# **Supplementary Material**

Supp. file 1. Machine-readable description of *Aphanogmus kretschmanni* sp. nov.

**Coloration & Sculpturation**:

Color hue pattern female: cranium and mesosoma dark brown; metasoma, femora, tegula, mandibles, proximal pedicellus and antennal flagellomeres brown; tibiae and scape ochre, tarsi and distal pedicellus yellow. Color intensity pattern female: metasoma and mandible lighter than mesosoma, metasoma lighter than mesosoma and cranium, flagellomeres and their branches darker than scape and pedicel. Scape and pedicel same as legs. Color of antenna female: flagellum dark brown, scape and pedicel light brown. Brightness of metasoma relative to mesosoma: metasoma lighter mesosoma. Color of metasoma: brownish all over. Body length universal: 1025.6 µm. Color hue pattern male: NOT CODED. Color intensity pattern male: NOT CODED. Foveolate scultpture on body count: absent. Scutes on vertex: present. Structure of scutes on head and mesosoma: Scute surface on head and mesosoma flat, scutes indistinct.

**Head**:

Anterior ocellar fovea shape: fovea extended ventrally into facial sulcus, reaching dorsal margin of antennal scrobe. Male flagellomeres shape: NOT CODED. Male scape length vs combined length of F1+F2: NOT CODED. 6th male flagellomere length vs. width: NOT CODED. Male flagellomere branches count: NOT CODED. Branch of male flagellomere 5 length compared to flagellomere 6: NOT CODED. Male F6 length vs combined length of F7+F8: NOT CODED. Mandibular lancea: absent. Occipital carina sculpture: crenulate. Occipital carina medially: continuous medially. Median flange of occipital carina: present. Submedial flange of occipital carina: absent. Dorsal margin of occipital carina vs. dorsal margin of lateral ocellus in lateral view: occipital carina dorsal to lateral ocellus in lateral view. Preoccipital lunula: present. Preoccipital carina: present. Preoccipital carina shape: complete. Preoccipital furrow: present. Preoccipital furrow anterior end: Preoccipital furrow ends inside ocellar triangle, but ends posterior to the anterior ocellus. Postocellar carina: absent. Male ocular ocellar line (OOL): posterior ocellar line (POL): lateral ocellar line (LOL): NOT CODED. Female ocular ocellar line (OOL): posterior ocellar line (POL): lateral ocellar line (LOL): 1.3:1.5:1.0. Head width vs. interorbital space (HW/IOS) Male: NOT CODED. Head width vs. interorbital space (HW/IOS) Female: 2.0. Setal pit on vertex size: NOT CODED. Transverse frontal carina: absent. Transverse scutes on upper face: absent. Rugose region on upper face: absent. Randomly sized areolae around setal pits on upper face: absent. Antennal scrobe: present. Ventromedian setiferous patch: absent. Facial structure: No external corresponding structure present. Supraclypeal depression: absent. Supraclypeal depression structure: NOT CODED. Intertorular carina: present. Intertorular area: absent. Median region of intertorular area shape: NOT CODED. Ventral margin of antennal rim vs. dorsal margin of clypeus: not adjacent. Torulo-clypeal carina: present. Subtorular carina: absent. Mandibular tooth count: 2. Female F1 length vs. pedicel length: 0.83. Female flagellomere number: 8. Female eighth flagellomere length: F8=F7+F6+ 0.5 F5. Sensillar patch of the male flagellomere pattern: NOT CODED. Length of setae on male flagellomere vs. male flagellomere width: NOT CODED. Male F1 length vs. male F2 length: NOT CODED. Male F1 length vs. pedicel length: NOT CODED. Cepahlic size: 258.8 μm. Head height (HH, lateral view) vs. eye height (EHf, anterior view): HH:EHf=1.4. Head height (HH) vs. head length (HL): 1.4. Head width (HW) vs. head height (HH): 1.3. Male ocular ocellar line (OOL) vs. lateral ocellar line (LOL): NOT CODED. Male ocular ocellar line (OOL) vs. posterior ocellar line (POL): NOT CODED. Female ocular ocellar line (OOL) vs. lateral ocellar line (LOL): OOL 1.3x as long as LOL. Female ocular ocellar line (OOL) vs. posterior ocellar line (POL): OOL:POL=0.8. White, thick setae on upper face count: absent. Head width vs head length lateral view (HW / HL): 1.7. Maximum eye diameter vs. minimum eye diameter: 1.25. Dorsal carina of occipital depression: absent. Dorsal carina of occipital depression medial continuity: NOT CODED. Preoccipital ridge: present. Preoccipital furrow anterior extension: adjacent anteriorly to the posterior margin of the median ocellus. Preoccipital furrow anterior region vs posterior region sculpture: crenulate in its entire length. Preoccipital furrow anterior region width vs posterior region width: as wide anteriorly as posteriorly. Preoccipital carina and occipital carina structure: the occipital carina is short, interrupted laterally of the occipital foramen, whereas the preoccipital carina extends ventrally to the oral foramen. Preocellar pit: present. Carina delimiting antennal scrobe: absent. Transverse striation on upper face: absent. Frontal ledge: absent. Ocellar fovea margin sharpness: NOT CODED. Median process on intertorular carina: absent. Intertorular ridge vs epistomal ridge: fused medially. Torulus position relative to anterior ocellus and distal margin of clypeus: torulus not reaching epistomal sulcus, closer to distal margin of clypeus than anterior ocellus. Subantennal groove: absent. Subantennal groove structure: NOT CODED. Posterolateral process of gena: absent. Ocular impression and post ocular orbital carina: absent. Ocular impression sculpture. NOT CODED. Median conjunctiva of cardines count (median fusion of left and right cardines): absent (cardines are fused). Maxillary palpomeres count: 4. Flagellar scrobe of the scape: present. Whorled rows of erect, elongate setae on male flagellomeres: NOT CODED. Number of flagellomeres with male specific ventral sensilla: NOT CODED. Multiporous plates on male flagellomeres: NOT CODED. Female scape length vs. pedicel length: 2.5.

**Mesosoma**:

Ventrolateral invagination of the pronotum: NOT CODED. Scutes on posterior region of mesoscutum and dorsal region of mesoscutellum convexity: flat. Median mesoscutal sulcus posterior end: adjacent to transscutal articulation. Axillular carina count: present. Axillular carina shape: left and right carina continuous posteromedially forming a U-shape carina on the mesoscutellar axillar complex. Epicnemium: absent. Speculum ventral limit: extending ventrally of pleural pit line. Mesometapleural sulcus: present. Metapleural carina : present. Transverse line of the metanotum-propodeum vs. antecostal sulcus of the first abdominal tergum: NOT CODED. Lateral propodeal carina: absent. Lateral propodeal carina shape: NOT CODED. Anteromedian projection of the metanoto-propodeo-metapecto-mesopectal complex: present. Transverse carina on petiole shape: concave. Distal margin of male S9 shape: NOT CODED. Proximolateral corner of male S9 shape: NOT CODED. Cupula length vs. gonostyle-volsella complex length: NOT CODED. Proximodorsal notch of cupula count: NOT CODED. Proximodorsal notch of cupula shape: NOT CODED. Proximolateral projection of the cupula shape: NOT CODED. Proximodorsal notch of cupula width vs length: NOT CODED. Distodorsal margin of cupula shape: NOT CODED. Dorsomedian conjunctiva of the gonostyle-volsella complex length relative to length of gonostyle-volsella complex: NOT CODED. Dorsomedian conjunctiva of the gonostyle-volsella complex: NOT CODED. Proximal end of dorsomedian conjunctiva of the gonostyle-volsella complex shape: NOT CODED. Parossiculus count or parossiculus and gonostipes fusion: NOT CODED. Apical parossicular setae count: NOT CODED. Distal projection of the parossiculus count: NOT CODED. Distal projection of the penisvalva count: NOT CODED. Dorsal apodeme of penisvalva: NOT CODED. Harpe length: NOT CODED. Distodorsal setae of sensillar ring of harpe length vs. harpe width in lateral view: NOT CODED. Distodorsal setae of sensillar ring of harpe orientation: NOT CODED. Sensillar ring area of harpe orientation: NOT CODED. Lateral setae of harpe: NOT CODED. Lateral setae of harpe orientation: NOT CODED. Distal margin of harpe in lateral view: NOT CODED. Lateral margin of harpe shape: NOT CODED. Distoventral submedian corner of the cupula count: NOT CODED. Weber length: 340 μm. Posterior margin of nucha in dorsal view shape: straight. Mesosoma shape: compressed laterally and distinctly higher than wide. Pronope count: present. Transverse pronotal sulcus (anterodorsal branch of pronotal y) count: absent. Epomial carina: absent. Posterodorsal branch of pronotal Y: absent. Occlusor muscle apodeme for the occlusor muscle of the anterior thoracic spiracle: NOT CODED. Occlusor muscle apodeme for the anterior thoracic spiracle structure: NOT CODED. Pit corresponding to the apodeme for the occlusor muscle of the anterior thoracic spiracle pit count: NOT CODED. Atrium of anterior mesothoracic spiracle: NOT CODED. Annullar pronotum: present. Ventromedian region of pronotum and anteroventral region of mesopectus continuity: pronotum and mesopectus continuous ventromedially. Lateroventral invagination of the propleuron: absent. Mesonotal fossa of the pronotum and pronotal condyle of the mesonotum: present. Mesonotum anterolateral margin shape: square. Median mesoscutal sulcus: present. Notaulus count: absent. Antero-admedian line count: absent. Posterior end of notaulus vs posterior end of antero-admedian line location: NOT CODED. Transscutal articulation completeness: complete. Scutes on posterior region of mesoscutum and dorsal region of mesoscutellum: present. Lateral carina on the mesoscutellum: present. Axillular setae: present. Posterolateral margin of mesoscutellum shape: acute. Anteromedian process of the metathorax propodeum complex: present. Anteromedian projection of the metathorax propodeum complex shape: simple. Anteromedian projection of the metathorax propodeum complex curvature lateral in view: straight. Sternaulus: absent. Longitudinal striae extending from crenulae of anterior mesopleural sulcus to mesopleural pit count: present. Ventral invagination of mesometapleural sulcus count: absent. Epicnemial pit: present. Mesodiscrimen: present. Anterior metapleural carina: absent. Anterior metapleural carina completeness: NOT CODED. Metapleural carina vs propodeal spiracle: metapleural carina extending ventrally of propodeal spiracle. Ventral projection of the metapleural carina: present. Ventral invagination of the metapleural carina: absent. Propodeal spiracle dilator muscle apodeme pit location: NOT CODED. Median propodeal carina: absent. Posterior propodeal projection: present. Posterior propodeal projection shape: simple. Propodeal and metacoxal verricules: absent. Posterior line of the posterodorsal metapectal area: NOT CODED. Posterodorsal metapleural area shape: NOT CODED. Mesofurca vs metadiscrimenal lamella continuity: fused. Metapecto-propodeal conjunctiva: absent. Calcar shape: simple. Mesotibial spur count: 1. Mesobasicoxa width vs. metabasicoxa width: metabasicoxa distinctly wider than mesobasicoxa. Posterior mesosomal comb: absent. Anterior mesothoracic spiracle occlusor muscle site of origin: NOT CODED. Pronoto-mesobasalar muscle site origin: NOT CODED. Pronoto-procoxal muscle origin: NOT CODED. Prophragmo-postoccipital muscle site of origin: NOT CODED. Prophragmo-postoccipital muscle site of origin: partly from the popsterior surface of the prophragma, partly from the lateral mesoscutal area. Mesonoto-mesotrochanteral muscle count: NOT CODED. Posterior mesonoto-metanotal muscle site of origin anterior limit: anterior limit not exceed midline of mesoscutellum. Second and third mesopleuro-third axillary sclerite of fore wing muscle site of origin: NOT CODED. Mesopleuro-mesocoxal muscle site of origin: NOT CODED. Mesofurco-mesotrochanteral muscle count: present. Mesofurco-mesotrochanteral muscle relative position: medial to mesonoto-mesotrochanteral muscles. Mesofurco-mesotrochanteral muscle site of insertion: NOT CODED. Transverse carina of petiole: present.

Wings:

Stigmal vein of fore wing: present. Stigmal vein length vs. pterostigma marginal length: stigmal vein longer than the pterostigma marginal length. Pterostigma of fore wing: absent. Hind wing reduction: well-developed.

Atrium of the anterior thoracic spiracle size: NOT CODED. Posteromedian process of the mesoscutellum: absent. Posteromedian process of the mesoscutellum shape: NOT CODED.

**Metasoma**: Basal, longitudinal carinae on syntergum count: more than 5. Transverse sulcus of synsternum: absent. Waterston's evaporatorium count: present. Acrotergal calyx of Waterston's evaporatorium: acrotergal calyx present. Intravalviferal articulation count: absent. Waterstons evaporatorium shape medially female: median unsculptured area absent.

## Suppl. 2: Table of exact measurements of morphological features. Measured in Amira (Thermo Fisher Scientific, Waltham, MA, USA) based on the synchrotron µCT reconstruction of the holotype (SMNS\_Hym\_Cer\_000227). All measurements are in µm and decimals were rounded to whole numbers.

|  |  |  |
| --- | --- | --- |
| Total body length | 1026 |  |
| **Head** |  |  |
| Head length | 183 |  |
| Head breadth/width | 319 |  |
| Head height | 253 |  |
| Interocular distance | 158 |  |
| Eye height | 183 |  |
| Eye width | 146 |  |
| Ocular ocellar line (OOL) | 42 |  |
| Posterior ocellar line (POL) | 52 |  |
| Lateral ocellar line (LOL) | 34 |  |
| Anterior ocellus diameter | 25 |  |
| Posterior ocellus diameter | 20 x 26 |  |
| Malar space | 71 |  |
| Subocellar sulcus | 71 |  |
| Cylpeus width | 74 |  |
| Clypeus height | 51 |  |
| Antennal segments lengths | left | right |
| Radicle | 14 | 16 |
| Scape | 172 | 179 |
| Pedicel | 71 | 71 |
| F1 | 57 | 61 |
| F2 | 41 | 40 |
| F3 | 36 | 37 |
| F4 | 37 | 37 |
| F5 | 38 | 37 |
| F6 | 39 | 38 |
| F7 | 39 | 43 |
| F8 | 97 | 95 |
| Antennal segments widths | | |
| Radicle | 22 | 23 |
| Scape | 48 | 49 |
| Pedicel | 29 | 30 |
| F1 | 30 | 30 |
| F2 | 33 | 30 |
| F3 | 34 | 33 |
| F4 | 36 | 38 |
| F5 | 38 | 40 |
| F6 | 42 | 43 |
| F7 | 41 | 41 |
| F8 | 47 | 48 |
| Length of mandible along ventral edge | 87 |  |
| Height of mandible in middle (along half its length) | 27 |  |
| **Mesosoma** |  |  |
| Mesosomal length | 383 |  |
| Mesosomal width | 241 |  |
| Mesosomal height | 358 |  |
| Mesoscutum length | 133 |  |
| Mesoscutal width | 241 |  |
| Median mesoscutal suture length | 194 |  |
| Interaxial sulcus length | 37 |  |
| Mesoscutellum length | 180 |  |
| Mesoscutellum width anterior | 116 |  |
| Frenum length | 28 |  |
| Frenal spine | 21 |  |
| Forewing length | 815 |  |
| Forewing width | 539 |  |
| Marginal setae | 26 |  |
| Hind wing length | 748 |  |
| Hind wing width | 182 |  |
| Max. Hind wing setae length | 43 |  |
| Hind wing setae angle | 67° |  |
| tergite 1 | 259 |  |
| tergite 2 | 69 |  |
| tergite 3 | 53 |  |
| tergite 4 | 41 |  |
| tergite 5 | 51 |  |
| tergite 6 | 15 |  |
| sternite 1 | 268 |  |
| sternite 2 | 61 |  |
| sternite 2(+3?) | 76 |  |
| last sternite | 69 |  |
| Length of last sternite ventral edge | 154 |  |
| 1st spine | 09 |  |
| 2nd spine | 10 |  |
| 3rd spine | 10 |  |
| 4th spine | 8 |  |
| 5th spine | 9 |  |
| 6th spine | 8 |  |
| 7th spikle | 12 |  |
| 1st paired spine | 9 |  |
| 5th paired spine | 8 |  |
| Max breadth of ovipositor sheath | 14 |  |
| Ovipositor width | 19 |  |
| Protruding distance of ovipositor | 24 |  |
| **Legs** |  |  |
| *Fore leg* | Left | Right |
| Fore coxa | 79 | 79 |
| Fore trochanter | 51 | 48 |
| Fore femur | 166 | 163 |
| Fore tibia | 156 | 154 |
| Fore tibial spurs | 46; 28 | 50; 30 |
| Fore tarsus 1 | 79 | - |
| Fore tarsus 2 | 20 | - |
| Fore tarsus 3 | 20 | - |
| Fore tarsus 4 | 20 | - |
| Fore tarsus 5 | 38 | - |
| *Middle leg* | Left | Right |
| middle coxa | 51 | 48 |
| Middle trochanter | 48 | 47 |
| Middle femur | 174 | 183 |
| Middle tibia | 171 | 168 |
| Middle tibial spur | 28 | 30 |
| Middle tarsus 1 | 95 | - |
| Middle tarsus 2 | 32 | - |
| Middle tarsus 3 | 28 | - |
| Middle tarsus 4 | 28 | - |
| Middle tarsus 5 | 43 | - |
| *Hind leg* | Left | Right |
| Hind coxa | 162 | 155 |
| Hind trochanter | 48 | 53 |
| Hind femur | 224 | 222 |
| Hind tibia | 250 | 239 |
| Hind tibial spurs | 52; 22 | 44; 20 |
| Hind tarsus 1 | 113 | 116 |
| Hind tarsus 2 | 37 | 32 |
| Hind tarsus 3 | 31 | 29 |
| Hind tarsus 4 | 27 | 25 |
| Hind tarsus 5 | 49 | 52 |

## Suppl. 3: Habitat information & Biogeography

Here, we present detailed collection data and ecological details on the habitats of all locations where *A. kretschmanni* has been found. Description of nature conservation areas is based on information provided by Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg (LUBW, [State Institute for the Environment, Survey and Nature Conservation Baden-Wuerttemberg]). Plant names are adopted from FloraWeb (www.floraweb.de, Bundesamt für Naturschutz, [Federal Agency for Nature Conservation]), accessed 11.03.2022).

**Locality 1**: Germany, Baden-Württemberg, Tübingen, Hirschau, Riedweingärten, plot number 4400; Lat 48.504817, Long 8.985067, 380 m.a.s.l.; Malaise trap: 1 ♀: 06.06.2014 - 20.06.2014; 1 ♀: 29-08.2014 - 12.09.2014.

*Habitat*: The Spitzberg is a mountain comprising a protected landscape and surrounding lands. Localities 1 and 2 are just outside a conservation area with very well-monitored flora and fauna (Gottschalk 2019). Locality 1 is located in a meadow orchard with scattered trees on former vineyard grounds on the south-facing slope of Spitzberg. The malaise trap was located in a slight hollow and therefore somewhat sheltered from the wind in the middle to lower part of the slope. Locality 1 is not exposed to particularly high levels of sunlight. The undergrowth is a flower-rich meadow that can be classified as *Arrhenatherum elatius*-grassland with interspersed patches of dry calcareous grassland. The grassland has a high coverage of *Centaurea scabiosa* L. and accommodates remarkable species of the Orchid family (e.g. *Himantoglossum hircinum* (L.) Spreng., *Orchis militaris* L. and *Ophrys apifera* Huds.).

**Locality 2**: Germany, Baden-Württemberg, Tübingen, Hirschau, Oberes Tal, plot number 4244; Lat 48.50503, Long 8.99346, 375 m.a.s.l.; Malaise trap: 7 ♀: 17.07.2014 - 31.07.2014; 6 ♀: 29.08.2014 - 12.09.2014; 2 ♀: 12.09.2014 - 26.09.2014; 1 ♀: 26.09.2014 - 09.10.2014.

*Habitat*: very similar to locality 1 (plot number 4400) but less marginal vegetation (e.g. *Peucedanum cervaria* (L.) Lapeyr.).

**Locality 3**: Germany, Baden-Württemberg, Östringen, Apfelberg, plot number 9836; Lat 49.16754, Long 8.79030, 181 m.a.s.l.; Malaise trap: 1 ♀: 16.07.2019 - 30.07.2019; 6 ♀: 10.09.2019 - 24.09.2019; 1 ♀: 24.09.2019 - 08.10.2019.

*Habitat*: Nature conservation area (NSG # 2.217) that represents a characteristic landscape section with hedge areas, semi-arid grasslands and orchards. The area was placed under protection to safeguard and preserve endangered animal and plant species. The trap was located on the southern slope of the nature conservation area and was surrounded by arable land, woody plants, shrubs, vineyards and grasslands (mainly *Arrhenatherum elatius*-grassland interspersed with *Bromus erectus*-semidry grassland. The dominating species are *Helictotrichon pubescens* (Huds.) Pilg., *Salvia pratensis* L. and *Trifolium campestre* Schreb.

**Locality 4**: Germany, Baden-Württemberg, Königsbach-Stein, Beim Steiner Mittelberg, plot number 11498, Lat 49.16754, Long. 8.79030, 234 m.a.s.l., Malaise trap: 1 ♀: 22.05.2019 - 05.06.2019; 4♀: 03.07.2019 - 17.07.2019; 2 ♀: 17.07. – 31.07.2019; 2♀: 31.07.2019 - 13.08.2019; 1♀: 28.08.2019 - 11.09.2019.

*Habitat:* Nature conservation area (NSG # 2.119) characterised by partly open, partly wooded semi-dry grassland on sun-exposed steep slopes on Muschelkalk and meadows partly interspersed with fruit trees. The trap was located on a hay meadow (patchy semidry grassland and *Arrhenatherum elatius*-grassland. The dominating species are *Plantago media* L. and *Prunella vulgaris* L. and the nature conservation area is surrounded by a small deciduous forest and wheat fields.