Heterotrissocladius bipartitus (Diptera: Chironomidae), a new species with keys to pupal exuviae and adult males of the world

Janne Raunio[1] and Yngve Brodin[2]

[1]*Metsähallitus, Sapokankatu 2, FIN – 48100 Kotka, Finland. Corresponding author. E-mail:* janne.raunio@metsa.fi
[2]*Yngve Brodin, Swedish Museum of Natural History. Department of Zoology, Box 50007, SE – 104 05 Stockholm, Sweden. E-mail:* tav77ygg@gmail.com

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Abstract

Heterotrissocladius bipartitus sp. n. is described from Finland. The species is known from 12 geographical provinces in southern and central Finland. According to DNA barcode data, the species also occurs in the United Kingdom. The description is based on the adult male, male pupal exuviae and molecular data. The adult male of the new species can be assigned to the *H. marcidus* species group, but its pupal exuviae do not fit well with any of the three species groups (*subpilosus*-, *maeaeri*- and *marcidus* group). Molecular data suggest that *H. marcidus* is the closest relative of *H. bipartitus*. Males are recognizable by the inferior volsella having a posteriorly directed lobe. Characteristic features of pupal exuviae are prominent frontal warts on frontal apodeme, three lateral taeniae on VII, five on VIII and 23-26 taeniae on anal lobe. A key to the pupal exuviae of West Palaearctic species and a key to the adult males of *Heterotrissocladius* species of the world are provided.

Introduction

The chironomid genus *Heterotrissocladius* was erected by Spärck in 1923. Sæther (1975) revised species of the genus from the Nearctic and Palaearctic regions. Approximately 23 species of *Heterotrissocladius* are known worldwide with species in the Palaearctic, Nearctic and Oriental regions (Oliver et al. 1990, Ashe and O'Connor 2012, Yavorskaya et al. 2016, Caldwell and Jacobsen 2018).

Of the described Palaearctic species, five have been recorded from Finland (Paasivirta 2014). The Finnish fauna includes one undescribed *Heterotrissocladius* taxon with the interim name *Heterotrissocladius* sp. "Kolmperä" (Paasivirta 2014). In the 1960s Bernhard Lindeberg collected this species from a ditch in the Kolmperä region of Espoo, near the city of Helsinki. Sampling in SE Finland in 2025 for adult males and pupae, and using molecular barcoding revealed that some specimens matched Lindeberg's undescribed *Heterotrissocladius* species. We here describe this species as new to science.

Material and Methods

Morphological terminology for males follows Sæther (1980) and Oliver and Dillon (1989), but wing length was measured from the joint point with thorax instead of from the tip of the arculus. Wing length when measured from arculus is approximately 12-14% shorter. Crista dorsalis of gonostylus is referred to as the distal inner lobe. Angle assessments and three additional ratios were used: anal point length/gonostylus length, inferior volsella length/width, and distal inner angle (Fig. 1), inferior volsella width/gonostylus width, gonostylus length/width and gonostylus distal outer angle (Fig. 2). Length and width of gonostylus is measured in lateral view, thus with the megaseta in a horizontal plane.

In addition to specimens described in published literature, we also studied 14 males of *Heterotrissocladius* stored in the Natural History Museum in Stockholm, Sweden; *H. brundini* (1 specimen Norway), *H. grimshawi* (3 specimens Sweden), *H. maeaeri* (2 specimens Norway, 2 specimens Sweden), *H. marcidus* (2 specimens Czechia, 2 specimens Sweden), *H. scutellatus* (1 specimen Sweden) and *H. subpilosus* (1 specimen Sweden).

Morphological terminology for pupa follows Langton (1994) and Langton and Visser (2003).

Measurements are given in µm or mm unless stated otherwise. The number of specimens or structures measured/counted (n) is given in parentheses.

Adult males and pupal exuviae of the new species were collected using a hand net. The samples were preserved in ethanol and Chironomidae were separated using a dissecting microscope. Specimens

were slide mounted in Euparal after dissection and clearing. Identification of *Heterotrissocladius* sp. "Kolmperä" was based on a sketch of the male hypopygium made by Jari Tuiskunen. The holotype and one adult male, two females, and one pharate female (either as a whole specimen or as an abdominal fragment) were sent to Bioname Oy for sequencing of the DNA barcoding fragment of cytochrome c oxidase subunit 1 (COI). Molecular data was uploaded to the Barcode of Life Data Systems database (BOLD; Ratnasingham et al. 2024) and are publicly available. The vouchers are deposited in the Regional Museum of Lapland in Rovaniemi.

A taxon ID-tree of *Heterotrissocladius* species was inferred using the Neighbor-Joining method (Saitou and Nei 1987). In the analysis, we used *Heterotrissocladius* specimens collected from Finland, Sweden and Norway. The sequences used in this study are available at: dx.doi.org/10.5883/DS-HETRIS. The pairwise genetic distances were computed using the Maximum Composite Likelihood method and are in the units of the number of base substitutions per site. The analytical procedure encompassed 139 coding nucleotide sequences using 1st, 2nd, 3rd, and non-coding positions. The pairwise deletion option was applied to all ambiguous positions for each sequence pair resulting in a final data set comprising 658 nucleotide positions. Evolutionary analyses were conducted in MEGA12 (Kumar et al. 2024).

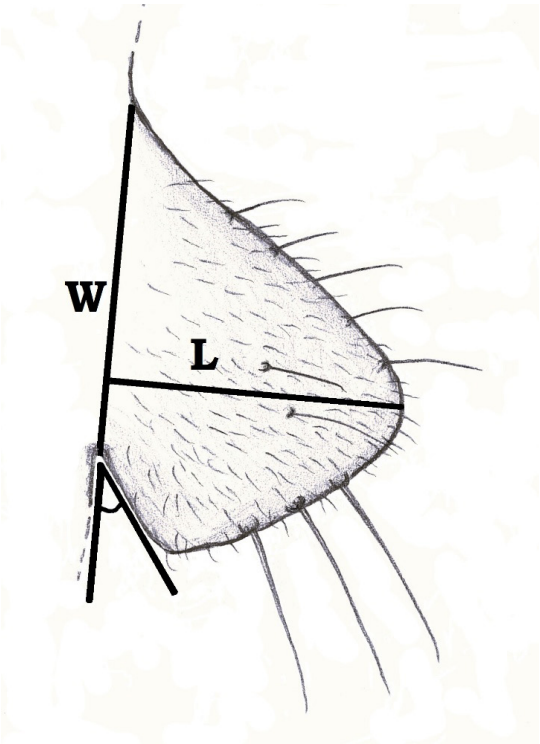


Figure 1. Inferior volsella of *Heterotrissocladius marcidus* (specimen from Czechia in the collection of the Swedish Museum of Natural History) with measurement of length/width and assessment of distal inner angle indicated.

Results and discussion

Heterotrissocladius Spärck, 1923

Diagnosis

The morphological diagnosis of the adult males of *Heterotrissocladius* from the Holarctic region in Cranston et al. (1989) is in most respects still valid in a global perspective. An update with adjustments underlined is as follows: antenna AR 0.5-2.1, wing length 1.2-3.3 mm, wing with macrotrichia from base to apex to only near apex, costa vein not produced beyond the end of R_{4+5} or produced by less than half the length of vein RM, R_{4+5} end about opposite or distal of M_{3+4} end.

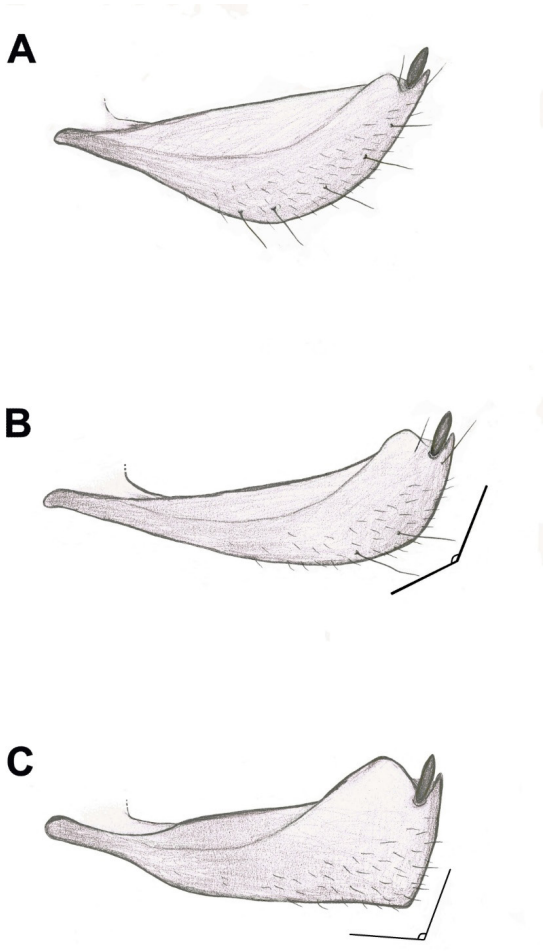


Figure 2. Gonostylus of *Heterotrissocladius* species with size of distal inner lobe and assessment of distal outer angle indicated: a) small lobe, *H. maeaeri*, b) medium-sized lobe, *H. marcidus*, c) large lobe, *H. grimshawi*. All specimens are from Sweden and stored in the collection of the Swedish Museum of Natural History.

Males of *Heterotrissocladius* can be distinguished from males of the world's other 21 Orthocladiinae genera with wing membrane macrotrichia by a combination of four characters: costa vein not produced beyond the end of R_{4+5} or produced by less than half the length of vein RM, vein R_{4+5} ends about opposite to, or distal to M_{3+4}, anal point always present and with macrotrichia, gonostylus not divided and with undivided megaseta. A fifth character that has been overlooked in previous literature is the often large protruding superior volsella of most species of *Heterotrissocladius,* while absent to moderately developed in the great majority of other Orthocladiinae with wing membrane macrotrichia (e.g. Cranston et al.1989, Langton and Pinder 2007). *Pseudorthocladius immenziensis* is one rare exception (Moubayed-Breil and Lods-Crozet 2021).

***Heterotrissocladius bipartitus* sp. n.**
Heterotrissocladius sp. 1 "Kolmperä". Paasivirta 2014:73 (checklist)

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Etymology. The species' name in Latin means two parts referring to the two lobes of the inferior volsella of the male.

Type material. Holotype: adult male (CHIJR051-25), FINLAND: Kymenlaakso, Kotka, Munasuo, 11 August 2025, leg. J. Raunio. Paratypes: one adult male (CHIJR061-25), two adult females (CHIJR052-25 and CHIJR053-25), one pharate female pupa (CHIJR054-25) and two pupal exuviae (males), 11 and 23 August 2025, same locality as holotype, leg. J. & I. Raunio. Lindeberg's collection of Chironomidae is placed in the Natural History Museum in Helsinki. We have been in contact with the museum and have been informed that they could not find Lindeberg's undescribed *Heterotrissocladius* species. We therefore do not include this specimen as part of the type material.

Additional material. DNA barcoded material included one larva (LEFIJ5903-16, collected by the Water and Environment Association of the River Kymi in 2016).

Diagnostic characters

Adult males of *Heterotrissocladius bipartitus* can be separated from all other species of the genus by the form of the inferior volsella which lower part is distinctly expanded beyond the distal margin of the upper part (Figs 4-5). The pupae are characterized by having prominent warts on frontal apotome, three lateral taenia on VII and five on VIII.

Description

Male (n = 1, holotype). Body size comparatively small, body length 3.4 mm. Body coloration light to medium brown; thorax generally the darkest, legs without markings; wings unmarked with pale veins.

Head. Temporal setae 9, including 3 inner verticals, 2 outer verticals and 4 postorbitals; clypeal setae 7. Antenna with 11 flagellomeres; total length 896 µm; AR 1.22. Maxillary palp with 5 palpomeres; lengths of palpomeres (in µm): 25; 41; 108; 98; 130.

Thorax. Setae: acrostichals, broken, ~10 (beginning near antepronotum); antepronotals 3; dorsocentrals 8; prealars 5; scutellars 7.

Wings (Fig. 3). Length 2.04 mm. Anal lobe slightly developed. C not extended beyond R_{4+5}. Vein setae: brachiolum 4; R 30; R_1 32; R_{4+5} 89; M_{1+2} 17; M_{3+4} 47; Cu 29; Cu_1 34. Macrotrichia on wing membrane from near arculus to apex (Fig. 3); squama with 24 setae.

Legs. Lengths of leg segments are shown in Table 1. Leg ratios are as follows: LR_1: 0.82; LR_2: 0.50; LR_3: 0.60.

Hypopygium (Figs 4-5). Laterosternite IX with 5 setae; anal point conical 28 µm long with about 6 setae on both sides; virga absent; inferior volsella with posteroventral projection; gonostylus club-shaped (length 87 µm) with a rounded outer angle, distal inner lobe of medium size and broadly triangular, megaseta 13 µm long.

Table 1. Lengths (µm) of leg segments of male *Heterotrissocladius bipartitus* sp. n.

P	Fe	Ti	Ta_1	Ta_2	Ta_3	Ta_4	Ta_5
P_1	704	798	652	354	264	184	117
P_2	694	710	355	187	141	96	87
P_3	762	891	531	280	214	146	109



Figure 3. Wing of *Heterotrissocladius bipartitus* male.

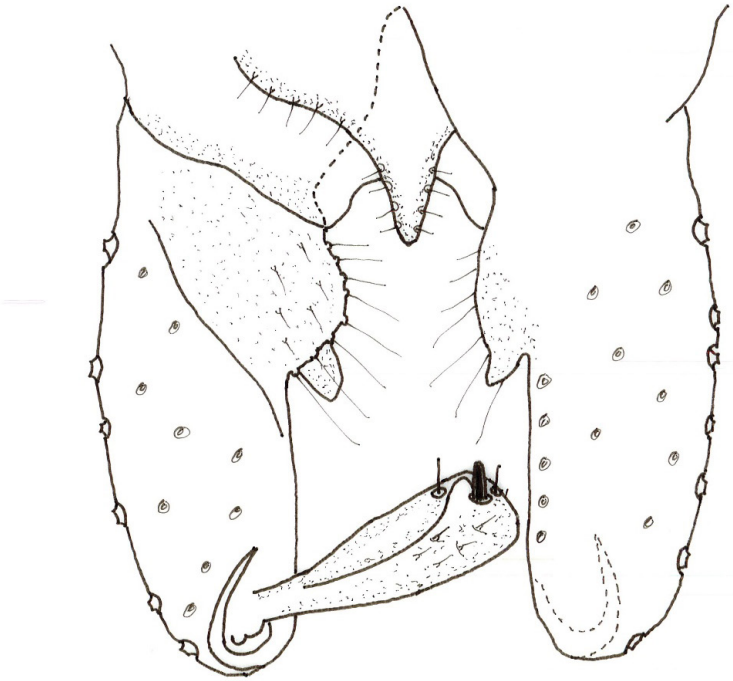


Figure 4. *Heterotrissocladius bipartitus* sp. n. drawing of the hypopygium in dorsal (left) and ventral (right) view.



Figure 5. *Heterotrissocladius bipartitus* sp. n. hypopygium.

Pupal exuviae (n = 2, males). Overall length 3.4; 3.8 mm.

Cephalothorax. Thoracic horn 307; 326 µm long, spinulate (Fig. 6A). Frontal apotome with distinctive warts (Fig. 6B) and frontal setae. Cephalic tubercles absent. Wing sheaths without pearl row.

Abdomen. Tergite I without points. Tergites II-VI armed with small points (Fig. 6C) becoming progressively larger posteriorly. Sternite VIII of male armed with a band of spines along the posterior margin (Fig. 6D). Pedes spurii A present on segments IV-VII. Pedes spurii B present on segment II, wider than high. Three lateral setae on segments II-VI; lateral taeniae of segment VII 3; VIII 5 (Figs. 6C, D). The most posterior taeniae of segment VIII may be shorter than anterior ones (Fig. 6D), but their bases are taeniae-like. Anal lobe with sublateral fringe of 23; 26 taeniae.

Remarks

The male can be separated from all other members of the genus by the form of the inferior volsella with its ventral part protruding posteriorly (Figs 4 and 5). There are no similar species described. Relatively small body size and wing membrane largely covered with macrotrichia are also notable characters. Pupal exuviae are similar to that of *H. marcidus* (Walker, 1856) and *H. grimshawi* (Edwards, 1929), but separable by having more prominent warts on frontal apotome, three lateral taenia on VII and five on VIII (Fig. 6). *H. brundini* (Sæther and Schnell, 1988) also has prominent frontal warts but differs from *H. bipartitus* by having embedded spine on posterolateral corner of VII (Langton and Visser 2003). Pupal exuviae of *H. bipartitus* are smaller (3.4-3.8 mm long) than those of *H. grimshawi* (4.0-5.3 mm, 4.4 mm) and *H. marcidus* (4.7-5.7 mm long, 5.2 mm), and have 23-26 taeniae on anal lobe, whereas *H. marcidus* have 26-36 taeniae and *H. grimshawi* 17-24 taeniae (Langton and Visser 2003; Sæther 1975).

Molecular data

In BOLD (Ratnasingham et al. 2024), there are currently 139 specimens from northern Europe (Finland, Sweden and Norway) of the genus *Heterotrissocladius* (Fig. 7), including the species *H. marcidus*, *H. grimshawi*, *H. subpilosus* and the new species *H. bipartitus*. Each species forms a distinct cluster in the taxon tree (Fig. 7). The percentages of replicate trees in which the associated

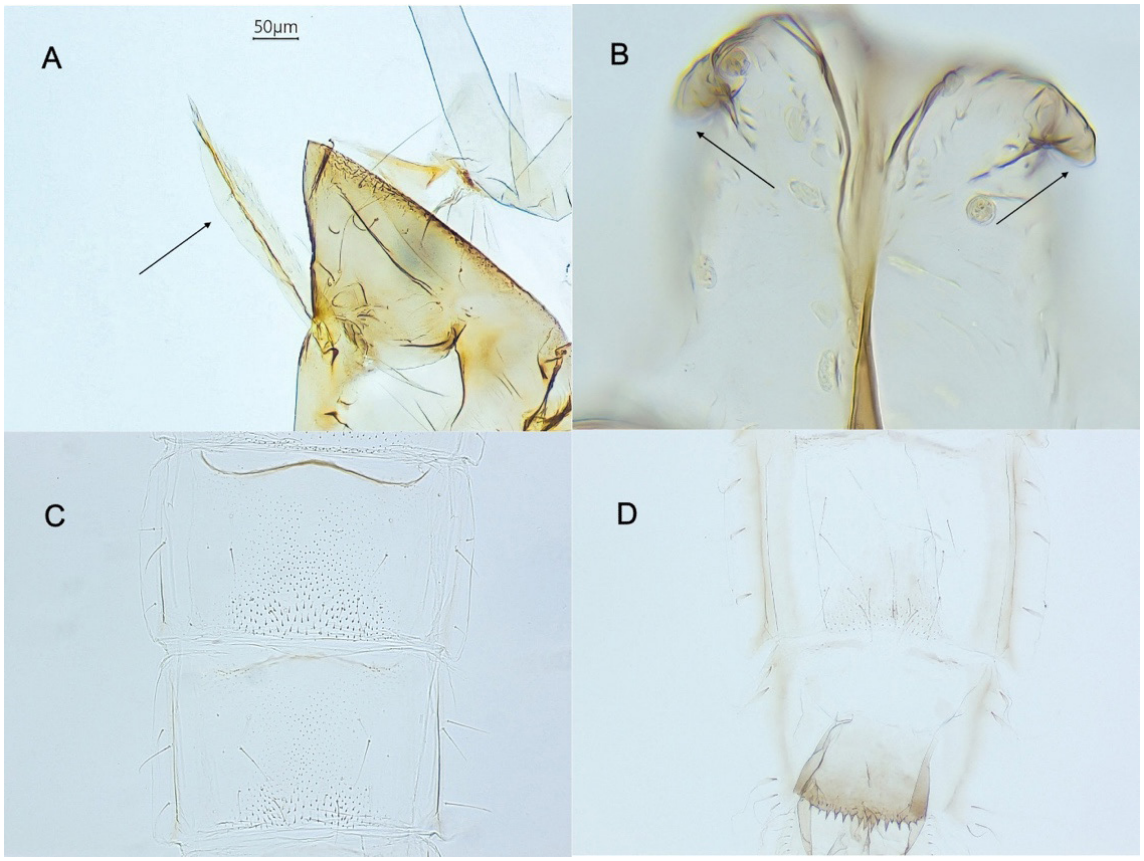


Figure 6. Pupal exuviae of *Heterotrissocladius bipartitus*. A) thoracic horn (pointed by an arrow), B) frontal warts (pointed by arrows), C) tergites V-VI and D) tergites VII-VIII.

taxa clustered together in the bootstrap test (500 replicates) are shown below the branches. The tree is drawn to scale, with branch lengths (next to the branches) in the same units as those of the evolutionary distances used to infer the phylogenetic tree.

The new species (*H. bipartitus,* BOLD:ADI3620) is separated by 13.3% genetic distance between clusters from the nearest neighbor (*H. marcidus*, BOLD:AAF2163) (Fig. 7). Such a distance is in most cases long enough to separate species (Lin et al. 2015). Interestingly, there appear to be two groups of *H. marcidus* (Fig. 7), indicating the presence of perhaps one additional undescribed taxon.

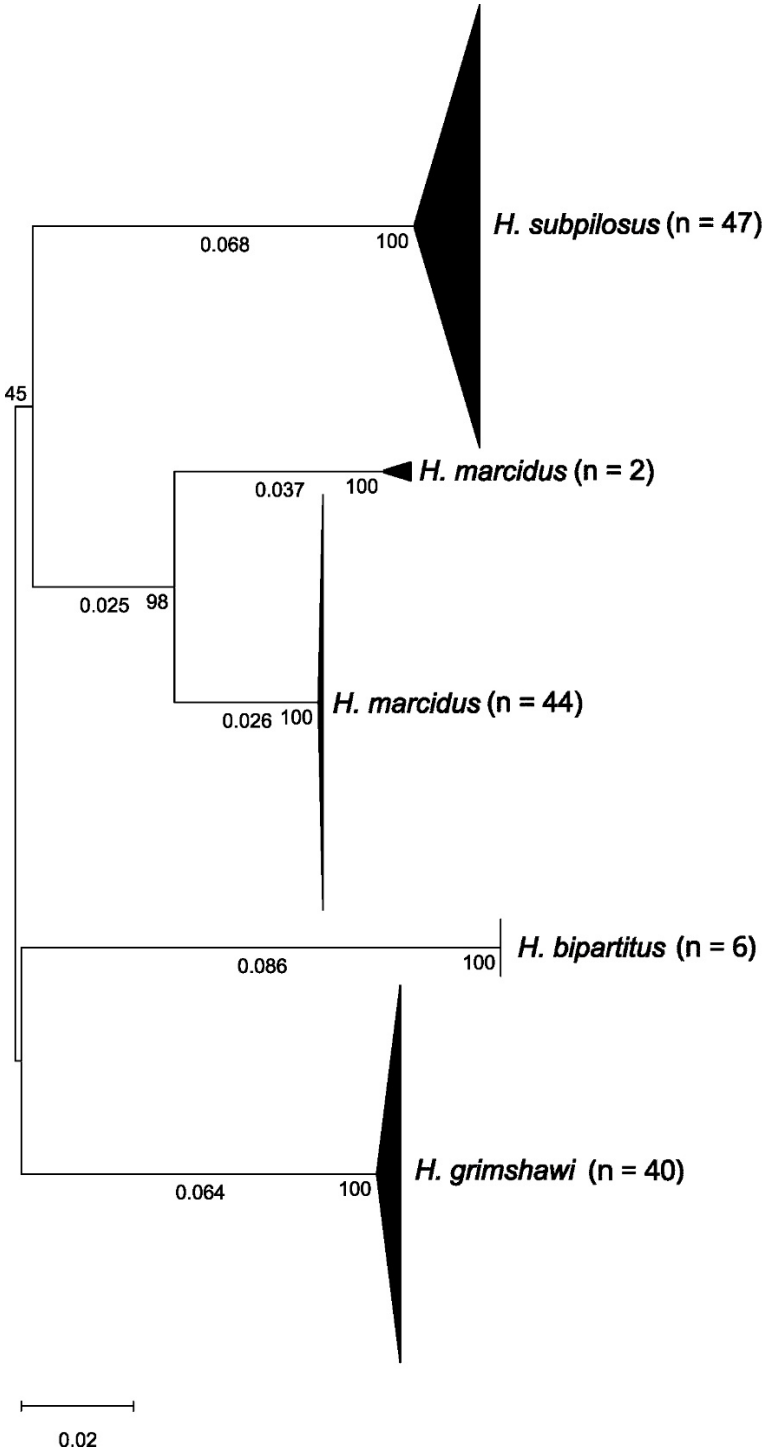


Figure 7. *Heterotrissocladius* taxon tree, based on specimens (n = 139) collected from Finland, Sweden and Norway. Taxon tree nodes with <2 % distance are collapsed to make the tree easier to read.

Key to pupal exuviae of West Palaearctic species of *Heterotrissocladius* (Note: pupal exuviae of *H. zierli* is not known)

1. Embedded spine present on posterolateral corner of segment VII .... *H. brundini* Sæther & Schnell, 1988

- Posterolateral corner of segment VII without an embedded spine 2

2. Pearl row present on wing sheets .... *H. subpilosus* (Kieffer, 1911)

- Pearl row absent on wing sheets 3

3. Exuviae smaller: 3.4-4.0 mm; thoracic horn about 200-350 µm; two or three lateral taeniae on segment VII 4

- Exuviae larger: 4.0-5.7 mm; thoracic horn about 350-510 µm; three or four lateral taeniae on segment VII, often with an additional short seta on posterolateral corner 5

4. Warts weak on frontal apotome; two or three lateral taeniae on segment VII; four on VIII; pedes spurii A absent on segment VII .... *H. maeaeri* Brundin, 1949

- Warts distinct; three lateral taeniae on segment VII; five on VIII, pedes spurii A present on segment VII, but may be composed of small group of spines that are difficult to detect .... *H. bipartitus* Raunio & Brodin n. sp.

5. Thoracic horn relatively narrow (length / width: 5.4-8.2); taeniae on anal lobes 17-24 ..... *H. grimshawi* (Edwards, 1929)

- Thoracic horn relatively broad (length / width: 3.2-5.9); taeniae on anal lobes 26-36 ..... *H. marcidus* (Walker, 1856) (Note: *H. scutellatus* also runs here)

Provisional key to adult *Heterotrissocladius* males of the world

The provisional key below to males of all known species of *Heterotrissocladius* of the world contains 22 species from Africa (north of Sahara), Asia, Europe and North America. A comprehensive integrated work studying available type material and, if possible, including all life stages of *Heterotrissocladius* is needed for completeness. The provisional key is intended to guide the user to find a relevant species suggestion. This should be followed by a quality assurance process by consulting species identification literature listed in Table 2 and data for 14 particularly important morphological characters or ratios of each species in Table 3.

We consider *Heterotrissocladius chuzedecimus* (Sasa, 1984 as *Parametriocnemus*) a junior synonym of *H. grimshawi* (Edwards, 1929). This is based on comparison of twenty overlapping male characters, of which ten refer to genitalia. The holotype of *H. chuzedecimus* is available with text information, illustrations of wing and genitalia in Sasa (1984) and Sasa and Kikuchi (1995), and as hypopygium photos in the National Museum of Nature and Science Tokyo (2024).

We consider *Heterotrissocladius latilaminus* Sæther, 1975 probable junior synonym of *H. grimshawi*. Studies of three additional males of *H. grimshawi* from Sweden bridges the morphological gap between *H. grimshawi* and *H. latilaminus* (Sæther 1975, 1 male Canada). Sæther's study did not include females of *H. grimshawi*. Sæther did not provide any illustration of the pupa of *H. grimshawi* but noted that the thoracic horn is as in *H. latilaminus*. Larval antenna and mentum of *H. grimshawi* and *H. latilaminus* are similar.

We consider *Heterotrissocladius shoukouzoensis* Sasa, 1989 and *H. kamibeceus* Sasa & Hirabayashi, 1993 junior synonyms of *H. marcidus* (Walker, 1856). The judgement is based on comparison of seventeen overlapping male characters, of which ten refer to the hypopygium. The holotypes of *H. shoukouzoensis* and *H. kamibeceus* are available with text information, illustrations of wing and hypopygium in Sasa (1989), Sasa & Hirabayashi (1993) and Sasa & Kikuchi (1995), and as hypopygium photos in the National Museum of Nature and Science Tokyo (2024).

The validity of several other species can be questioned as morphological differences are small, type material not available or not studied. One example is that Langton and Visser (2003) reported a reared *H. scutellatus* (Goetghebuer, 1942), not type specimen, to be indistinguishable from British specimens of *H. marcidus*. *H. cooki* Sæther, 1975, known only as male, might be a more hirsute form of *H. grimshawi* as size and all hypopygia characters are overlapping substantially.

Provisional key to *Heterotrissocladius* males of the world.

1. Virga very long, ratio virga length/gonostylus length 0.72-0.76. Anal point long, ratio anal point length/gonostylus length 0.70-0.75. Gonostylus length/width 2.0-2.3 ..... *H. spiesi* Caldwell & Jacobsen, 2018 [N America]

- Virga absent to half as long as gonostylus, ratio virga length/gonostylus length 0-0.47. Anal point short to long, ratio anal point length/gonostylus

length 0.17-0.62. Gonostylus length/width 2.4-4.6 2

2. Inferior volsella lower part distinctly expanded beyond distal margin of upper part. Inferior volsella short, length/width 0.3-0.4. Inferior volsella distal inner angle strongly obtuse 130-140°. Figs 4-5 ..... *H. bipartitus* Raunio & Brodin n. sp. [Europe]

- Inferior volsella lower part not expanded beyond distal margin of upper part. Inferior volsella length/width 0.4-1.5. Inferior volsella distal inner angle strongly acute to strongly obtuse 20-140° .. 3

3. Gonostylus rather parallel-sided and notably slender, length/width 4.0-4.3. Inferior volsella width/gonostylus width 1.9-2.2. Inferior volsella distal inner angle strongly obtuse 130-140° ..... *H. kuluensis* (Singh, 1958) [Asia]

- Gonostylus expanded from base to near apex, length/width 2.0-4.3. Inferior volsella width/gonostylus width 0.7-1.9. Inferior volsella distal inner angle 20-140° 4

4. Virga almost half as long as gonostylus, ratio 0.44-0.47. Anal point very short, ratio anal point length/gonostylus length 0.17-0.21. Gonostylus distal inner lobe of medium size (cf. Fig. 2b) ..... *H. sonah* (Makarchenko & Makarchenko, 2007) [Asia]

- Virga absent or short, ratio 0-0.12. Anal point short to moderately long, ratio anal point length/gonostylus length 0.25-0.61. Gonostylus distal inner lobe absent to large 5

5. Wing anal lobe absent, angle 140-180°. Wing length 1.3-2.1 mm. Antenna AR 0.8-1.1 6

- Wing anal lobe indicated to projected, angle 80-130°. Wing length 1.5-4.0 mm. Antenna AR 0.5-2.1 8

6. Inferior volsella curved and longish, length/width 1.2-1.4. Acrostichals 0. Ratio anal point length/gonostylus length 0.52-0.56 ..... *H. tusimoteuus* Sasa & Suzuki, 1999 [Asia]

- Inferior volsella rounded to rectangular, length/width 0.5-0.8. Acrostichals 7-15. Ratio anal point length/gonostylus length 0.38-0.47 7

7. Inferior volsella distal inner angle 30° (cf. Fig. 1). Wing with macrotrichia from base to apex, 90-100%. Inferior volsella length/width 0.5-0.6 ..... *H. reductus* Kong & Wang, 2011 [Asia]

- Inferior volsella distal inner angle 90-100°. Wing with macrotrichia from mid to apex, 50%. Inferior volsella length/width 0.7-0.8 ..... *H. boltoni* Sæther, 1993 [N. America]

8. Clypeus distinctly swollen and 1.3-1.7 times wider than pedicel width. Wing membrane with macrotrichia in less than distal third, 0-30%. Acrostichals 0-4 9

- Clypeus not distinctly swollen, less than 1.3 times wider than pedicel width. Wing membrane with macrotrichia from base to only apically, 10-100%. Acrostichals 0-33 10

9. Gonostylus rather broad, length/width 2.4-3.1. Gonostylus distal outer angle right or almost right, 90-100°. Gonostylus distal inner lobe medium to large (cf. Fig. 2b-c) ..... *H. subpilosus* (Kieffer, 1911) [Asia, Europe]

- Gonostylus length/width 3.2-3.9. Gonostylus distal outer angle obtuse, 100-140°. Gonostylus distal inner lobe of medium size (cf. Fig. 2b) ..... *H. oliveri* Sæther, 1975 [N America]

10. Inferior volsella curved and longish, length/width 1.4-1.5. Wing length 1.5-2.0 mm. Antenna AR 0.8-0.9 .. *H. flectus* Kong & Wang, 2011 [Asia]

- Inferior volsella rectangular to roundish, length/width 0.5-1.1. Wing length 1.5-3.5 mm. Antenna AR 0.5-2.1 11

11. Antenna AR 0.5-0.6. Front leg LR 0.62-0.68. Wing length 1.5-1.8 mm 12

- Antenna AR 0.7-2.1. Front leg LR 0.71-0.95. Wing length 1.5-3.5 mm 13

12. Preepisternum with 9-13 setae. Palp of five segments. Inferior volsella width/gonostylus width 0.8-1.0 ..... *H. zierli* Stur & Wiedenbrug, 2005 [Europe]

- Preepisternum without setae. Palp of four segments. Inferior volsella width/gonostylus width 1.5-1.9 ..... *H. quartus* Kong & Wang, 2011 [Asia]

13. Acrostichals absent. Antenna AR 1.9-2.1. Wing length 3.1-3.5 mm ..... *H. bazovi* Makarchenko & Makarchenko, 2010 [Asia]

- Acrostichals 3-33. Antenna AR 0.7-1.9. Wing length 1.5-3.4 mm 14

14. Virga short but distinct, ratio virga length/gonostylus length 0.08-0.12. Inferior volsella short, length/width 0.5. Anal point short, ratio anal point length/gonostylus length 0.28-0.33 .... *H. simmiensis* Makarchenko & Makarchenko, 2016 [Asia]

- Virga absent or short, ratio virga length/gonostylus length 0.-0.08. Inferior volsella length/width 0.6-1.1. Ratio anal point length/gonostylus length 0.25-0.54 15

15. Wing membrane with macrotrichia only on api-

cal third or less, 10-30%. Inferior volsella width/gonostylus width 1.2-1.9. Virga very small or not visible 16

- Wing membrane with macrotrichia on more than apical third, 40-100%. Inferior volsella width/gonostylus width 0.7-1.6. Virga not visible 17

16. Anal point short, ratio anal point length/gonostylus length 0.25-0.38. Inferior volsella distal inner angle acute 30-60°. Gonostylus distal inner lobe small (Fig. 2a) .... *H. maeaeri* Brundin, 1949 [Europe, N America]

- Anal point rather long, ratio anal point length/gonostylus length 0.49-0.61. Inferior volsella distal inner angle slightly acute to obtuse 80-120°. Gonostylus distal inner lobe small to medium size (cf. Fig. 2a-b) .... *H. brundini* Sæther & Schnell, 1988 [Europe]

17. Wing with microtrichia from arculus or slightly distal of arculus to apex, 80-100%. Gonostylus distal outer angle obtuse, 120-160° (Fig. 2b). Gonostylus distal inner lobe small to medium size ..... *H. marcidus* (Walker, 1856) [Africa, Asia, Europe, N America]

- Wing with macrotrichia in distal 40-70%. Gonostylus distal outer angle right to strongly obtuse, 90-180°. Gonostylus distal inner lobe small to large 18

18. Gonostylus distal outer angle strongly obtuse 150-180°. Inferior volsella relatively short, length/width 0.6-0.7. Inferior volsella width/gonostylus width 1.3-1.6 .... *H. hirtapex* Sæther, 1975 [N America]

- Gonostylus distal outer angle right to obtuse, 90-130°. Inferior volsella length/width 0.7-1.1. Inferior volsella width/gonostylus width 0.7-1.5 19

19. Inferior volsella width/gonostylus width 1.2-1.5. Gonostylus distal inner lobe small (cf. Fig. 2a). Gonostylus length/gonocoxite inner length (GR-ratio) 0.50-0.55 ..... *H. scutellatus* (Goetghebuer, 1942) [Asia, Europe]

- Inferior volsella width/gonostylus width 0.7-1.1. Gonostylus distal inner lobe medium to large (cf. Fig. 2b-c). Gonostylus length/gonocoxite inner length 0.45-0.52 20

20. Wing with macrotrichia in distal 40-60%. Acrostichals 6-16. Wing vein R4+5 with 12-36 setae ..... *H. grimshawi* (Edwards, 1929) [Asia, Europe, N America]

- Wing with macrotrichia in distal 60-70%. Acrostichals 11-33. Wing vein R4+5 with 7-107 setae 21

21. Inferior volsella length/width 0.9-1.1. Dorsocentrals 7-19. Gonostylus distal inner lobe of medium size (cf. Fig. 2b) .... *H. changi* Sæther, 1975 [Europe, N America]

- Inferior volsella length/width 0.7-0.8. Dorsocentrals 23-35. Gonostylus distal inner lobe medium to large (cf. Fig. 2b-c) .... *H. cooki* Sæther, 1975 [N America]

Geographical distribution and ecological notes

The new species is currently known from 12 geographical provinces and 18 different sampling sites mainly in southern and central Finland (Paasivirta 2014). The species also occurs in the United Kingdom according to the BOLD database (Ratnasingham et al. 2024) (BOLD:ADI3620). Species distribution outside Finland and the UK is not known. The habitats of the species in Finland are small boggy ditches and brooks, which is likely why it has gone largely unnoticed as most species of *Heterotrissocladius* are found in lakes (Cranston et al. 1989). In southern Finland, *H. bipartitus* seems to have two generations per year; the first generation emerges in May and the second generation in August. Emergence periods largely overlap that of *H. marcidus* (Raunio and Paasivirta 2008).

With *H. bipartitus* added to the Finland's species list (Paasivirta 2014), the number of *Heterotrissocladius* species rises to six. Molecular data indicate that one additional species may be present. Larvae in this BIN were collected from a spring in the Oulanka National Park and were identified as *H. marcidus*. Soil and bedrock in the Oulanka National Park are calcareous and unusual in the country and thus resemble the habitat of *H. zierli* (see Stur and Wiedenbrug 2005), which may be the species in question. Another possible taxon is *H. scutellatus*, which has not yet been recorded from Finland. Further studies are required to resolve the identity of the *Heterotrissocladius marcidus*-type taxon in the Oulanka National Park.

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Table 2. *Heterotrissocladius* species of the world and literature with morphological information on males, females, pupae and larvae.

Species	Literature
H. bazovi	Makarchenko et al. 2010
H. bipartitus	Raunio & Brodin present paper
H. boltoni	Sæther 1993, Epler 2001, Namayandeh et al. 2012
H. brundini	Sæther 1975 (as *H. maeaeri*), Sæther and Schnell 1988, Langton and Visser 2003, Langton and Pinder 2007, Samietz 2021
H. changi	Sæther 1975, Cranston et al. 1983, Andersen et al. 2013, Lindegaard 2015, Samietz 2021, Webb et al. 2022
H. cooki	Sæther 1975
H. flectus	Kong and Wang 2011
H. grimshawi	Edwards, 1929, Goetghebuer and Lenz 1940, Brundin 1947, Brundin 1949, Brundin 1956, Sæther 1975 (also as *H. latilaminus* nom. syn.), Sasa 1984 (as *Parametriocnemus chuzedecimus* nom. syn.), Langton and Visser 2003, Samietz 2021, National Museum Nature Science Tokyo 2024 (as *H. chuzedecimus*)
H. hirtapex	Sæther 1975, Kong and Wang 2011
H. kuluensis	Singh 1958
H. maeaeri	Brundin 1949, Shilova 1969, Sæther and Schnell 1988, Langton and Visser 2003, Samietz 2021
H. marcidus	Walker 1856, Goetghebuer 1921 (as *Metriocnemus aestivalis* nom. syn.), Edwards 1929, Goetghebuer 1932, Goetghebuer 1934 (as *Metriocnemus alticola* nom. syn.), Brundin 1947, Brundin 1949, Chernovskii 1949, Coe 1950, Pankratova 1970, Sæther 1975, Pinder 1978, Moller-Pillot 1984, Cranston et al. 1989, Sasa 1989 (as *H. shoukouzoensis* nom. syn.), Sasa and Hirabayashi 1993 (as *H. kamibeceus* nom. syn.) Sasa and Kikuchi 1995 (as *H. shoukouzoensis*), Langton & Visser 2003, Langton and Pinder 2007, Lindegaard 2015, Samietz 2021, National Museum Nature Science Tokyo 2024 (as *H. kamibeceus*), Kappert 2025
H. oliveri	Henriksen 1939 (as *H. subpilosus*), Sæther 1975, Cranston et al. 1983, Coffman et al. 1986, Cranston et al. 1989, Andersen et al. 2013, Lindegaard 2015
H. quartus	Kong and Wang 2011
H. reductus	Kong and Wang 2011
H. scutellatus	Goetghebuer 1942, Thienemann 1944, Sæther 1975, Pinder 1978 (as *H. grimshawi*), Langton and Pinder 2007 (as *H. grimshawi*), Kong and Wang 2011, Samietz 2021
H. simmiensis	Yavorskaya et al. 2016
H. sonah	Makarchenko and Makarchenko 2007
H. spiesi	Epler 2001, Caldwell and Jacobsen 2018
H. subpilosus	Kieffer and Lundbeck 1911, Lundström 1915 (as *Orthocladius cinereipennis* nom. syn.), Edwards 1935, Goetghebuer and Lenz 1940, Brundin 1949, Brundin 1956, Chernovskii 1949, Oliver 1962, Shilova 1969, Pankratova 1970, Sæther 1975, Sasa and Kikuchi 1995, Langton and Visser 2003, Przhiboro and Sæther 2008, Lindegaard 2015, Stur and Ekrem 2020, Samietz 2021
H. tusimoteuus	Sasa and Suzuki 1999
H. zierli	Stur and Wiedenbrug 2005, Samietz 2021

Table 3a. Morphological characters of head, thorax, wings and virga particularly useful for identification of males of *Heterotrissocladius* species worldwide. Virga; 0 = not visible. Gstyl = gonostylus.

Species	Antenna AR	Thorax acro-stichals	Wing length mm	Wing macrotrichia cover %	Wing anal lobe	Leg front leg LR	Virga length/ Gstyl length
H. bazovi	1.90-2.10	0	3.1-3.5	10-30	90-100	0.85-0.86	0
H. bipartitus	1.22	10	2.0-2.1	90-100	100	0.82	0
H. boltoni	0.92-1.11	12-15	1.3-1.8	50	160-180	0.70-0.71	0
H. brundini	0.92-1.23	3-9	2.2-2.5	10-30	100-130	0.71-0.78	0-0.08
H. changi	1.30-1.69	11-26	2.1-3.1	60-70	100-110	0.81-0.92	0
H. cooki	1.57-1.84	18-33	2.7-3.4	60-70	.	0.84-0.90	0
H. flectus	0.78-0.90	12-14	1.5-2.0	80-90	100-110	0.68-0.79	0
H. grimshawi	1.38-1.82	6-16	2.3-3.1	40-60	100-120	0.76-0.92	0
H. hirtapex	1.55-1.62	18-23	2.6-3.0	50-60	100-120	0.84-0.94	0
H. kuluensis	1.5	0	1.6	80-90	90	.	.
H. maeaeri	0.97-1.35	3-5	2.2-2.6	10-30	120-130	0.73-0.76	0-0.07
H. marcidus	1.23-1.65	14-26	2.3-3.3	80-100	90-110	0.84-0.95	0
H. oliveri	1.43-1.80	0-4	2.5-3.3	10-30	90-100	0.79-0.86	0
H. quartus	0.56	14	1.5-1.7	90-100	100-110	0.64	0
H. reductus	0.95	7	1.5-1.7	90-100	140-160	.	0
H. scutellatus	1.47-1.60	12	2.7-3.3	50-70	.	0.85-0.86	0
H. simmiensis	.	12	1.5-1.7	60-70	.	.	0.08-0.12
H. sonah	1.14-1.17	9-18	1.9-2.1	50	110-120	0.77-0.81	0.44-0.47
H. spiesi	0.79-0.94	0-4	1.5-1.8	60-70	170-180	0.79-0.81	0.72-0.76
H. subpilosus	1.70-1.91	0	3.2-4.0	0-20	90-100	0.77-0.82	0
H. tusimoteuus	0.88-1.01	0	2.0-2.1	90-100	160-170	0.59	0
H. zierli	0.51-0.54	12-15	1.6-1.8	70-80	90-100	0.62-0.68	0.05-0.09

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Table 3b. Morphological characters of genitalia particularly useful for identification of males of *Heterotrissocladius* species worldwide. An P = anal point, Inf vol = inferior volsella, Gstyl = gonostylus, L = length, W = width. Gstyl distal inner lobe size (crista dorsalis in Sæther 1980); 0 = absent, 1 = small (Fig. 2a), 2 = medium-sized (Fig. 2b), 3 = large (Fig. 2c). GR = length of gonostylus/length of gonocoxite (cf. HR ratio in Sæther 1980).

Species	An P L/ Gstyl L	Inf vols L/W	Inf vol distal inner angle °	Inf vol W/ Gstyl W	Gstyl distal inner lobe	Gstyl L/W	Gstyl distal outer angle °
H. bazovi	0.37-0.41	0.8-0.9	30-50	0.7-0.8	2	2.5-2.9	100-110
H. bipartitus	0.26-0.42	0.3-0.4	130-140	1.4-1.7	2	3.2-3.5	90-100
H. boltoni	0.38-0.42	0.7-0.8	90-100	1.4-1.8	1	3.3-4.1	100-110
H. brundini	0.49-0.61	0.6-0.8	80-120	1.4-1.9	1-2	2.9-3.6	120-150
H. changi	0.45-0.51	0.9-1.1	40-50	0.9-1.1	2	3.0-3.4	90-100
H. cooki	0.40-0.45	0.7-0.8	30-40	0.9-1.1	2-3	2.8-3.3	90-100
H. flectus	0.33-0.39	1.4-1.5	20-40	0.9-1.2	1	3.0-3.4	100-130
H. grimshawi	0.28-0.45	0.7-1.0	30-50	0.7-1.0	2-3	2.5-3.3	90-110
H. hirtapex	0.30-0.35	0.6-0.7	30-50	1.3-1.6	2	3.2-3.6	150-180
H. kuluensis	0.56-0.62	0.4-0.5	130-140	1.9-2.2	1	4.0-4.3	140-160
H. maeaeri	0.25-0.38	0.6-0.8	30-60	1.2-1.6	1	2.9-3.5	120-160
H. marcidus	0.42-0.53	0.8-1.0	40-60	1.1-1.5	1-2	3.3-4.5	120-160
H. oliveri	0.43-0.48	0.5-0.6	40-50	1.2-1.4	2	3.2-3.9	100-140
H. quartus	0.35-0.39	0.4-0.5	120-130	1.5-1.9	2	3.2-3.6	100-120
H. reductus	0.43-0.47	0.5-0.6	30	1.3-1.6	1	3.5-3.8	90-100
H. scutellatus	0.35-0.41	0.7	30-50	1.2-1.4	1	3.0-3.7	110-130
H. simmiensis	0.28-0.33	0.5	80-90	1.2-1.5	2	2.6-3.0	150-170
H. sonah	0.17-0.21	0.8-0.9	70-80	0.8-1.2	2	2.9-3.4	100-130
H. spiesi	0.70-0.75	0.8-0.9	30-40	0.8-1.1	0	2.0-2.3	90-100
H. subpilosus	0.40-0.48	0.5-0.7	40-50	1.0-1.4	2-3	2.4-3.1	90-100
H. tusimoteuus	0.52-0.56	1.2-1.4	20-30	1.1-1.3	0	3.4-3.8	120-140
H. zierli	0.27-0.32	0.6	40-50	0.8-1.0	1	2.8-3.4	90-100

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