the common sandpiper, proved to represent a new species and genus. Eleven specimens were studied microscopically and reported here. The new genus was placed in a new family and order because of its unusual combination of features that did not fit any existing family or order.

DESCRIPTION

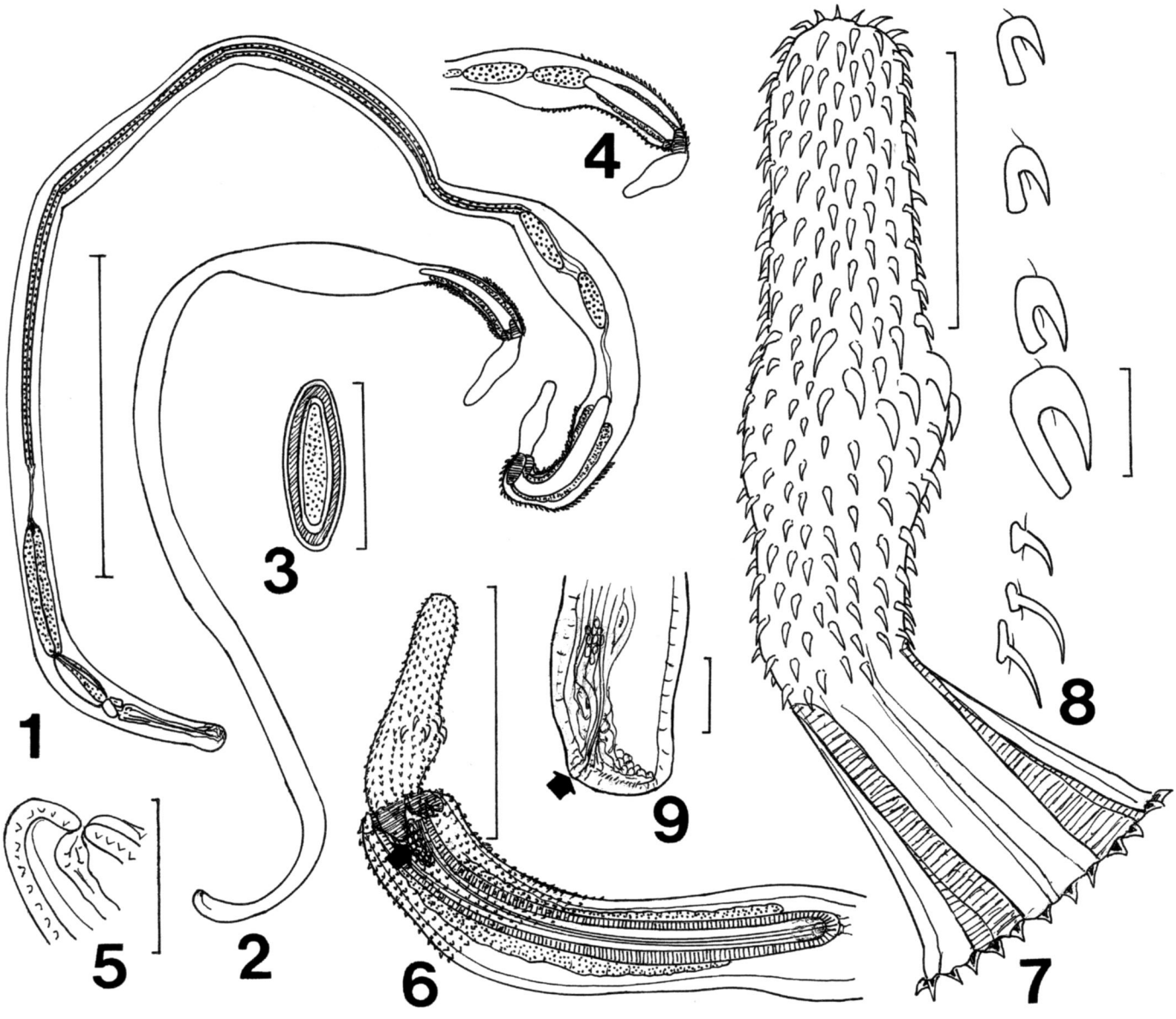
Heteramorphida n. order

Diagnosis: Palaeacanthocephala. Main longitudinal canals lateral. Trunk spinose. Hypodermal nuclei fragmented. No protonephridia. Proboscis with asymmetrical hooks enlarged ventrally. Proboscis receptacle double-walled with anterior cerebral ganglion. Cement glands tubular. Eggs with concentric shells. Parasites of shore birds.

Pyrirhynchidae n. fam.

Diagnosis: Heteramorphida. Trunk slender, spinose anteriorly. Hypodermic nuclei small and numerous. Proboscis spindle-shaped with ventral proboscis hooks rooted and markedly larger than dorsal rootless hooks. Proboscis receptacle double-walled with cerebral ganglion at its anterior end. Lemnisci, shorter than receptacle. Cement glands 2, tubular. Eggs with concentric shells; no prolongation of fertilization membrane or external polar caps.

Received 19 September 2007; revised 30 November 2007, 5 April 2008; accepted 7 April 2008.
* Institute of Ecology and Biological Science, Nghiado, Caugiay, Hanoi, Vietnam.



FIGS. 1–9. *Pyrirhynchus heterospinus* n. gen., n. sp. from *Actitis hypoleucos*. (**1**) Holotype male; note specialized cement glands. (**2**) Allotype female. (**3**) Egg. (**4**) Anterior portion of a paratype male showing extreme anterior position of testes. (**5**) Posterior end of allotype female showing the subterminal position of the gonopore. (**6**) Anterior portion of the paratype male; note the small stubby processes at the anterior end of the body cavity and the cephalic ganglion (arrow). (**7**) Proboscis and neck of a paratype female. (**8**) Lateral view of ventral proboscis hooks, roots, and spines in circles nos. 1, 5, 10, 11, 12, 17, and basal circle from a paratype female. (**9**) Posterior end of a paratype male showing the genital terminalia and gonopore (arrow) at the ventral side of the posterior end. Bar = 3 mm (1, 2, 4), 60 μm (3), 100 μm (5, 9), 750 μm (6), 300 μm (7), and 70 μm (8).

Pyrirhynchus n. gen.

Diagnosis: Pyrirhynchidae. Cylindrical slender worms with trunk spinose anteriorly. Proboscis spindle-shaped-elongate with posterior ventral rooted hooks considerably larger than rootless dorsal hooks at swelling; posterior spines also longer than dorsal. Cerebral ganglion at anterior wider end of double-walled receptacle. Lemnisci digitiform, subequal shorter than receptacle. Testes in anterior trunk swelling. Cement glands, 2, tubular, long and slender. Eggs with concentric shells. Parasites of shore birds.

Pyrirhynchus heterospines n. sp.

(Figs. 1–9)

General diagnosis (11 specimens [7 males, 4 females]): With characters of *Pyrirhynchus* (Pyrirhynchidae). Somewhat small, almost filamentous, spinose anteriorly in 1 field, uniformly cylindrical but usually with marked anterior ovate swelling just posterior to proboscis receptacle in both sexes; posterior trunk not dialated (Figs. 1, 2); few specimens with unremarkable swelling. Shared structures somewhat larger in females than in males. Proboscis pyriform-elongate with 16 to 20 rows of 17 to 19 hooks each. Anterior 9–11 hooks rooted; posterior 6–10 spines rootless. Posteriormost 10–11 ventral and lateral hooks abruptly increase in size at proboscis swelling (Fig. 7). Anteriormost hooks smallest. Dorso-lateral hooks opposite massive hooks very small. Hook roots simple, posteriorly directed, usually as long as hooks. Proboscis spines smallest anteriorly with second to fourth spines from anterior longer ventrally than dorsally and with knoblike roots in anterior spines but with small anteriorly directed manubria in posterior spines (Fig. 8). Trunk spines anterior, in 1 band, extending more ventrally than dorsally, more or less uniform in size vertically and dorso-ventrally but

slightly larger anteriorly (Fig. 6; Table I). Proboscis receptacle double-walled, widest anteriorly, in vicinity of large ovoid cephalic ganglion. Lemnisci subequal, digitiform, shorter than receptacle (Fig. 6). Two, occasionally lobulated, accessory processes at anteriormost end of body cavity.

Males (based on 5 mature specimens with sperm): Trunk 12.87–16.17 (14.86) mm long in 3 distinct regions: anterior region 1.12–2.05 (1.76) mm long by 0.35–0.45 (0.39) mm wide, ovate swelling 1.12–2.05 (1.45) mm long by 0.35–0.52 (0.42) mm wide, posterior trunk 10.62–12.63 (11.66) mm long by 0.30–0.47 (0.38) mm wide. Dorsal trunk spines in circles, incomplete posteriorly, 13–17 dorsally compared with 23–24 ventrally. Dorsal trunk spines 30–47 long, ventral spines 22–50 long (Table I). Proboscis 686–780 (731) long by 177–260 (195) wide at swelling, with 17–20 rows of 16–18 hooks each (9–10 hooks and 7–9 spines); measurements of dorsal lateral, and ventral hooks in Table I. Proboscis receptacle 1,300–1,612 (1,456) long by 132–170 (143) wide. Lemnisci subequal 884–1,342 (1,035) long by 30–92 (58) wide; Testes pre-equatorial, equal, oblong, close but not contiguous, and close to proboscis receptacle, but may overlap it (Fig. 4). Anterior testis 530–645 (593) long by 156–187 (169) wide; posterior testis 489–749 (629) long by 146–177 (158) wide. Cement glands 2, 9.54–11.00 (10.25) mm long, in 3 parts: single glands in anterior part long and slender 7,970–8,500 long by 42–65 wide followed by constriction 208–325 long by 15–35 wide and then becoming robust resembling cement reservoir (Fig. 1) 1,140–1,250 long by 50–110 wide. Saefftigen's pouch 625–832 (724) long by 114–177 (150) wide. Posterior end squarish with genital terminalia and gonopore on ventral side of posterior end (Fig. 9).

Females (based on 3 gravid females and 1 with ovarian balls): Trunk 10.15–21.50 (15.82) mm long in 3 distinct regions. In shorter female: anterior region 1.25 mm long by 0.22 mm wide, ovate swelling 1.75 mm long by 0.42 mm wide, posterior trunk 7.15 mm long by 0.22 wide. Dorsal trunk spines in 12–20 circles compared with 21–27 ventral circles. Dorsal trunk spines 30–55 long, ventral spines 30–45 long (Table I). Proboscis 718–780 (752) long by 150–198 (178) wide at swelling with 19–20 rows of 16–19 hooks each (9–11 hooks and 6–10 spines); measurements of dorsal, lateral and ventral hooks in Table I. Neck 312 long by 156 and 291 wide anteriorly and posteriorly, respectively. Proboscis receptacle 1,477–1,872 (1,620) long by 137–167 (157) wide. Lemnisci subequal, digitiform 1.125–1.269 (1.197) mm long by 0.035–0,050 (0.042) mm wide. Eggs elliptoid, with concentric shells and no external polar caps (Fig. 3) 55–65 (61) long by 22–30 (26) wide. Gonopore subterminal (Fig. 5).

Taxonomic summary

Type host: Actitis hypoleucos (Linnaeus, 1758), common sand piper.

Type locality: Quang Ninh Province (106°15′–107°00′N, 20°15′–21°15′W), Vietnam.

Site of infection: Intestine.

Type specimens: USNPC 99988 (holotype male), 99989 (allotype female and paratypes on same slide) (illustrated). Two additional paratype slides were deposited in the HWMLC (HWML48874, HWML48875).

Other specimens examined: Arhythmorhunchus comptus Van Cleave and Rausch, 1950 (USNPC 37584, 97965, 97966; HWMLC 34572); *Arhythmorhynchus duocinctus* Chandler, 1935 (USNPC 97935); *Arhythmorhynchus eroliae* (Yamaguti, 1939) Van Cleave and Rausch, 1950 (USNPC 80789); *Arhythmorhynchus frassoni* (Molin, 1858) Lühe, 1911 (USNPC 97962; HWMLC 34766); *Arhythmorhynchus frontospinosus* (Tubangui, 1935) Yamaguti, 1963 (USNPC 65272); *Arhythmorhynchus jeffreyi* Schmidt, 1973 (HWMLC 33925); *Arhythmorhynchus longicollis* (Villot, 1875) Lühe, 1912 (HWMLC 34411); and *Arhythmorhynchus pumilirostris* Van Cleave, 1916 (USNPC Kaiser, 1893) Lühe, 1911 (USNPC 97967).

Etymology: The new genus is named for the shape of the proboscis and the new species for the dorso-ventral asymmetry of posterior proboscis hooks. The family and order names combine elements from Heteracanthocephalidae and Polymorphidae.

Remarks

Attempts to fit Heteramorphida into Polymorphida Petrochenko, 1956, especially Polymorphidae Meyer, 1931 (usually with uniform proboscis hooks, medium position of the cephalic ganglion in the receptacle, and usually with polar prolongation of egg fertilization membrane), or into Echinorhynchida Southwell and MacFie, 1925, especially Heteracanthocephalidae Petrochenko, 1956 (with spherical to pear-shaped cement glands, polar prolongation of egg fertilization membrane, and parasitic specialization in fish), has failed as a new set of exceptions would have had to be created in either case involving higher taxonomic criteria. The new order, nevertheless, has similarities to both Polymorphida and Echinorhynchida. The name of the new order reflects this relationship. Pyrirhynchidae combines classical features of Polymorphidae (Polymorphida) and Heteracanthocephalidae (Echinorhynchida) with other features not represented in either family. The new family has the dorso-ventral proboscis hook asymmetry characteristic of Heteracanthocephalidae, but it does not share its pear-shaped to spherical cement glands, egg anatomy, or host preferences. Instead, it has the distinctly long tubular cement glands usually present in Polymorphidae, which often parasitizes birds, such as Pyrirhynchidae n. fam. does. Specimens of the new family also have eggs with concentric shells lacking the prolongation of the fertilization membrane found in the 2 other families (Table II).

The new genus is clearly distinguished from all genera of Polymorphidae and Heteracanthocephalidae (Table II). *Pyrirhynchus heterospinus* has a superficial similarity to *A. frassoni* and *A. uncinatus* (Polymorphidae) in body form and proboscis armature. Examination of these and the other species of *Arhythmorhynchus* confirmed the position of their cephalic ganglia at the middle of the receptacle as is characteristic of *Arythmorhynchus* and Polymorphidae. In addition, males of all species had terminal male gonopore, unspecialized cement glands, and eggs usually had polar prolongation of fertilization membrane. These 4 characteristics are the most important taxonomic traits separating taxa at the generic and family levels. The genera *Acanthocephalus* Koelreuther, 1771 and *Echinorhynchus* Zoega in O. F. Müller, 1776 are distinguished based only on the position of the cephalic ganglion, being at the posterior end or the middle of the receptacle, respectively. The egg structure and the position of the female gonopore distinguish *Prosthorhynchus* Kostylew, 1915 from *Plagiorhynchus* Lühe, 1911 (see Schmidt and Kuntz, 1966 and Amin et al., 1999). Van Cleave (1949) recognized the taxonomic and the phylogenetic importance of the cement glands, and Petrochenko (1956) split the genus *Echinorhynchus* into 3 genera, i.e., *Echinorhynchus*, *Pseudoechinorhynchus* Petrochenko, 1956, and *Metechinorhynchus* Petrochenko, 1956, based only on cement gland patterns.

Examination of specimens and of descriptions of species of *Arhythmorhynchus* demonstrated that the genus has a remarkably heterogeneous membership showing considerable variations in body form (cylindrical or with anterior swelling as in *A. frassoni* and *A. uncinatus*); proboscis shape (bulbous or cylindrical as in *A. eroliae* and *A. jeffreyi*); absence or presence of few and very large ventral proboscis hooks as in *A. frassoni*, *A. trichocephalus* (Leuckart, Kaiser, 1893), and *A. uncinatus*; number of unspecialized cement glands (2 or 4 as in *A. erolia* and *A. frassoni*); and structure of ripe eggs (fusiform with polar prolongation of fertilization membrane or ovoid with concentric membranes that may have external polar caps as in *A. frassoni* and *A. uncinatus*).

The taxonomic significance of these characters at the generic level cannot be underestimated. A revision of the taxonomic position of *Arhythmorhynchus* and its 31 species seems to be in order. The generic diagnosis needs to be emended, and membership of species in that genus and of the genus in Polymorphidae (considering its asymmetrical heteracanthocephalid-like proboscis hooks) needs to be reexamined. Van Cleave (1916), early on, already emended the diagnosis of *Arhythmorhynchus* and Petrochenko (1956) established *Skrjabinorhynchus* (now a junior synonym of *Arhythmorhynchus*) to include *A. capellae* and *A. eroliae* based on having 4 cement glands, no conspicuous swelling of proboscis or trunk, and no greatly enlarged proboscis hooks. Various species of *Arhythmorhynchus* have already been relegated to other genera, e.g., *Arhythmorhynchus brevis* (Van Cleave, 1916) to *Polymorphus* Lühe, 1911 (see Amin, 1992), and *Arhythmorhynchus fusus* (Harada, 1929) and *Arhythmorhynchus hispidus* (Van Cleave, 1925) to *Southwellina* Witenberg, 1932 (see Golvan, 1994). The confused state of *Arhythmorhynchus* taxonomy was briefly discussed by Schmidt (1973).

TABLE I. Armature of the proboscis and trunk of *Pyrirhynchus heterospinus* n. sp. from *Actitis hypoleucos* in Vietnam.

Length of proboscis hooks and spines: range (mean) in μm						Length of trunk spines: range (mean) in μm			
Males (n = 2)			Females (n =3)			Males (n =2)		Females (n =3)	
Dorsal	Lateral	Ventral	Dorsal	Lateral	Ventral	Dorsal	Ventral	Dorsal	Ventral
Hooks (from anterior)						Spines (from anterior)			
30–36 (33)	30–35 (32)	35–37 (36)	25–32 (29)	28–37 (32)	25–32 (29)	42–45 (43)	40–42 (41)	40–48 (45)	35–42 (39)
40, 40 (40)	35–37 (36)	37–45 (41)	30–37 (34)	32–40 (36)	35–42 (37)	42–47 (44)	37–40 (38)	40–55 (48)	37–42 (40)
42, 42 (42)	37–40 (38)	40–42 (41)	35–42 (39)	37–47 (42)	37–45 (41)	37–40 (38)	37–38 (37)	35–45 (40)	32–40 (37)
40–44 (42)	40, 40 (40)	40–45 (42)	41–42 (42)	42–47 (44)	42–47 (44)	35–37 (36)	35–38 (36)	37–45 (42)	30–40 (35)
40–44 (42)	40–42 (41)	40–45 (42)	42–45 (43)	37–47 (42)	42–47 (44)	32–35 (33)	32–35 (33)	32–48 (42)	30–37 (34)
40–42 (41)	40–42 (41)	40–45 (42)	42–46 (43)	37–47 (42)	44–45 (44)	32, 32 (32)	32–35 (33)	32–37 (34)	32–37 (35)
42–42 (42)	35–42 (38)	40–45 (42)	40–44 (42)	37–47 (42)	40–46 (43)	32, 32 (32)	32–35 (33)	35–37 (36)	35, 35 (35)
35–43 (39)	32–40 (36)	42–45 (43)	37–44 (40)	34–47 (41)	37–42 (40)	30–32 (31)	32–35 (33)	32–40 (36)	32–37 (34)
32–42 (37)	35–45 (40)	42–45 (43)	37–42 (40)	35, 62 (48)	40–45 (43)	30, 30 (30)	35, 35 (35)	35–42 (38)	32–37 (35)
–	65–67 (66)	57–71 (64)	42, 42 (42)	55–67 (59)	42, 60 (51)	30–35 (32)	35, 35 (35)	40–42 (41)	32–40 (36)
–	–	–	–	–	70–71 (71)	32–35 (33)	35–37 (36)	32–47 (39)	35–37 (36)
N = 9 hooks	10 hooks	10 hooks	9, 10 hooks	9, 10 hooks	10, 11 hooks	32–37 (34)	35–37 (36)	35–42 (38)	32–37 (35)
						30–36 (33)	35–37 (36)	32–37 (34)	37–45 (41)
Spines (from anterior):									
27–30 (28)	25–27 (26)	30–35 (32)	25–27 (26)	20–30 (25)	22–35 (29)	36	35, 35 (35)	32, 40 (36)	37–40 (38)
30–42 (36)	30–40 (35)	47–50 (48)	30–35 (32)	27–47 (37)	44–55 (50)	40	32–35 (33)	30, 30 (30)	35–40 (37)
42–47 (44)	25–30 (27)	50–52 (51)	40–45 (42)	30–45 (40)	50–57 (54)	40	32–35 (33)	30–32 (31)	37–40 (38)
40–51 (45)	30–40 (35)	52–55 (53)	45–47 (46)	25–47 (36)	45–55 (52)	40	35, 35 (35)	30–37 (33)	35–40 (38)
47–51 (49)	37–47 (42)	52, 52 (52)	46–52 (48)	30–45 (37)	50–51 (52)	–	35–42 (38)	30–32 (31)	38–40 (39)
45–52 (48)	45–50 (47)	47, 47 (47)	46–57 (50)	40, 40 (40)	47–57 (52)	–	35–45 (40)	30–32 (31)	35–40 (37)
50, 50 (50)	40–48 (44)	42, 42 (42)	35–52 (44)	42, 42 (42)	45–47 (46)	–	35–50 (42)	32	35–45 (40)
44–47 (45)	–	40, 40 (40)	37–40 (39)	35	45	–	32–40 (36)	–	35–37 (36)
45	–	–	45	–	–	–	27–37 (32)	–	40, 40 (40)
–	–	–	42	–	–	–	22–37 (30)	–	40–42 (41)
N = 8, 9 spines	7 spines	8 spines	9, 10 spines	6–8 spines	7, 8 spines	–	30	–	40, 42 (41)
						–	–	–	35, 40 (37)
						–	–	–	25
						–	–	–	37
Total hooks and spines:						Total spines:			
17, 18	17	18	18, 19	16, 17	17–19	13–17	23–24	12–20	21–27

TABLE II. Comparative features among Pyrirhynchidae n. fam., Polymorphidae, and Heteracanthocephalidae.

Character	Polymorphidae	Heteracanthocephalidae	Pyrirhynchidae
Trunk	Slender or bulbous, usually spinose	Slender or wider anteriorly, spinose in Aspersentinae Golvan, 1960	Elongate cylindrical, spinose
Proboscis	May be bulbous	Maybe swollen anteriorly	Spindle-shaped-elongate
Hooks	Usually similar dorso-ventrally	Much larger ventrally	Much larger ventrally
Brain	At middle of receptacle	At base of receptacle	At anterior end of receptacle
Cement gland	2–8, usually tubular	6, spherical to pear-shaped	2, tubular, specialized
Male gonopore	Terminal	Terminal	Subterminal
Eggs	Fusiform to oval with polar prolongation of fertilization membrane	Fusiform with polar prolongation of fertilization membrane	Elliptoid with concentric shells
Adult hosts	Fish-eating birds, waterfowl, marine mammals	Fish	Marsh birds

DISCUSSION

The new genus and species belong in a new unique family that combines an interesting assortment of features mostly represented in Polymorphidae and Heteracanthocephalidae. Avian hosts are rarely examined for parasites in these parts of Southeast Asia. Further studies of parasites of other bird species in these virgin territories may reveal related or unique new acanthocephalan forms, not to mention other parasitic groups. The common sandpiper, the definitive host for the present material, is also found across most of Europe and Asia. It migrates to Africa, southern Asia, and Australia and feeds on insects, crustaceans, and other invertebrates (Hadden, 2004). To the best of our knowledge, there seems to be no parasites reported from *A. hypoleucos* to date, save the present report. The wide geographical distribution of the common sandpiper, however, suggests that the distribution of the new species may not be limited to Vietnam.

Considering the above-mentioned points, the erection of a new order seems to be noncontroversial in light of a similar precedent. Thus, Amin (1987) erected a new order, Polyacanthorhynchida, in a new class, Polyacanthocephala to accommodate members of the monogeneric Polyacanthorhynchidae Golvan, 1956, that had been previously sheltered under Rhadinorhynchidae Travassos, 1923 (Palaeacanthocephala) by some authors and under Eoacanthocephala, by other authors, through 2 sets of exceptions. The legitimacy of these new taxa (Amin, 1987) has since been verified based on phylogenetic analysis (García-Valera et al., 2002). If the new order Heteramorphida is not established and the new genus *Pyrirhynchus* is assigned to either Heteracanthocephalidae or Polymorphidae, a whole new set of exceptions would have to be created to modify the concept of the foster family (and order) accommodating the new genus. We do not regard this as good taxonomy.

The former taxonomic system of the Acanthocephala may not always reflect or predict the many evolutionary forms that exist in nature. Ideally, a revision of the order-level systematics in the Acanthocephala would be desirable. This process, however, has been occurring on an incremental basis. Amin (1985) has already established a new system for the classification of the Acanthocephala. Moreover, Amin (1987) has erected a new order and class and provided a key to the higher taxa including classes, orders, families, and subfamilies. The present work adds a new order and a new family to the existing system. A new project on the higher taxonomy of the Acanthocephala will be forthcoming by the first author. The phylogenetic analysis of the reported new taxa will be published at a later date.

LITERATURE CITED

AMIN, O. M. 1985. Classification. *In* Biology of the Acanthocephala. D. W. T. Crompton and B. B. Nickol (eds.). Cambridge University Press, Cambridge, U.K., p. 27–72.

———. 1987. Key to families and subfamilies of Acanthocephala, with the erection of a new class (Polyacanthocephala) and a new order (Polyacanthorhynchida). Journal of Parasitology **73:** 1216–1219.

———. 1992. Review of the genus *Polymorphus* Lühe, 1911 (Acanthocephala: Polymorphidae), with the synonymization of *Hexaglandula* Petrochenko, 1950, and *Subcorynosoma* Hoklova, 1967, and a key to the species. Qatar University Science Journal **12:** 115–123.

———, A. G. CANARIS, AND J. M. KINSELLA. 1999. A taxonomic reconsideration of the genus *Plagiorhynchus* s. lat. (Acanthocephala: Plagiorhynchidae), with description of South African *Plagiorhynchus* (*Prosthorhynchus*) *cylindratus* from shore birds and *P.* (*P.*) *malayensis*, and key to the species of the subgenus *Prosthorhynchus*. Journal of the Helminthological Society of Washington **66:** 123–132.

———, N. V. HA, AND R. A. HECKMANN. 2008a. Four new acanthocephalans from birds in Vietnam. Comparative Parasitology **75:** 200–214.

———, ———, AND ———. 2008b. New and already known acanthocephalans from Amphibians and reptiles in Vietnam, with keys to species of *Pseudoacanthocephalus* Petrockenko, 1956 (Echinorhynchidae) and *Sphaerechinorhynchus* Johnston and Deland, 1929 (Plagiorhynchidae). Journal of Parasitology **94:** 181–189.

———, ———, AND ———. 2008c. New and already known acanthocephalans mostly from mammals in Vietnam, with descriptions of two new genera and species in Archiacanthocephala. Journal of Parasitology **94:** 194–201.

———, R. A. HECKMANN, AND N. V. HA. 2004. On the immature stages of *Pallisentis* (*Pallisentis*) *celatus* (Acanthocephala: Quadrigyridae) from occasional fish hosts in Vietnam. The Raffles Bulletin of Zoology **52:** 593–598.

———, ———, ———, P. V. LUC, AND P. N. DOANH. 2000. Revision of the genus *Pallisentis* (Acanthocephala: Quadrigyridae) with the erection of three new subgenera, the description of *Pallisentis* (*Brevitritospinus*) *vietnamensis* subgen. et. sp. n., a key to species of *Pallisentis*, and the erection of a new quadrigyrid genus, *Pararaosentis* gen. n. Comparative Parasitology **67:** 40–50.

ARTHUR, J. R., AND B. Q. TE. 2006. Checklist of the parasites of fishes of Vietnam. FAO Fisheries Technical Paper 369/2, Ho Chi Ming City, Vietnam, 133 p.

GARCÍA-VALERA, M., M. P. CUMMINGS, G. PÉREZ-PONCE DE LEÓN, S. C.

GARDNER, AND J. P. LACLETTE. 2002. Phylogenetic analysis based on 18S ribosomal RNA gene sequences supports the existence of class Polyacanthocephala (Acanthocephala). Molecular Phylogenetics and Evolution **23:** 288–292.

GOLVAN, Y. J. 1994. Nomenclature of the Acanthocephala. Research and Review in Parasitology **54:** 135–205.

HADDEN, D. W. 2004. Birds of the northern atolls of the North Solomons Province of Papua New Guinea. Notornis **51:** 91–102.

PETROCHENKO, V. I. 1956. Acanthocephala of domestic and wild animals, vol. 1. Izdatel'stvoAcademii Nauk SSSR, Moscow, Russia, 465 p.

SCHMIDT, G. D. 1973. Resurrection of *Southwellina* Witenberg, 1932, with a description of *Southwellina dimorpha* sp. n., and a key to genera of Polymorphidae (Acanthocephala). Journal of Parasitology **59:** 299–305.

———, AND R. E. KUNTZ. 1966. New and little-known plagiorhynchid Acanthocephala from Taiwan and the Pescadores Islands. Journal of Parasitology **52:** 520–527.

VAN CLEAVE, H. J. 1916. A revision of the genus *Arythmorhynchus* with descriptions of two new species from North American birds. Journal of Parasitology **2:** 167–174.

———. 1949. Morphological and phylogenetic interpretation of the cement glands in the Acanthocephala. Journal of Morphology **84:** 427–457.