What is Skeneidae?
Soft Part Morphology of Three Putative Representatives (Gastropoda:Vetigastropoda)

Brückner, Martin; Ruthensteiner, Bernhard & Haszprunar, Gerhard
Zoologische Staatssammlung Muenchen, Munich, Germany
Email: haszi@zsm.mwn.de

Introduction

The current systematics of the vetigastropod family Skeneidae is mainly based on shell and radula characters. However, most authors consider the taxon as a polyphyletic assemblage and prefer to speak about "skeneimorph Vetigastropoda". In order to provide a better data basis and in particular to define Skeneidae also anatomically, we studied the morphology and anatomy of *Skenea serpuloides* (MONTAGU, 1808), the type species of Skeneidae and two additional skeneimorph gastropods.

Material and Methods

Specimens of *Skenea serpuloides* (MONTAGU, 1808), *Dikoleps cutleriana* (CLARK, 1849) and *Cyclostremiscus ornatus* OLSSON & MCGINTY, 1958 were serially sectioned after embedding in araldite resin. Anatomical reconstructions were prepared manually by measuring distances on every other or every fourth section.

	Skenea serpuloides and *Dikoleps cutleriana*	*Cyclostremiscus ornatus*
shell	thin	thick
operculum	multispiral	unknown
pattern on protoconch	unknown	honeycomb shaped
head tentacels	1 pair	1 pair
parapodial penis	present	missing
epipodial tentacle	2 pairs	3 pairs
eso-tentacle	present	present
eso-tentacle combined with epipodial tentacle	yes	no
ctenidium with ventilatory cilia	yes	yes
number of ctenidia	1	1
type of ctenidium	monopectinate	monopectinate
number of ctenidium lamellae	8	6
ctenidial bursicles	present	present
ctenidium with free tips	no	yes
ctenidium with skeletal rods	present	present
hermaphroditic	yes	yes
testis / ovary	seperate	true hermaphroditic gland
gonoducts	right kidney	right kidney
eggs	lecitotrophic	lecitotrophic
nervous system type	hypoathroid	hypoathroid
statocyst contents	statoconies	statoconies
eye type	retinal cup eye	retinal cup eye
pigmentation of eyes	missing	present
position of pericard	right	right
number of atria	1	1
rectum passing through venticle	unknown	yes
number of kidneys	2	2
kidneys different	yes	yes
radula type	rhipidoglossate	rhipidoglossate
number of radula cartilages	2	2
gastric shield	present	present
midgut gland	unpaired	unpaired

Table 1: Comparison of characters between *Skenea serpuloides*, *Dikoleps cutleriana* and *Cyclostremiscus ornatus*

Results

Skenea serpuloides (figs. 1, 2, 3, 6) and *Dikoleps cutleriana*
The morphology of both species is very similar. The shell is very thin, finely spirally striated and has a prosocline aperture. The protoconch is perfectly smooth.
A muscular foot bears a typical anteriorly opening pedal gland. Four different tentacles can be found: (1) one pair of papillate head tentacles, (2) two pairs of papillate epipodial tentacles with (3) epipodial sensory organ tentacles (= ESO-tentacles) at their base (fig. 6A), (4) a parapodial penis (fig. 6B). In the mantle cavity a monopectinate ctenidium can be found, which represents the original left ctenidium. Its lamellae insert at the axis, which is attached to the mantle cavity roof all over its length. The ctenidium bears skeletal rods and bursicles in the tips of each lamella. Both species have a highly specialised genital system with a large propodial penis and a corresponding receptaculum in the mantle cavity for inner fertilisation (fig. 1). They are simultaneous hermaphrodites with separated testis and an ovary opening into the right kidney. The eggs have a yolk-rich vitelline coat. The nervous system has fused pleuropedal ganglia and thus is hypathroid (fig. 2). The eyes are retinal cups which lack pigmentation. The monotocardian heart lies at the right side (fig. 1). The two kidneys, which are both connected to the pericard by the renopericardioducts, exhibit distinctly different histologies. The radula is rhipidoglossate. The stomach bears a gastric shield and has single opening into the unpaired midgut gland (fig. 3).

Cyclostremiscus ornatus (figs. 1, 2, 3, 4, 5)
The shell of this species is solid, flat spired, rich sculptured (fig. 5A) and with a honeycomb pattern on the protoconch (fig. 5B).
Softpart anatomy differs to the other two species investigated in:

- the parapodial penis is missing
- three pairs of epipodial tentacles, which are not combined with ESO-tentacles
- the ctenidial lamellae have free tips hanging into the mantle cavity
- true hermaphroditic gland (fig. 1)
- pigmented eyes

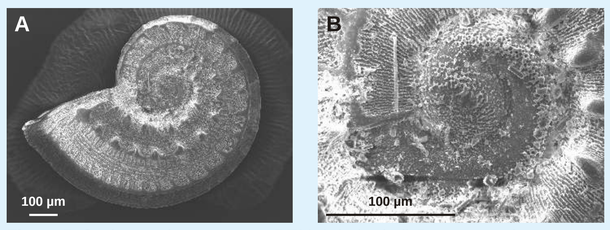

Figure 5: *Cyclostremiscus ornatus*, REM; A: hole shell; B: protoconch

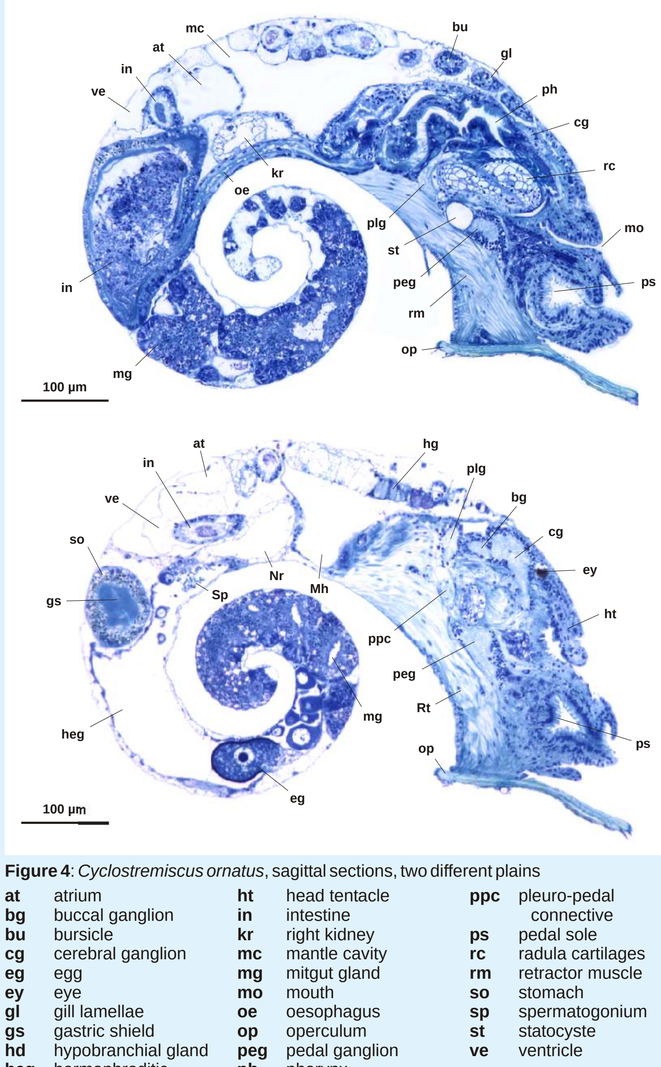

Figure 4: *Cyclostremiscus ornatus*, sagittal sections, two different plains

at	atrium	**ht**	head tentacle	**ppc**	pleuro-pedal connective
bg	buccal ganglion	**in**	intestine	**ps**	pedal sole
bu	bursicle	**kr**	right kidney	**rc**	radula cartilages
cg	cerebral ganglion	**mc**	mantle cavity	**rm**	retractor muscle
eg	egg	**mg**	mitgut gland	**so**	stomach
ey	eye	**mo**	mouth	**sp**	spermatogonium
gl	gill lamellae	**oe**	oesophagus	**st**	statocyste
gs	gastric shield	**op**	operculum	**ve**	ventricle
hd	hypobranchial gland	**peg**	pedal ganglion		
heg	hermaphroditic gland	**ph**	pharynx		
		plg	pleural ganglion		

Discussion and Conclusions

With our additional observations on the type species *Skenea serpuloides* and the very similar *Dikoleps cutleriana* the family Skeneidae can now be defined by the following combination of characters:

- very small (shell less 5 mm)
- loss of nacre in the shell
- prosocline aperture
- monopectinate ctenidium
- gill bursicles present
- elongated papillate head and epipodial tentacles (in lateral rows)*
- parapodial tentacle* (=penis) (fig. 6B)
- ESO-tentacle, combined with the epipodial tentacles**
- Hermaphroditic with seperated genital glands** (fig. 1)
- Monotocardian heart on the right side**

(* modified, ** newly established during this study)
These characters show the monophyly of Skeneidae and also support the systematic position of the family within the Vetigastropoda.

Cyclostremiscus ornatus cannot be assigned to the Skeneidae as defined above. At present it can only be placed within the Vetigastropoda because of the papillate tentacles, the ESO-tentacles and the gill bursicles. More specific placement is impossible because the combination of characteristics exclude the species from every other vetigastropodan clade too. It is obvious that many more taxa are to be anatomically studied to resolve the "skeneimorph lumping pot".

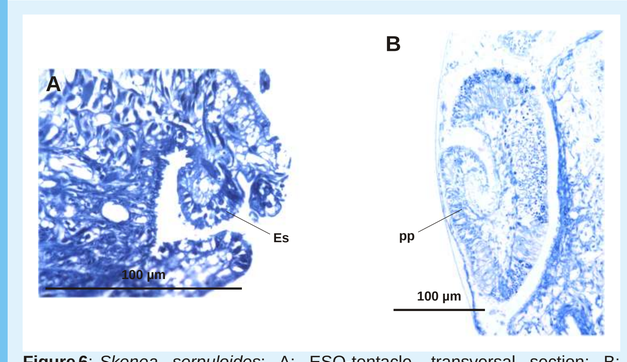

Figure 6: *Skenea serpuloides*; A: ESO-tentacle, transversal section; B: parapodial penis, transversal section
es ESO-tentacle **pp** parapodial penis

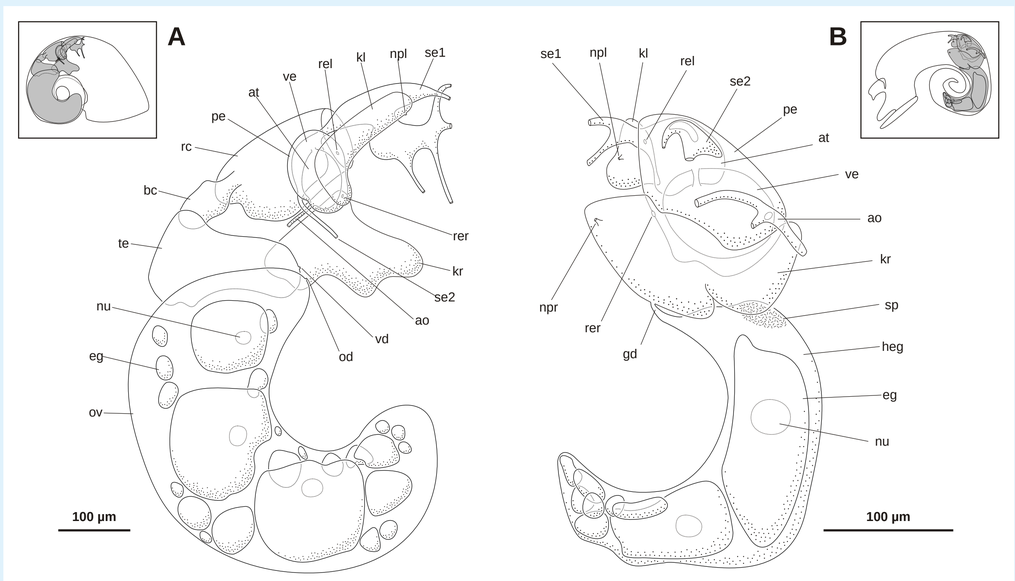

Figure 1: Genital- and Renopericardialsystem **A**: *Skenea serpuloides* **B**: *Cyclostremiscus ornatus*

ao	aorta	**kl**	left kidney	**ov**	ovary	**sp**	sperms
at	atrium	**kr**	right kidney	**pe**	pericardium	**te**	testis
bc	bursa copulatrix	**npl**	nephroporus left	**rc**	receptaculum seminis	**vd**	vas deferens
eg	egg	**npr**	nephroporus right	**rel**	renopericardiaduct left	**ve**	ventricle
gd	gonoduct	**nu**	nucleus of egg	**rer**	renoperikardiadukt right		
heg	hermaphroditic gland	**od**	oviduct	**se**	efferent sinus		

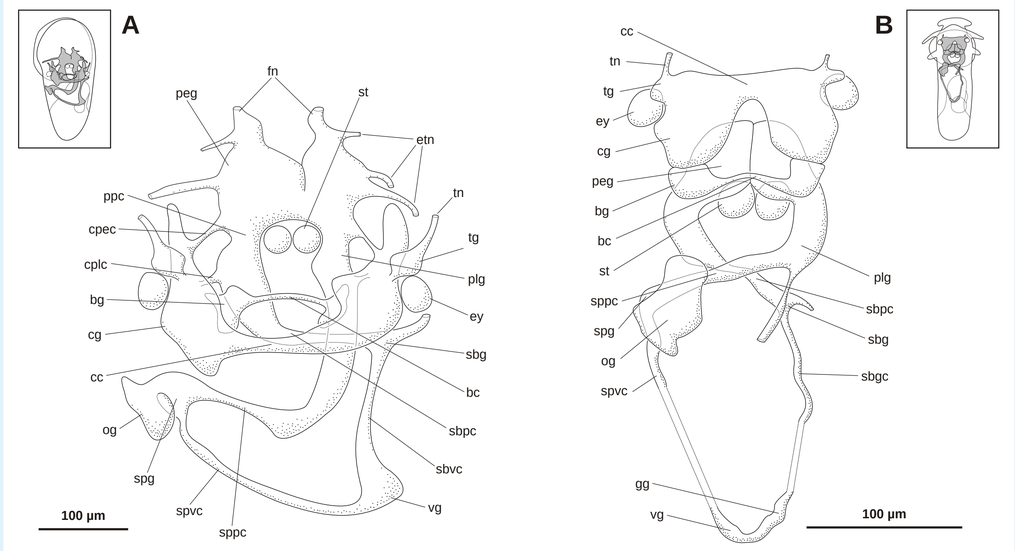

Figure 2: Nervous system **A**: *Skenea serpuloides* **B**: *Cyclostremiscus ornatus*

bc	buccal commissure	**ey**	eye	**sbg**	suboesophageal ganglion	**sppc**	supraoesophageal-pleural connective
bg	buccal ganglion	**fn**	foot nerve	**sbgc**	suboesophageal-genital connective	**spvc**	supraoesophageal-visceral connective
cc	cerebral commissure	**gg**	genital ganglion	**sbpc**	suboesophageal-pleural connective	**st**	statocyst
cg	cerebral ganglion	**og**	osphradial ganglion	**sbvc**	suboesophageal-visceral connective	**tg**	tentacle ganglion
cpec	cerebro-pedal connective	**spg**	supraoesophageal ganglion			**tn**	tentacle nerve
cplc	cerebro-pleural connective	**peg**	pedal ganglion			**vg**	visceral ganglion
etn	epipodial tentacle nerve	**plg**	pleural ganglion				
		ppc	pleuropedal connective				

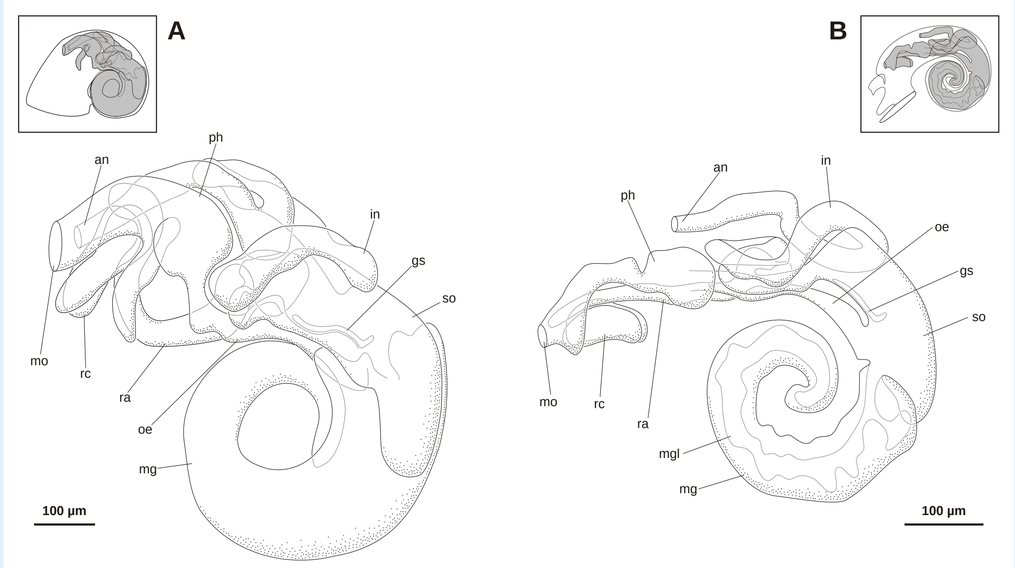

Figure 3: Digestive system **A**: *Skenea serpuloides* **B**: *Cyclostremiscus ornatus*

an	anus	**mg**	midgut gland	**oe**	oesophagus	**rc**	radula cartilages
gs	gastric shield	**mgl**	lumen of midgut gland	**ph**	pharynx	**so**	stomach
in	instestine	**mo**	mouth	**ra**	radula		