Studies on *Haliplectus* Cobb, 1913. A diagnostic species compendium of the genus *Haliplectus* and notes on intraspecific variation in *H. bickneri* Chitwood, 1956

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This last part of a series on *Haliplectus* Cobb, 1913 includes a species compendium of the genus and a brief comparative study of different populations of *H. bickneri* Chitwood, 1956.

Hierdie laaste gedeelte van 'n reeks artikels oor *Haliplectus* Cobb, 1913 bevat 'n diagnostiese spesiekompendium van die genus en 'n kort vergelykende studie van verskillende bevolkings van *H. bickneri* Chitwood, 1956.

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Introduction

This is the last paper in a series on the genus *Haliplectus*, the first of which contained a description of *H. algoensis* Swart, Heyns & Furstenberg, 1992, the second a redescription of *H. bickneri* Chitwood, 1956 based on an SEM-study of southern African specimens (Swart, Heyns & Coomans, in press) and the third a report on *Haliplectus* species from the Seychelles (Heyns & Swart, in press).

The following approach was used in the construction of the species compendium (Table 2): all nominal species were included, regardless of their status or the existing state of description, some of which are very incomplete (e.g. *H. conicephalus* Cobb in Chitwood, 1956 for which there are no illustrations and *H. obtusicauda* Schuurmans Stekhoven, 1943 for which the description is rather incomplete. We selected characters which are easily recognizable under the light microscope, and which were found during the present study to be the most useful diagnostic characters in this genus, viz. body length, number and arrangement of supplements, length and shape of spicules, tail shape, prominence of striations on valve plates in the basal bulb and prominence of caudal papillae. Naturally, we were limited by lack of information on characters in some earlier descriptions.

Information on number and position of caudal pores, and direction of winding of the amphid, is not available for enough species to evaluate the diagnostic value thereof. In some cases certain information or measurements had to be deducted or calculated from the illustrations. The a, b and c ratio's, although not of much diagnostic value, were included for the sake of completeness.

Notes on species

1. *Haliplectus bickneri* Chitwood, 1956 and *H. onepui* Yeates, 1967

At the time of our redescription of *H. bickneri*, we were still of the opinion that *H. onepui* was distinct from *H. bickneri*, and it was not considered in the discussion (Swart, Heyns & Coomans, in press). More recently, however, we studied *Haliplectus* specimens collected from sandy soil among the roots of *Arundo donax* (Spanish reed) at Sandvis Bay, Namibia (*legit* 20.7.86 by A. Coomans and J. Heyns). Since these specimens seemed to form a link between *H. bickneri* and *H. onepui*, we studied them in more detail, and compared them with our southern African specimens of *H. bickneri* as well as with one allotype male and two male and three female paratypes of *H. onepui* (courtesy of Dr. W.M. Wouts, Mt. Albert Research Centre, New Zealand). For comparative purposes, we present here brief descriptions of the Sandvis Bay specimens (including data on juvenile stages) as well as of the paratypes of *H. onepui*, and in Table 1 we compare these with morphometrical data of *H. bickneri*.

Sandvis Bay specimens (Figures 1A–F and 2A)

Male (n = 3): Cuticle 1,8–2,1 µm thick in neck region, 2,4 µm at midbody and 1,6–1,8 µm in tail region. Lateral chord 17 µm wide; two rows of sublateral pores present on both sides of body. Amphid apertures circular, 4–4,5 µm in diameter, unispiral, wound ventrad or dorsad. Anterior rim of amphid apertures situated 14–17 µm from anterior end. Basal bulb with smooth valve plates. Stoma with one denticle in base. Coelomocytes observed in some individuals. Spicules arcuate, equal in length (41 µm) and weakly cephalated in one male; of unequal length in the other two males, with the right hand side spicule longer (42–45 µm *vs* 37,5–41,5 µm) and more strongly cephalated than the one on the left hand side. Gubernaculum plate-like, without apophysis. Caudal pores on male tail numerous, six pairs situated subventrally and five pairs subdorsally. Tail elongate-conoid, spinneret faintly visible.

Female (n = 10): Tail elongate-conoid, slightly tapering in posterior one-third, with six or seven subventral and six subdorsal pairs of pores.

Juveniles: Description as for adults. Coelomocytes observed in almost all specimens of all juvenile stages.

J2 (n = 2) L = 0,81–0,91 mm; a = 24,5-25,1; b = 6,8-8,4; c = 21,3; c′ = 1,7; tail length 38–42,5 µm; stoma length 49–65 µm; oesophagus length 107,5–118 µm.

J3(n = 3): L = 0,83–0,84 mm; a = 20,2–23,1; b = 7,1–7,6; c = 20,7–24,0; c′ = 1,5–1,7; tail length 35–37 µm; stoma

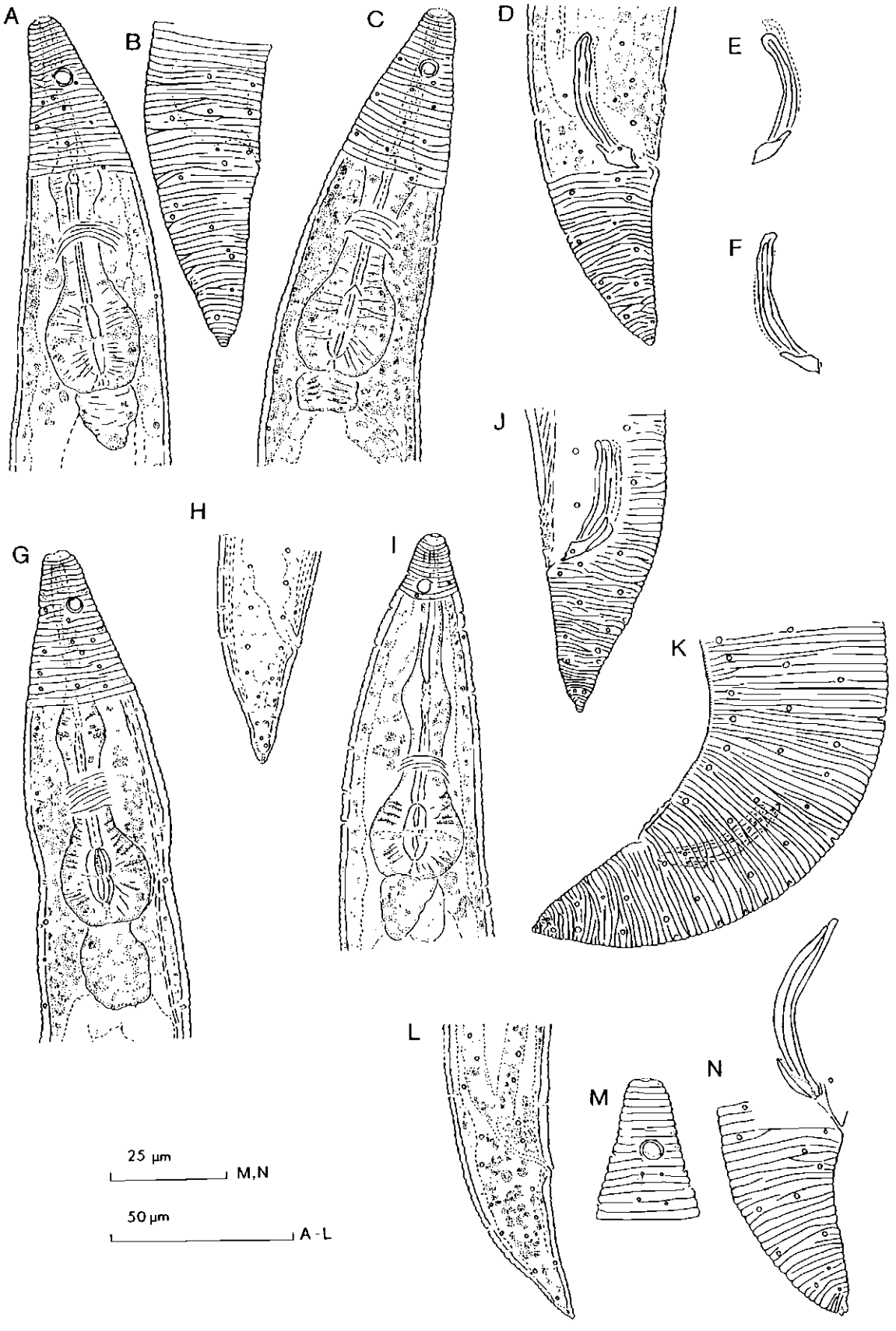


Figure 1A–F *Haliplectus bickneri* (Sandvis Bay population). A: anterior region of male; B: female tail; C: anterior region of female; D: male tail with spicules of equal lengths; E and F: spicules of unequal lengths. **G–K** *Haliplectus onepui* (paratype specimens). G: anterior region of male; H: female tail; I: anterior region of female; J: male tail with equal spicules; K: male tail with unequal spicules. **L–N** *Haliplectus bickneri* (from Swart, Heyns & Coomans, in press). L: female tail (Swartvlei population); M: external morphology of male head (Cebe population); N: male tail (Cebe population).

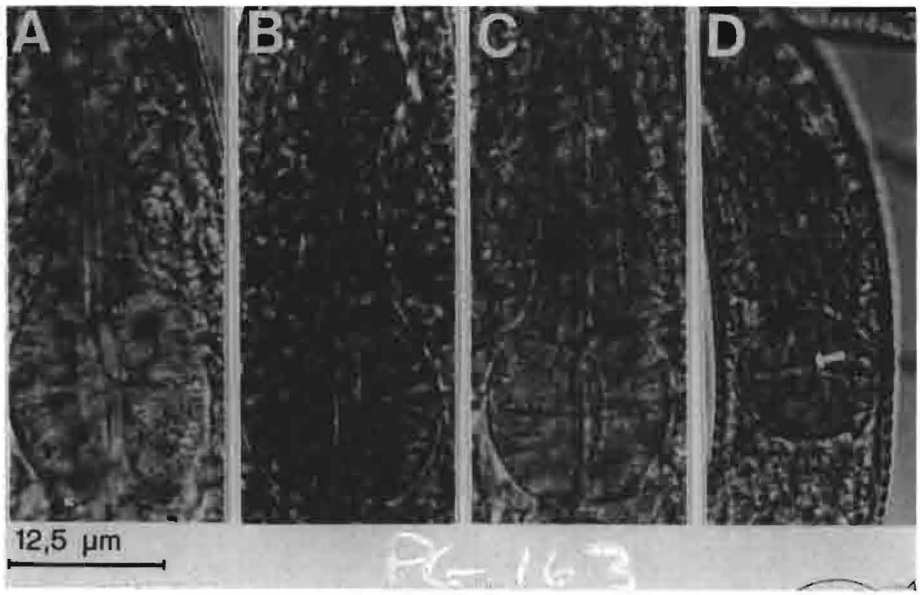


Figure 2A–D Comparison between the basal bulb valve plates of A: *Haliplectus bickneri* (Sandvis Bay population, ♂);B: *Haliplectus onepui* (Paratype specimen, ♂);C: *Haliplectus bickneri* (Swartvlei specimen, ♂,for locality see Swart, Heyns & Coomans, in press); D: *Haliplectus algoensis* Swart, Heyns & Furstenberg, 1992. Arrow indicates well-defined striations on the valve plates of *H. algoensis*, which are absent in Figures A, B and C.

Table 1 Morphometrical data of *H. bickneri*, New Zealand specimens (*H. onepui*) and Sandvis Bay specimens *(H. bickneri)*

	H. bickneri		New Zealand specimens		Sandvis Bay specimens	
	♂	♀	♂	♀	♂	♀
L (mm)	0,76–1,24	0,68–0,93	0,83–1,06	0,67–0,93	1,08–1,14	0,84–1,05
a	17–28	17–27	18–26	16–25	22,5–25,2	17,8–22,7
b	7–10,6	6,7–9,5	7,3–9,5	6,6–9,0	9,8–10,4	7,5–9,8
c	17,3–33	17–21	18–25	16–25	22,1–25,1	19,6–23,8
c′	1,4–1,9	1,4–1,8	1,2–1,9	1,5–2,1	1,3–1,6	1,4–1,8
Tail	38–48	27–47	35,5–38*	37–40*	43–51	38–50
V(%)		49–55		51–59,5		52,5–57,4
Stoma length (µm)	35–48	35–48	43–54*	45–46*	51–53,5	50,5–65,5
Pharynx length (µm)	86–117	86–117	94–108*	93–96*	106–110	101–121
Spicule length (µm)	35–45		31–39		37,5–45	
	always equal		equal or unequal		equal or unequal	
Gubernaculum length (µm)	12–18		12–13		13–14	
Supplements	4–5		4		5	
	contiguous		contiguous		contiguous	
Valve plates	not striated	not striated	striated or not striated	striated or not striated	not striated	not striated
Extent of midventral cuticular ridge	anterior to mid-body		anterior to mid-body		anterior to mid-body	

* Our measurements

length = 50–61,5 µm; oesophagus length = 98–117 µm.

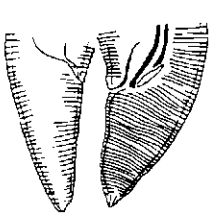
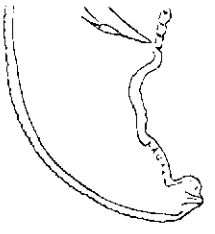
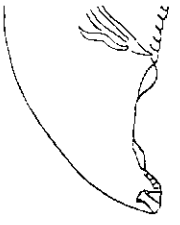
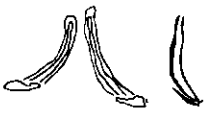
J4 (Immature female; *n* = 4): L = 0,89–0,98 mm; a = 18,1–21,1; b = 7,6–8,3; c = 19,7–23,9; c′ = 1,4–1,6; tail length = 41–46,5 µm; stoma length = 57,5–64 µm; oesophagus length = 114–122 µm; V = 51,2–55%.

J4 (Immature male; *n* = 3): L = 0,87–0,94 mm; a = 21,3–24,6; b = 7,8–8,3; c = 16,9–23,9; c′ = 1,4–1,7; tail length = 36,5–55 µm; stoma length = 51–57 µm; oesophagus length = 111–117 µm.

Paratypes of H. onepui *(Figures 1G–K and 2B)*

Male: Description as in Yeates (1967) with the following additional features: the allotype male has faintly striated valve plates and unequal spicules. The spicule on the left hand side is longer (38 µm) and slightly more strongly cephalated than the spicule on the right hand side (34 µm long). The spicules of the other two males (paratypes) are arcuate, slightly cephalated and of equal length. These two males have no striations on the valve plates. Caudal pores

Table 2 Diagnostic species compendium of the genus *Haliplectus* Cobb, 1913

	Species and author					
	algoensis Swart, Heyns & Furstenberg, 1992	*bibulbosus* (Schulz, 1935)	*bickneri* Chitwood, 1956	*bidenticulatus* Heyns & Swart (in press)	*brevispiculatus* Andrássy, 1973	*caudopapillatus* Gerlach, 1967
L (mm) ♂	0,66–0,68	0,85–1,17	0,76–1,24	1,2–1,5	1,05–1,08	1,41–1,5
♀	0,54–0,60	0,83–1,06	0,67–1,05	1,1–1,4		
a ♂	26,3–28,6	17–23	17–28	24–30	32–35	32–37
♀	21,7–29,3	14–19	16–27	22–24		
b ♂	7,8–8,7	7,9–11,5	7–10,6	9,9–12	11–11,6	11,6–12
♀	7,5–7,6	7,6–10,4	6,6–9,8	9–10,1		
c ♂	15,1–16,3	16,6–20	17,3–33	23,7–27,8	27–29	24–38
♀	15,5–21,1	15,5–21,6	16–25	20,5–26,9		
V(%)	50,0–50,2	50–66,6	49–59,3	46,9–56,3	only males found	only males found
Tail shape						
Striations on basal bulb valve plates	clearly striated	not striated	not striated or faintly striated	not striated	clearly striated	not striated
Protruberant caudal papillae	none	none	none	none	1	2 protruberant 1 thickening with 5 pores
No. of supplements	3	none	4–5	4	3	5–7
Arrangement of supplements	contiguous	–	contiguous	contiguous	contiguous	contiguous
Length of spicules (µm)	22–24	45–52	equal: 31–45 unequal: left 38** right 34	49–59	25	42–44
Shape of spicules						
Distribution	South Africa	Europe; Africa, Scandinavia	Europe; USA; Cuba; Africa New Zealand	Seychelles	Cuba	Red Sea
Illustration credit	20	8	4;11;** 24	13	1	12
Literature	20	8;9;11;12;18	1;4;11;12;21**;24	13	1	12

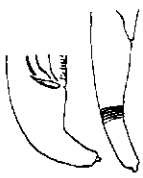
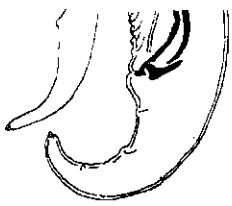
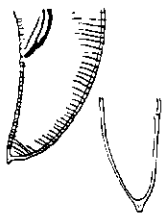
* Calculated, **Present study (pulication), ***Original description = 'striated'

on male tail numerous, four or five pairs subventrally, as well as subdorsally. Male tail elongate-conoid, the tail of one male slightly tapered in posterior one-third. Midventral ridge stretching from anteriormost supplement to about midbody (50–52% from anterior end). Amphids wound ventrad.

Female: Description as in Yeates (1967) with the following additional characters: caudal pores numerous, five or six pairs situated subventrally, five pairs subdorsally. Female tail elongate-conoid, tapering in posterior one-third. Amphids wound ventrad. No striations on basal bulb valve plates.

Discussion: A scrutiny of Table 1 shows that the diagnostic features of *H. bickneri* and the specimens of New Zealand (= *H. onepui*) and Sandvis Bay are very similar, except for striation of valve plates (absent in southern African and Namibian specimens, present in some New Zealand specimens — Figure 2 A–C) and spicule morphology (equal in length in all southern African specimens, unequal in some Namibian and New Zealand specimens — Figure 1 D, E, F, J, K and N). Average vulva position and stoma length differ among the three groups, but there is appreciable overlap in range of variation. Consideration of the above convinced us of the correctness of Bussau's (1990) synonymization of *H. onepui* with *H. bickneri*. It is interesting to note that Bussau

Table 2 Continued

Species and author						
conicephalus Cobb in Chitwood, 1956	*cylindricaudatus* Hopper, 1969	*dorsalis* Cobb in Chitwood, 1956	*floridanus* Cobb in Chitwood, 1956	*leptocephalus* Vinciguerra & Zullini, 1980	*minimus* Gerlach, 1967	*obtusicauda* (Schuurmans Stekhoven, 1943)
	0,67–0,71	0,7–1,0	1,46–1,6	0,51	0,49	1,36
1,9	0,65–0,69	0,66–0,73	1,6	0,51–0,58	0,40	0,76
	24–27	25–30	28–40	23	19	24
45	23,1	23–26	40	16–19	15,8	12,6
	7,1–7,8	7,0–10	11,5–13,6	7,3	8,1	10,5
14,5	7,4–7,5	7,1–7,7	13,3	7–8,3	7,3	6
	11,3–11,9	15,2–30	19,0–22,4	12	11,5	22
23	10,4–11,4	11–18	18,8	10–12	10,7	12,6
49	42–43	44–46	48	44–49	48	48*
unknown						
strongly striated	faintly striated	clearly striated or not striated	clearly striated	clearly striated	clearly striated	unknown
unknown	1 or 2*	none* or 2 lateral & 3 subdorsal	1 or 2*	none*	none*	unknown
unknown	2	1;2;3 or 4		none	±4*	unknown
unknown	wide apart	1;1+1 or 1+2-3	contiguous	–	contiguous*	unknown
unknown	32–35	26–32	33–48*	24	27	48*
unknown						
Massachusetts (USA)	Canada	USA; Europe	North America South America; Europe	Italy	Red Sea	Alexandria (North Africa)
–	14	15	4; 10	22	12	19
4	14	4;10;11;15	4;5;10;11	22	12	19

(1990) was of the opinion that both vulva position and stoma length are rather variable in *Haliplectus* species, and not useful for species diagnosis. He also found that striation of valve plates may vary within some species, confirming the opinion of Gerlach (1963) and Hopper (1969). No reference to unequal spicules in other species of *Haliplectus* could be found in literature, suggesting that this feature is unique in *H. bickneri*.

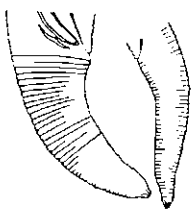
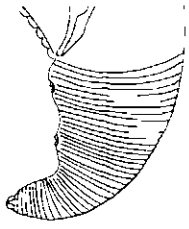
2. *H. obtusicauda* Schuurmans Stekhoven, 1943

The description of *H. obtusicauda* is very short and inaccurate (e.g. the gubernaculum length is given as one-half of the spicule length which does not correspond to the illustration). Furthermore, the morphometrical data of female and male differ so much that they might well represent two different species (e.g. L = 0,756 mm *vs* L = 1,356 mm; a = 12,6 *vs* a = 24,2; b = 6 *vs* b = 10,5 and c = 12,6 *vs* c = 21,8). We therefore consider this species as a *species inquirendae*.

3. *H. conicephalus* Cobb in Chitwood, 1956

The existing description of *H. conicephalus* has no illustrations. Gerlach (1963) suspected *H. conicephalus* and *H. floridanus* Cobb in Chitwood, 1956 to be synonymous. We consider this species as a *species inquirendae*.

Table 2 Continued

	Species and author					
	pellucidus Cobb, 1913	*salicornius* Pastor de Ward, 1984	*schulzi* De Coninck, 1943	*seychellensis* Heyns & Swart, (in press)	*tripapillatus* Blome, 1982	*wheeleri* Coles, 1965
L (mm) ♂	1	0,76–0,8	0,50–0,51	0,58–0,73	0,53–0,61	1,05–1,30
♀	1	0,8	0,51–0,59	0,60–0,63	0,60	1,05–1,15
a ♂	34	30–40	22–23	16,1–16,6	23	25–29
♀	32	26,7	19–22	14,1–16,9	23	21–27
b ♂	9,1	8,4	6,9–8,1	6,6–7,5	8–10	9,3–10,8
♀	8,6	9,2	6,4–7,1	6,4–6,9	7,5	9,6–10,1
c ♂	21	13,8–14,5	11,3–12,4	17,1	10,4–15,2	26–29
♀	21	11,4	11,1–12,7	15–17,2	13	29–32
V(%)	43	43,7	46–46,5	52,6–56,1	47	41,7–47,7
Tail shape						
Striations on basal bulb valve plates	striated***	clearly striated	not striated*	not striated	clearly striated	not striated*
Protruberant caudal papillae	unknown	none*	none*	2	none*	2 pairs
No. of supplements	unknown	3 or 4 papillae 2 pores	4	4	3	5
Arrangement of supplements	unknown	3 or 4 + 2	wide apart	contiguous	wide apart	contiguous
Length of spicules (µm)	unknown	20	19,6	41–43	21–23	30–31
Shape of spicules						
Distribution	Atlantic and Pacific coast (USA)	Argentina	Iceland; Europe	Seychelles	North Sea island	Great Britain
Illustration credit		23	7	13	2	6
Literature	4;5;11	23	7	13	2	6

4. *H. pellucidus* Cobb, 1913

The type species, *H. pellucidus* presents a problem as no drawings of this species are available. Blome (pers. comm. 1993) thinks that *H. pellucidus* should be regarded as a *species dubium* because of its insufficient description and the fact that it was said to have 'testes outstretched, anteriad in tandem' (original Cobb, 1913), an unusual condition among adenophorean nematodes (Lorenzen, 1981). Gerlach (1963) also speculated that *H. pellucidus* might belong to a totally different genus. In spite of this, we feel that the *status quo* should be retained until the type locality of *H. pellucidus* has been sampled for new material, especially since *Haliplectus* is such a well-established and easily identifiable genus.

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