2009

Historical Account of the Two Family-group Names in Use for the Single Accepted Family Comprising the "Fish Blood Flukes"

Stephen A. Bullard
Auburn University, ash.bullard@auburn.edu

Kirsten Jensen
University of Kansas

Robin M. Overstreet
Gulf Coast Research Laboratory, robin.overstreet@usm.edu

DOI: 10.2478/s11686-009-0012-8

Acta Parasitologica, 2009, 54(1), 78–84; ISSN 1230-2821

VERSITA

Historical account of the two family-group names in use for the single accepted family comprising the "fish blood flukes"

Stephen A. Bullard[1]*, Kirsten Jensen[2] and Robin M. Overstreet[3]

[1]Department of Fisheries and Allied Aquacultures, Auburn University, 203 Swingle Hall, Auburn, Alabama 36849, USA;
[2]Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, Kansas 66045, USA;
[3]Department of Coastal Sciences, Gulf Coast Research Laboratory, University of Southern Mississippi, 703 East Beach Drive, Ocean Springs, Mississippi, 39564, USA

Abstract

The family-group name for the "fish blood flukes" is unstable, with both "Aporocotylidae Odhner, 1912" and "Sanguinicolidae von Graff, 1907" in use for the single family. Although "Sanguinicolidae von Graff, 1907" (or "Graff, 1907") has been a widely-accepted family-group name for the fish blood flukes subsequent to Yamaguti's 1954 and 1958 synoptical publications ("Systema Helminthum"), a critical examination of the relevant literature, much of it published in German during 1900 through 1926, reveals that "Aporocotylidae Odhner, 1912" is the earliest available family-group name for these flukes. The name Aporocotylidae, moreover, was in wide usage by alpha taxonomists before 1954 and by several authors between 1954 and the present time. We speculate that the recent long-standing uncertainty about the earliest available family-group name primarily stems from the (1) logistics of Ludwig von Graff's tome published in 1904–1908, (2) bibliographic confusion between that work and another Graff work published in 1907 (both of which treat *Sanguinicola* but not *Aporocotyle*), (3) initial ambiguity regarding the phylogenetic relatedness of the first four aporocotylid species that were named, (4) lack of consensus on the status of Aporocotylidae and Sanguinicolidae and the genera included within them, and (5) misleading application of "Graff, 1907" to Sanguinicolidae by Poche in 1926, Fuhrmann in 1928, Yamaguti in 1954 and 1958, and subsequent review articles that treated fish blood flukes. Under the International Code of Zoological Nomenclature (ICZN, Article 8.3), "Sanguinicolidae" was not made available by Graff because he disclaimed the name in the same, and only, work wherein he used the name (ICZN, Article 8.3). Sanguinicolidae was first made available in 1926 by Poche, who referenced Graff's 1907 work. Hence, "Poche, 1926" comprises the correct authority and date for that family-group name, not "von Graff, 1907" or "Graff, 1907". Since we presently accept only a single family for all fish blood flukes and abide by the Principal of Priority (ICZN, Article 23), we herein regard Sanguinicolidae Poche, 1926 as a junior subjective synonym of Aporocotylidae Odhner, 1912.

Keywords

Aporocotylidae, fish blood fluke, Graff, nomenclature, Odhner, Plehn, Poche, Sanguinicolidae

Introduction

The family-group name for "fish blood flukes" is unstable, with some authors using "Aporocotylidae Odhner, 1912" and others using "Sanguinicolidae Graff, 1907". The history of the two family-group names for the fish blood flukes is interesting because it exemplifies a few ways in which an invalid taxon name can be misconstrued by taxonomists abiding by the provisions of the "International Code of Zoological Nomenclature" (ICZN) (International Commission of Zoological Nomenclature 1999) and using the "Index Catalogue of Medical and Veterinary Zoology" (Doss and Humphrey 1955). Herein, near the centennial of the first literary mention of "Sanguinicolidae", we provide several important contributions to the nomenclature of fish blood flukes by (1) translating from Old German to English key passages within the series of early works treating fish blood flukes, (2) providing complete references for those early works, (3) providing a historical account of the family-group names for the fish blood flukes, and (4) emphasizing the correct authority and date of the earliest available family-group name.

Results and discussion

The first-named fish blood flukes

Odhner (1900) described the first-named fish blood fluke, *Aporocotyle simplex* Odhner, 1900, based on specimens col-

*Corresponding author: ash.bullard@auburn.edu

lected from the gill of flounder, *Platichthys flesus* (Linnaeus, 1758), (Pleuronectiformes, Pleuronectidae) (see Thulin 1980). He neither realized the worm was a digenean nor that it infected the blood, and he described it on page 62 as,

> "*Den Namen der neuen Gattung habe ich mit Rücksicht darauf gewählt*, *daß die ektoparasitischen Trematoden der Saugnäpfe und aller sonstigen mehr spezialisierten Anheftungsapparate völlig entbehrt*" ("*I chose the name of the new genus taking into trematodes that have been described so far*, *lacks suckers and any other more specialized attachment apparatuses*").

Five years later, Plehn (1905) described *Sanguinicola armata* Plehn, 1905 (type species) and *Sanguinicola inermis* Plehn, 1905 from the blood vascular system of tench, *Tinca tinca* (L., 1758), (Cypriniformes, Cyprinidae) and common carp, *Cyprinus carpio* L., 1758 (Cyprinidae), respectively, in Europe. As she indicated by her choice of the genus name, Plehn (1905) was the first worker to realize that these worms infected blood. But she, like Odhner five years before, did not recognize these species as digeneans nor did she group these species along with *A. simplex* in the same family. This level of confusion is understandable given the site of infection and the morphological features of species in *Aporocotyle* and *Sanguinicola*; these species, like all other fish blood flukes that have been named to date, infect extraintestinal sites and lack obvious, strongly muscular suckers, both of which are typical features of the nominal species of digeneans that were known in the early 1900's. Further, adult specimens of species of *Sanguinicola* are extremely small and difficult to study, even with modern microscopes, if specimens are not properly fixed, stained, and mounted. Plehn (1905) understandably misclassified the blood parasites as turbellarians for which she proposed the family-group name "Rhynchostomida". Plehn (1905) first recognized fish blood flukes as belonging to a unique family-group, and she diagnosed Rhynchostomida on page 252 as,

> "*Rhabdocoloelen mit ganz reduziertem Pharynx*. *Am Ende des geraden Vorderdarmes 4–6 große Blindsäcke rosettenförmig angeordnet*. *Mund an der Spitze des rüsselartig verlängerten Vorderendes*. *Zwei Geschlechtsöffnungen*; *Ovarien über den größten Teil des Körpers verteilt*; *sie umgeben die Hoden*, *die auf einen mittleren Streifen beschränkt sind*; *Copulationsorgan nur als stumpfe Papille entwickelt*. *Gehirn fehlt*. *2 Nervenlängsstämme mit einer vorderen Commissur*. *Sinnesorgane fehlen*. *Excretionsporus am hinteren Ende*; *zwei seitliche Hauptstämme vereinigen sich zu einem kurzen Ausführungsgang*" ("*Rhabdocoels with completely reduced pharynx*. *At the end of the straight anterior gut region* [oesophagus] *4–6 large*, *blind ending sacs arranged in a rosette*. *Mouth at the tip of the trunk/rhynchus-like elongated anterior end*. *Two genital openings*; *ovaries distributed across the majority of the body*; *they surround the testes which are restricted to a median band*; *copulatory organ developed as a blunt papilla only*. *Brain absent*. *2 longitudinal nerve stems with an anterior commissure*. *Sensory organs absent*. *Excretory pore at the posterior end*; *two lateral main stems unite to form a short excretory duct* [bladder]").

The family-group name "Rhynchostomida Plehn, 1905" was not accepted subsequently nor is it available under the ICZN (International Code of Zoological Nomenclature 1999). It does not fulfill Article 29.1 (Formation of family-group names) because it is not based on the name of any included genus (i.e., that of the type genus). Graff (1904–1908, page 2,505) rejected it, in part, on the grounds that the taxon "Rhynchostoma", whose rank was not specified by Graff, already existed, although this is not a case of true synonymy. Three years later, Plehn (1908) assigned *S. armata* and *S. inermis* to the Cestodaria based on a misinterpretation of particular features associated with the tegument, gut, and ovary (see below). *Deontacylix ovalis* Linton, 1910 was the fourth named species of fish blood fluke and the type species for the third accepted aporocotylid genus, *Deontacylix* Linton, 1910. Linton (1910) on page 16 stated that,

> "*One trematode*, Deontacylix ovalis, *was found which I do not recognize as having any near resemblance to any family*, *and I have therefore made it the type of a new suborder Deontacotylea*".

Although he realized it was a rather unique digenean, he neither proposed a family-group name for it nor compared it with the flukes described by Odhner or Plehn. Hence, although an active group of helminthologists (i.e., Linton, Odhner, and Plehn) had contributed thoroughly detailed descriptions of fish blood flukes before 1912, no worker had realized their close phylogenetic affiliation, and no available family-group name existed for any of the four nominal species.

Ludwig von Graff's two publications: 1904–1908 and 1907

It is quite possible that much of the confusion regarding priority of the available family-group names for fish blood flukes may have began with a German helminthologist, Ludwig von Graff, who evidently did not specialize in the study of fish blood flukes. Even though "Sanguinicolidae von Graff, 1907" is presently a widely-accepted name (e.g., Smith 1972, 1997a, b, 2002), the name Sanguinicolidae was not made available by Graff (see below). Graff published two large works relevant to the nomenclatural history of fish blood flukes, and both were published in German: one in 1907 having 132 pages (Graff 1907) and another during 1904–1908 having 867 pages (Graff 1904–1908). Graff (1907) treated the diversity and biology of animal parasites. It lacked the word "Sanguinicolidae"; however, it incorporated Plehn's (1905) published classification of *S. armata* and *S. inermis* as turbellarians in a single paragraph on page 24 that treated endoparasitic turbellarians,

> "*Unter den parasitischen Strudelwürmern gibt es ektoparasitische Blutsauger*, *entoparasitische Schmarotzer in der Niere und Leber der Weichtiere*, *im Darm und in der Leibeshöhle von Stachelhäutern und Krebsen*, *sowie schließlich im Blute von Fischen lebende*. *Teilweiser Verlust der Cilien*, *Verlust der zum Fang der Beute dienenden '-stäbchenförmigen Körper' und der diese liefernden Drüsen*, *teilweise oder gänzliche Reduktion der Sinnesorgane oder*

des Nervensystems sowie des Darmes (Sanguinicola, Fecampia) *sind die Rückbildungserscheinungen*, *denen als Neubildungen Bohr- und Haftapparte gegenüberstehen*" ("*Among the parasitic turbellarians there are ectoparasitic blood suckers*, *endoparasitic parasites in the kidney and liver of molluscs*, *in the gut and in the body cavity of echinoderms and crabs* [or crustaceans], *as well as finally those living in the blood of fish*. *Partial loss of cilia*, *loss of 'rod shaped bodies'*, *which serve to capture prey*, *and the glands associated with these* [bodies], *part or complete reduction of sense organs or the nervous system*, *as well as of the gut (*Sanguinicola *and* Fecampia*) are demonstrations of reversions*, *which are in opposite to penetration- and attachment apparatuses as new formations*").

Probably while Plehn (1908) was revisiting the morphological features of her specimens and determining them to be cestodarians rather than turbellarians (Plehn 1905), Graff continued working on the larger tome (Graff 1904–1908) that treated the taxonomy and systematics of turbellarians. This work was part of an encyclopedia-like natural history series entitled, "*Dr. H.G. Bronn's Klassen und Ordnungen des Tier-Reichs*". Graff's (1904–1908) "Turbellaria" (in "Abtheilung I. c" ["Part I. c"]) was included in the 4th volume ("Vierter Band") on "Vermes." In accordance with Doss and Humphrey (1955) and the ICZN, the tome Graff (1904–1908) is a single work printed over five years. Graff (1904–1908), not Graff (1907), is the Graff publication wherein "Sanguinicolidae" is used the first and only time.

Graff's disclaimer

In his tome treating turbellarians, Graff (1904–1908) used the word "Sanguinicolidae" a total of six times in reference to Plehn's (1905) "turbellarians" (= *Sanguinicola* spp.), see pages 2,091, 2,092, 2,093, 2,217, 2,289, and 2,505. However, because Graff incorporated newly-published taxonomic information drawn from various sources into his tome as it was undergoing the printing process, he ultimately revised some of the nomenclatural acts that had already been printed. That is, having access to the new data of his colleagues, Plehn being one of them, Graff (1904–1908) was compelled to emend particular nomenclatural acts. He included those emendations in the same published work (Graff 1904–1908) and directed the reader to pages 2,504–2,508 wherein he explained changes made to the tome during its printing so as to resolve confusion. The Preface written in September 1908 stated that,

"*Das Manuscript des morphologischen Theiles des vorliegenden Bandes war im April 1907 beendet*, *doch erlitt der Druck durch meine Studienreise nach den Vereinigten Staaten von Nordamerika eine halbjährige Unterbrechung*, *so dass die Abtheilung Rhabdocoelida nicht in so rascher Folge ausgegeben werden konnte*, *als ich ursprünglich in Aussicht genommen hatte*. *Und da Unterdessen eine grosse Zahl von Arbeiten im Gebiete der Turbellarien erschien*, *so war ich gezwungen*, *von S. 2290 angefangen*, *auch solche Publicationen zu berücksichtigen*, *welche im I. Nachtrag zum Litteraturverzeichnisse* (*S. 1985 ff.*) *nicht enthalten sind*. *Doch halte ich diese Ungleichmässigkeit für ein geringeres Uebel*, *als es die gänzliche Ausserachtlassung der seit October 1906 erschienenen Turbellarienlitteratur gewesen wäre*. *Allerdings sind dadurch Incongruenzen entstanden zwischen dem in morphologischen Theile zugrunde gelegten System und dem*, *mit Berücksichtigung der seither erschienenen Publicationen aufgestellten*, *neuen System*. *Ich rathe deshalb allen Lesern dieses Bandes*, *vorerst die S. 2504–2508 gegebene Begründung des neuen Systems einzusehen und namentlich auf folgende Punkte zu achten*: *1.* Sanguinicola *ist keine Turbellarie* (*s. S. 2505*)" ("*The morphological part of the manuscript in hand was completed in April 1907*, *but the printing was interrupted for half a year because of my study trip to the United States of North America*, *so that the Rhabdocoelida part was not distributed in due time*, *as I had originally proposed*. *Because a large number of works in the field of the Turbellaria had been published in the mean time*, *I was forced*, *starting on page 2*,*290*, *to take such publications under consideration*, *which are not included in the first addendum of the reference section* (*page 1*,*985 and following*). *However*, *I do consider this inconsistency to be the lesser of two evils*, *as compared to omitting all literature on turbellarians published since October 1906*. *Because of this*, *inconsistencies resulted between the system on which the morphological part was based and the new system erected with consideration of the publications that have appeared since*. *I therefore suggest to all readers of this volume to first consider the new system on pages 2*,*504–2*,*508*, *and namely to pay attention to*: *1.* Sanguinicola *is not a turbellarian* (*see page 2*,*505*)").

On page 2,505 he stated that,

"*Den* Hysterophora *musste ferner die*, *unmittelbar ehe der Druck des Rhabdocölidentextes began*, *durch Plehn* (*1098*) *bekannt gewordene Gattung* Sanguinicola *angeschlossen warden*, *wobei ich aber die für sie errichtete Familie im Sinne des Art. 4 der internationalen Regeln für die zoologische Nomenclatur Sanguinicolidae und nicht Rhynchostomida**) *benannte*." ("*Immediately before the printing of the rhabdocoelid text began*, *the genus* Sanguinicola, *which became known because of Plehn* (*1098*) [the four-digit number in parentheses is a reference number citing Plehn {1905}], *had to be attributed to the* Hysterophora, *whereby I however named the family for it according to Article 4 of the international rules for the zoological nomenclature Sanguinicolidae and not Rhynchostomida*").

The footnote on page 2,505 associated with "Rhynchostomida" reads,

"*Der Name* Rhynchostoma *ist überdies schon vergeben*" ("*Moreover*, *the name* Rhynchostoma *is already in use*").

He continues on to state that,

"*Kurz bevor diese Zeilen zum Druck befördert wurden*, *benachrichtigte mich jedoch Frau Dr. M. Plehn*, *dass es sich nach weiteren Untersuchungen herausgestellt habe*, *dass* Sanguinicola *zu den Cestodarien gehöre*. *Die "Cilien" des Integumentes hätten sich als Stäbchenbesatz*, *der*

> *"Darm" als ein Drüsenapparat unbekannter Function*, *die "Ovarialfollikel" als Dotterzellen erwiesen*. *Diese Familie muss demnach nunmehr ausgeschaltet werden*" ("*Shortly before these lines were carried to press*, *I was however contacted by Mrs*. *Dr*. *M*. *Plehn that through further investigations it became apparent that* Sanguinicola *belongs to the cestodarians*. *The 'cilia' of the integument turned out to be a rod-like covering, the 'gut' a gland apparatus of unknown function*, *the 'ovarian follicles' vitelline cells*. *This family* [i.e., Sanguinicolidae] *therefore now has to be dismissed*").

The verb "*auschalten*" also can mean that its object should not be used, rejected, turned off, excluded, or eliminated (Graff 1904–1908); all of which comprise a statement to the effect that the name Sanguinicolidae should be disclaimed for the purposes of nomenclature. Hence, in the earlier-printed portions of the tome (Graff 1904–1908), Graff assigned the species described by Plehn (1905), *S. armata* and *S. inermis*, both of which he assumed to be turbellarians, to a family within "Rhabdocoelida" that he planned to call "Sanguinicolidae". However, after being informed that Plehn (1908) had reclassified *S. armata* and *S. inermis* as cestodarians, Graff (1904–1908) updated the tome and disclaimed the name Sanguinicolidae. Without reading beyond page 2,091 in Graff (1904–1908), where Graff first mentions the family-group name Sanguinicolidae, this disclaimer would go unnoticed. According to ICZN Article 8.3 (names and acts may be disclaimed),

> "*If a work contains a statement to the effect that all or any of the names or nomenclatural acts in it are disclaimed for nomenclatural purposes*, *the disclaimed names or acts are not available*".

Interestingly, the Index Catalogue of Medical and Veterinary Zoology (Doss and Humphrey 1955) lists only page 2,505 (the page including the disclaimer), not page 2,091 (the first time "Sanguinicolidae" is used), following "Sanguinicolidae von Graff, L." (see page 1,388; Parts 5–8, H-Z); perhaps intending to emphasize this nomenclatural disclaimer in the published work of Graff (1904–1908) rather than the first literary mention of the word Sanguinicolidae.

Which has priority: *Aporocotylidae or Sanguinicolidae*?

In 1911, three years after the last pages of Graff's tome (1904–1908) were published, Odhner (1911, page 338) corrected his previous publication (Odhner 1900) and characterized *A. simplex* as a digenean that infects the branchial arterial system of flatfishes. As Stunkard (1923) pointed out on page 168,

> "*Odhner reinvestigated these forms and discovered their true nature*".

Odhner (1911) related *Sanguinicola* and *Aporocotyle* and then later (1912) proposed the family Aporocotylidae, including within it all of the species of fish blood flukes that had been named to date: *A. simplex*, *S. armata*, *S. inermis*, and *D. ovalis*. He did not mention the family-group name Sanguinicolidae nor reference Graff (1904–1908). The earliest justification for accepting separate families of fish blood flukes was given by Poche (1926), who did reference Graff. He proposed the superfamily "Sanguinicolida" and diagnosed each of the families he included within it: Aporocotylidae (*Aporocotyle* and *Deontacylix*, page 178), Sanguinicolidae (*Sanguinicola*, page 180), and "Spirorchidae" (page 176). Because he was the first worker who treated Sanguinicolidae as a valid taxon, "Poche, 1926", rather than "Graff, 1907" or "von Graff, 1907", made the name "Sanguinicolidae" available under the provisions of the ICZN. Fuhrmann (1930, pages 129–130) followed Poche's (1926) division of those genera into Aporocotylidae and Sanguinicolidae. Yamaguti (1954, 1958, 1970) apparently agreed with Poche (1926) in accepting both "Sanguinicolidae Graff, 1907" (including the subfamilies Sanguinicolinae Plehn, 1905 [not "Sanguinicolinae Yamaguti, 1958": by the principal of coordination, all family-level taxa based on the same type genus have the same author] [*Sanguinicola*, *Paradeontacylix* McIntosh, 1934], Cardicolinae Short, 1953 [*Selachohemecus* Short, 1954, *Cardicola* Short, 1953], Deontacylicinae Linton, 1910 [not "Deontacylicinae Yamaguti, 1958": see above] [*Deontacylix*], and Psettariinae Goto et Ozaki, 1930 [*Psettarium* Goto et Ozaki, 1930]) as well as "Aporocotylidae Odhner, 1912" (including only *Aporocotyle*). Yamaguti (1958), however, disagreed with Poche (1926) by including *Deontacylix* in Sanguinicolidae rather than Aporocotylidae. Regardless, these various divisions of genera by Poche (1926), Fuhrmann (1930), and Yamaguti (1958) have been summarily rejected by more recent workers (e.g., Overstreet and Køie 1989, Smith 2002), and a phylogenetic analysis of the interrelationships of fish blood flukes does not support that specific separation of the genera among those subfamilies (Bullard, unpublished data). Accepting for now only a single family of fish blood flukes as discussed above, we consider Aporocotylidae Odhner, 1912 as the earliest available family-group name for the fish blood flukes, and Sanguinicolidae Poche, 1926 as its junior subjective synonym (Bullard *et al*. 2008, Bullard and Jensen, in press).

Pre- and post-1954 usage of Aporocotylidae and Sanguinicolidae

We find it noteworthy that many German-writing taxonomists (e.g., Odhner 1912; Stunkard 1923; Ejsmont 1926; Szidat 1951, 1955) as well as others (Linton 1910; Joyeux 1924; La Rue 1926; Van Cleave and Mueller 1932; McIntosh 1934; Manter 1940, 1954; Short 1952, 1953, 1954) who treated fish blood flukes during 1900–1954 used the family-group name Aporocotylidae Odhner, 1912 only. Other authors have used "Aporocotylidae" since Yamaguti's synopses (1954, 1958) (e.g., Nahhas and Short 1965, Smith 1967, Wardle 1979, Stunkard 1983, Chu *et al*. 1992, Williams and Jones 1994, Shvetsova 2005), but their intent can be ambiguous. Do they recognize two families of fish blood flukes or do they accept Aporocotylidae as the earliest available family-group name for all fish blood flukes? Still other authors have recognized both "Aporocotylidae" (or "aporocotylid") and "Sanguinicolidae" (or "sanguinicolid") (e.g., Poche 1926; Fuhrmann 1928, 1930; Rasín 1929; Cheng 1964; Combes 2001), while

others unambiguously recognize Aporocotylidae only (e.g., Dawes 1968; Nobel and Nobel 1971; McLaren and Hockley 1977; Bullard *et al*. 2008; Bullard and Jensen, in press). Some authors accepted, without justification, only "Sanguinicolidae", e.g., Ginetsinskaya (1961, page 152), while others apparently overlooked all genera except *Sanguinicola* and referred to Sanguinicolidae only, e.g., Hyman (1951, page 295). Van der Land (1967, page 113) was the first author to specifically discuss the matter of priority regarding these family-group names, and he clearly accepted only "Sanguinicolidae Graff, 1907" while considering "Aporocotylidae Odhner, 1912" as its junior subjective synonym. Under the heading "The family Sanguinicolidae Graff, 1907" on page 113, Van der Land (1967) stated that,

> "*The characters of the new genus* Chimaerohemecus *suggest an evident relationship to the previously described blood flukes from fishes*, *all of which are here regarded as belonging to the family Sanguinicolidae*".

Following Van der Land (1967), some recent authors (e.g., Nobel *et al*. 1989; Smith 2002; Bullard and Overstreet 2003, 2004, 2006; Bullard *et al*. 2006) have rejected separate families of fish blood flukes and accepted "Sanguinicolidae Graff, 1907". Contrary to Van der Land (1967) and several others who published on fish blood flukes after 1954, Dawes (1968, page 93) clearly listed "Sanguinicolidae Graff of Fuhrmann, 1928, in part" as a synonym of "Aporocotylidae Odhner, 1912", including Aporocotylinae and Sanguinicolinae. Why Dawes (1968) referenced Fuhrmann (1928) rather than Poche (1926) is unclear, but regardless Dawes (1968) appears to be the only author who specified this synonymy before the present work.

Bibliographic confusion and a coincidence involving the year 1907

The synoptical works of Yamaguti (1954, 1958, 1970, 1971, 1975), the statement by Van der Land (1967), the reviews of Smith (1972, 1997a, b, 2002), and earlier works (Poche 1926; Fuhrmann 1928, 1930) have inadvertently propagated confusion regarding the earliest available family-group name for the fish blood flukes because of the application of "Graff, 1907" to "Sanguinicolidae". Contributing to this confusion, Graff (1907) discussed *Sanguinicola*, i.e., the genus name only, in a work that was published the same year as a portion of his larger work (1904–1908) wherein he used the word Sanguinicolidae the first time (Graff 1904–1908, page 2,091). Hence at first glance, one may assume that Graff (1907) is the correct work to cite as including a "proposal" of Sanguinicolidae; however, the only work that can correctly be cited for including the word "Sanguinicolidae" is the larger tome (Graff 1904–1908). Had Graff not disclaimed the name Sanguinicolidae on page 2,505 of his large tome, i.e., the last published mention of that family-group name by Graff, the correct taxonomic authority and date for Sanguinicolidae would indeed be "Graff, 1907". However, that name and date pertain to only the printing date of the relevant work. The two publications of Graff in 1907 have obviously been confused by some previous authors. For example, it is not uncommon to read the statement,

> "*The family Sanguinicolidae was erected by von Graff* (*1907*) *for the blood flukes of fish*".

In such an example, the author may reference Graff's (1907) "*Das Schmarotzertum im Tierreich und feine Bedeutung für die Artbildung*", which is in fact the incorrect reference (see above and References). Although excluded from Yamaguti's and Smith's works treating fish blood flukes, "*Dr. H.G. Bronn's Klassen und Ordnungen des Tier-Reiches*, *wissenschaftlich dargesstellt in Wort und Bild*" (Graff 1904–1908) is the only publication wherein Graff wrote the word "Sanguinicolidae". Also important regarding bibliographic confusion is the presentation of family-group dates by Yamaguti (1954, 1958), which may have mislead some readers, including most notably Van der Land (1967), because "Sanguinicolidae Graff, 1907" would appear to be available prior to "Aporocotylidae Odhner, 1912". Unrelated to nomenclature, Graff (1904–1908) did not recognize *Sanguinicola* spp. as flukes nor did he realize that Plehn's species were phylogenetically related to *A. simplex*. In fact, no evidence suggests that Graff (1904–1908) planned on using the name "Sanguinicolidae" for anything other than endoparasitic turbellarians. Because of that, although having no bearing on nomenclature, it is misleading to state that Graff proposed that family-group name for any fluke. On the other hand, Theodore Odhner was the first worker to (1) publish a description and name for a species of fish blood fluke (Odhner 1900), (2) diagnose and name a genus of fish blood fluke (Odhner 1900), (3) realize the close phylogenetic relationship between the species and other family members (Odhner 1911), and (4) propose a family-group name that still includes all of the "fish blood flukes" named at that time (Odhner 1912).

Acknowledgements. We thank Catherine Schloss and Joyce Shaw (both Gunter Library, Gulf Coast Research Laboratory) for interlibrary loan assistance and Judy Mullen (Guin Library, Hartfield Marine Science Center, Oregon State University) for reference help. We thank Daphne Fautin (University of Kansas, Lawrence) and two anonymous reviewers for providing valuable comments on an earlier draft of this manuscript. Funding for this work was provided by the Department of Fisheries and Allied Aquacultures (College of Agriculture, Auburn University) and the National Science Foundation under grant numbers 0508856, 0529684, and 0608603.

References

Bullard S.A., Jensen K. Blood flukes (Digenea: Aporocotylidae) of stingrays (Myliobatiformes: Dasyatidae): *Orchispirium heterovitellatum* from *Himantura imbricata* in the Bay of Bengal and a new genus and species of Aporocotylidae from *Dasyatis sabina* in the northern Gulf of Mexico. *Journal of Parasitology*, in press.

Bullard S.A., Overstreet R.M. 2003. *Elaphrobates euzeti* gen. and sp. n. (Digenea: Sanguinicolidae) from snappers (Lutjanidae) in the Gulf of Mexico. In: (Eds. C. Combes and J. Jourdane) *Taxonomie*, *écologie et évolution des métazoaires parasites*. *Taxonomy*, *ecology and evolution of metazoan parasites*. (*Livre hommage à Louis Euzet*). Tome 1. PUP Perpignan, France, 97–113.

Bullard S.A., Overstreet R.M. 2004. Two new species of *Cardicola* (Digenea: Sanguinicolidae) in drums (Sciaenidae) from Mississippi and Louisiana. *Journal of Parasitology*, 90, 128–136. DOI: 10.1645/GE-106R.

Bullard S.A., Overstreet R.M. 2006. *Psettarium anthicum* sp. n. (Digenea: Sanguinicolidae) from the heart of cobia *Rachycentron canadum* (Rachycentridae) in the northern Gulf of Mexico. *Folia Parasitologica*, 53, 117–124.

Bullard S.A., Overstreet R.M., Carlson J.K. 2006. *Selachohemecus benzi* n. sp. (Digenea: Sanguinicolidae) from the blacktip shark *Carcharhinus limbatus* in the Northern Gulf of Mexico. *Systematic Parasitology*, 63, 143–154. DOI: 10.1007/s11230-005-9010-x.

Bullard S.A., Snyder S.D., Jensen K., Overstreet R.M. 2008. New genus and species of Aporocotylidae (Digenea) from a basal actinopterygian, the American paddlefish, *Polyodon spathula*, (Acipenseriformes: Polyodontidae) from the Mississippi Delta. *Journal of Parasitology*, 94, 487–495. DOI: 10.1645/GE-1323.1.

Cheng T.C. 1964. The Biology of Animal Parasites. W.B. Saunders Company, Philadelphia, Pennsylvania, USA, 727 pp.

Chu J., Chu Ju., Lee Y., Youn M. 1992. *Aporocotyle theragrae* (Trematoda: Aporocotylidae) from the blood vessel of *Theragra chalcogramma*. *Korean Journal of Parasitology*, 30, 255–258.

Combes C. 2001. Parasitism: The Ecology and Evolution of Intimate Interactions. The University of Chicago Press, Chicago, Illinois, 728 pp.

Dawes B. 1968. The Trematoda, with Special Reference to British and other European Forms. Cambridge University Press, Cambridge, Massachusetts, 644 pp.

Doss M.A., Humphrey J.M. 1955. Supplement 3, Authors: A to I. In: *Index-Catalogue of Medical and Veterinary Zoology*. United States Government Printing Office, Washington D.C., 459–970.

Ejsmont L. 1926. Badania morfologiczne, systematyczne i rozwojowe nad gatunkami rodzaju *Sanguinicola* Plehn. (Morphologische, systematische und entwickelungsgeschichtliche Untersuchungen an Arten des Genus *Sanguinicola* Plehn). *Bulletin de l'Académie Polonaise des Sciences et des Lettres, Classe des Sciences Mathématiques et Naturelles*, *Sér. B*, *Sciences Naturelles* (1925), 877–966 (In German).

Fuhrmann O. 1928. Zweite Klasse des Cladus Plathelminthes: Trematoda. Handbuch der Zoologie (Kükenthal u. Krumbach), v. 2, 3 Lief., Teil 2. Bogen 1–8, p. 1–128, figs. 1–171 (continued in 1930).

Fuhrmann O. 1930. Idem. [concluded from 1928] Handbuch der Zoologie (Kükenthal u. Krumbach), v. 2, 7 Lief., Teil 2. Bogen 9–16, 18 Jan., p. 129–140, figs. 172–175.

Ginetsinskaya T.A. 1961. The life cycles of fish helminths and the biology of their larval stages. In: (Eds. V.A. Dogiel, G.K. Petrushevski and Yu.I. Polyanski) *Parasitology of Fishes*. Translation Oliver and Boyd, Edinburgh; reprint TFH Publications, Jersey City, New Jersey, 140–179.

Graff L. von. 1904–1908. Turbellaria, Bd. [volume] 4. Pages 1733–2599 *in* H.G. Bronn's Klassen und Ordnungen des Tier-Reichs, wissenschaftlich dargestellt in Wort und Bild. C.F. Winter'sche Verlagshandlung, Leipzig.

Graff L. von. 1907. Das Schmarotzertum im Tierreich und seine Bedeutung für die Artbildung. Verlag von Quelle and Meyer, Leipzig, 132 pp.

Hyman L.H. 1951. The Invertebrates: Platyhelminthes and Rhynchocoela, the Acoelomate Bilateria. McGraw-Hill Book Company, Inc., New York, 550 pp.

International Commission on Zoological Nomenclature. 1999. International Code of Zoological Nomenclature. 4th ed. International Trust for Zoological Nomenclature, London, UK, 306 pp.

Joyeux C.E. 1924. Les trematodes sanguicoles. *Annales de Parasitologie*, 2, 615–1619.

La Rue G.R. 1926. Studies on the trematode family Strigeidae (Holostomidae) No. III. Relationships. *Transactions of the American Microscopical Society*, 45, 265–281.

Linton E. 1910. Helminth fauna of the Dry Tortugas. II. Trematodes. Carnegie Institution of Washington, 133, 11–98.

Manter H.W. 1940. Digenetic trematodes of fishes from the Galapagos Islands and the neighboring Pacific. *Reports of the Allan Hancock Pacific Expedition*, 2, 329–497.

Manter H.W. 1954. Some digenetic trematodes from fishes of New Zealand. *Transactions of the Royal Society of New Zealand*, 82, 475–568.

McIntosh A. 1934. A new blood trematode, *Paradeontacylix sanguinicoloides* n. g., n. sp., from *Seriola lalandi* with a key to the species of the family Aporocotylidae. *Parasitology*, 26, 463–467.

McLaren D.J., Hockley D.J. 1977. Blood flukes have a double outer membrane. *Nature*, 269, 147–149.

Nahhas F.M., Short R.B. 1965. Digenetic trematodes of marine fishes from Apalachee Bay, Gulf of Mexico. *Tulane Studies on Zoology*, 12, 39–50.

Nobel E.R., Nobel G.A. 1971. Parasitology. The Biology of Animal Parasites. 3rd ed. Lea and Febriger, Philadelphia, 617 pp.

Nobel E.R., Nobel G.A., Schad G.A., MacInnes A.J. 1989. Parasitology. The Biology of Animal Parasites. 6th ed. Lea and Febriger, Philadelphia, 574 pp.

Odhner T. 1900. *Aporocotyle simplex* n. g. n. sp., ein neuer Typus von ektoparasitischen Trematoden. *Zentralblatt für Bakteriogie*, *Parasitenkunde*, *und Infektions krankheiten*, 72, 62–66.

Odhner T. 1911. *Sanguinicola* M. PlehnCein digenetischer Trematode! Mit einem Nachtrag über ältere Beobachtungen von Prof. A. Looss, Kairo. *Zoologischer Anzeiger*, 38, 33–45.

Odhner T. 1912. Zum natürlichen System der digenen Trematoden. V. *Zoologischer Anzeiger*, 41, 54–71.

Overstreet R.M., Køie M. 1989. *Pearsonellum corventum*, gen. et sp. nov. (Digenea: Sanguinicolidae), in serranid fishes from the Capricornia Section of the Great Barrier Reef. *Australian Journal of Zoology*, 37, 71–79.

Plehn M. 1905. *Sanguinicola armata* und *inermis* (n. gen. n. sp.) n. fam. Rhynchostomida. Ein ento-parasitisches Turbellar im Blute von Cypriniden. *Zoologischer Anzeiger*, 29, 244–252.

Plehn M. 1908. Ein monozoischer Cestode als Blutparasit (*Sanguinicola armata* und *inermis* Plehn). *Zoologischer Anzeiger*, 33, 427–440.

Poche F. 1926. Das System der Platodaria. *Archiv für Naturgeschichte*, 91, 1–458.

Rasín K. 1929. *Janickia volgensis* n. gen. n. sp., krevní motolice z ryby *Pelecus cultratus* (L.). *Biologické Spisy Vysoké Skoly Zverolékarské*, 8, 1–21.

Short R.B. 1952. A new species of blood fluke from marine fish (Trematoda: Aporocotylidae). *Journal of Parasitology*, 38 (4, section 2), 36.

Short R.B. 1953. A new blood fluke, *Cardicola laruei* n. g., n. sp., (Aporocotylidae) from marine fishes. *Journal of Parasitology*, 39, 304–309.

Short R.B. 1954. A new blood fluke, *Selachohemecus olsoni*, n. g., n. sp. (Aporocotylidae) from the sharp-nosed shark, *Scoliodon terra-novae*. *Proceedings of the Helminthological Society of Washington*, 21, 78–82.

Shvetsova L.S. 2005. Trematoda of the genus *Aporocotyle* (Sanguinicolata: Aporocotylidae) from fish far eastern seas. *Parazitologiya*, 39, 423–426.

Smith J.W. 1967. *Aporocotyle margolisi* n. sp. (Digenea: Aporocotylidae) from *Merluccius productus*. *Journal of the Fisheries Research Board of Canada*, 24, 1763–1773.

Smith J.W. 1972. The blood flukes (Digenea: Sanguinicolidae and Spirorchidae) of cold-blooded vertebrates and some comparison with the schistosomes. *Helminthological Abstracts*, *Ser. A*, 41, 161–204.

Smith J.W. 1997a. The blood flukes (Digenea: Sanguinicolidae and Spirorchidae) of cold-blooded vertebrates: Part 1. A review of the published literature since 1971, and bibliography. *Helminthological Abstracts*, 66, 255–294.

Smith J.W. 1997b. The blood flukes (Digenea: Sanguinicolidae and Spirorchidae) of cold-blooded vertebrates: Part 2. Appendix I: Comprehensive parasite-host list; Appendix II: Comprehensive host-parasite list. *Helminthological Abstracts*, 66, 329–344.

Smith J.W. 2002. Family Sanguinicolidae von Graff, 1907. In: (Eds. D.I. Gibson, A. Jones and R.A. Bray) *Keys to the Trematoda*. Vol .1. CAB International and The Natural History Museum, London, 433–452.

Stunkard H.W. 1923. Studies on North American blood flukes. *Bulletin of the American Museum of Natural History*, 48, 165–221.

Stunkard H.W. 1983. The marine cercariae of the Woods Hole, Massachusetts region, a review and revision. *Biological Bulletin*, 164, 143–162.

Szidat L. 1951. Neue Arten der Trematodenfamilie Aporocotylidae aus dem Blut und der Leibeshöhle von Süsswasserfischen des Rio de la Plata. *Zeitschrift für Parasitenkunde*, 15, 70–86.

Szidat L. 1955. La fauna de parasitos de *Merluccius hubbsi* como caracter auxiliar para la solucion de problemas sistematicos y zoogeograficos del genro *Merluccius*. *Comunicaciones del Instituto Nacional de Investigación de las Ciencias Naturales y Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"*, 3, 1–54.

Thulin J. 1980. A redescription of the fish blood-fluke *Aporocotyle simplex* Odhner, 1900 (Digenea, Sanguinicolidae) with comments on its biology. *Sarsia,* 65, 35–48.

Van Cleave H.J., Mueller J.F. 1932. Parasites of the Oneida Lake fishes. Part 1. Descriptions of new genera and species. *Roosevelt Wild Life Annals*, 3, 5–71.

Van der Land J. 1967. A new blood fluke (Trematoda) from *Chimaera monstrosa* L. *Proceedings. Koninklijke Nederlandse Akademie van Wetenschappen. Sect. C*, *Biological and Medical Sciences*, 70, 110–120.

Wardle W.J. 1979. A new marine cercaria (Digenea: Aporocotylidae) from the southern quahog *Mercenaria campechiensis*. *Contributions in Marine Science*, 22, 53–56.

Williams H., Jones A. 1994. The Variety of Fish Worms. In: (Eds. H. Williams and A. Jones) *Parasitic Worms of Fish*. Taylor and Francis Inc., Bristol, Pennsylvania, 1–52.

Yamaguti S. 1954. Systema Helminthum. Part I. Digenetic Trematodes of Fishes. Satyu Yamaguti (1953), 405 pp.

Yamaguti S. 1958. Systema Helminthum. Volume 1, Parts 1 and 2. Digenetic Trematodes. Interscience, London, 1575 pp.

Yamaguti S. 1970. Digenetic Trematodes of Hawaiian Fishes. Keigaku Publishing Company, Limited, Tokyo, 436 pp.

Yamaguti S. 1971. Synopsis of Digenetic Trematodes of Vertebrates. Keigaku Publishing Company, Limited, Tokyo, 1074 pp. (Vol. 1), 349 pp. + 219 pls. (Vol. 2).

Yamaguti S. 1975. A Synoptical Review of Life Histories of Digenetic Trematodes of Vertebrates with Special Reference to the Morphology of Their Larval Forms. Satyu Yamaguti, Kyoto, 590 pp. + 219 pls.

(Accepted November 20, 2008)