The *Knautia* feeding species of *Aphis* (Insecta: Hemiptera: Aphididae) with notes on *Aphis knautiae* Holman nomen nudum

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1urn:lsid:zoobank.org:author:78C290A3-D07B-4AF9-9358-ED8C05A702BF
2urn:lsid:zoobank.org:author:E7A39AC2-AE8C-4CF1-8594-7951FF5A7058

Abstract. Here we present a review of *Knautia* feeding aphid species of the genus *Aphis* Linnaeus, 1758 (Insecta: Hemiptera: Aphididae). A new European species *Aphis holmani* sp. nov. is described from specimens collected in the Czech Republic, Bulgaria and Romania by the late Jaroslav Holman, who already recognized this new species, but never published its description. It has previously been referred to as *Aphis knautiae* Holman nomen nudum. Morphological characters of apterous and alate viviparous females as well as the sexual generation (oviparous females and males) are described and figured. The new species is associated with *Knautia drymeia* and its affinities with other related species living on species of *Knautia* are presented. Morphological characteristics of known morphs of other *Knautia* feeding species *A. confusa* Walker, 1849, *A. longini* Huculak, 1968 and *A. thomasi* (Börner, 1950) are given and figured. Additionally hitherto unknown sexual forms of *A. thomasi* are described from specimens collected in the Czech Republic and Poland. A key to known aphid species living on species of *Knautia* is also provided.

Key words. Aphidini, Aphidoidea, description, Europe, taxonomy, *Aphis holmani* sp. nov.

INTRODUCTION

*Aphis* Linnaeus, 1758 with 589 valid species is the most speciose genus within the Aphidoidea as a whole (Favret 2019; Blackman & Eastop 2019). Species belonging to this genus are known mostly from the northern hemisphere with small number of taxa which are native for the southern part of the globe. Most of species form groups of similar or very similar species whose elucidation may be difficult, but mostly all they are characterized by terminal process which is no longer than the fourfold of the basal part length, relatively short siphunculi and a subtriangular or tongue-shaped cauda. Viviparous and sexual generations of *Aphis* are furthermore characterized by undeveloped or low antennal tubercles with a little convex frons, marginal tubercles on prothorax, abdominal segments I and VII and occasionally on other segments of the abdomen, which although lack in some species (Heie 1986).

The plant genus *Knautia* L. (Dipsacaceae) comprises about 50–55 species distributed in western Eurasia and northwestern Africa, with the highest species diversity is in southern and southeastern Europe, especially the Alps and the Balkan Peninsula. Species from this genus can be found dry grasslands, wet meadows, alpine grasslands, forests, and ruderal communities (Ehrendorfer 1976; Rešetnik et al. 2014). So far 11 aphis species have been described or recorded from ten *Knautia* species of which three species belong to genus *Aphis*: *A. confusa* Walker, 1849, *A. longini* Huculak, 1968 and *A. thomasi* (Börner, 1950) are associated with *Knautia arvensis* (L.) Coult., *K. dinarica* (Murb.) Borbás, *K. dipscicfolia* Kreutzer and *K. integrifolia* Ehrend. Only *A. confusa* feeds on all four species (both, *A. longini* and *A. thomasi* are known only from *K. arvensis*) (Holman 2009; Blackman & Eastop 2019).

*Knautia drymeia* Heuff. has a native distribution range from South-eastern Germany to Northern Greece (Albania, Austria, Bulgaria, Czech Republic, Croatia, Greece, Hungary, Montenegro, Romania, Serbia and Slovakia) (Rešetnik et al. 2016). It is a perennial herb, usually with a monopodial stalk bearing a terminal leaf rosette and lateral flowering stems. Its habitats are forests and forest margins, especially deciduous and hard-wood floodplain forests, but it also reaches into subalpine habitats (Ehrendorfer 1962; Fischer et al. 2008). Only four aphis species from the tribe Macrosiphini have been reported from this species to date: *Aulacorthum knautiae* Heie, 1960, *Macrosiphum knautiae* Holman, 1972, *M. rosae* (Linnaeus, 1758) and *M. rosae* (Linnaeus, 1758) (Murb. & Sali, 1872) (Ehrendorfer 1962; Fischer et al. 2008).
Another nominal species associated with *K. drymeia* is *Aphis knautiae* Holman which was for the first time mentioned in 1981 in the list of aphids of Romania (Holman & Pintera 1981) but recognized as a nomen nudum (ICZN 1999; Remaudière & Remaudière 1997; Favret 2019). During the work in the Aphidoidea collection of the late Jaroslav Holman (now deposited in the Biology Centre of the Czech Academy of Sciences, Institute of Entomology, České Budějovice, Czech Republic) specimens collected in the Czech Republic, Bulgaria and Romania from *K. drymeia* and labeled as “*Aphis knautiae* Holman” have been found and recognized as *A. knautiae* Holman nomen nudum. A careful examination and comparison with other *Aphis* species associated with *Knautia* revealed that the specimens represent an undescribed species; its diagnosis and detailed description is given in this paper which makes this name available.

**MATERIAL AND METHODS**

The specimens were examined using light microscope Leica DM 3000 led with Leica MC 190 HD camera and Nikon Eclipse E600 with Nikon DS–Fi camera. The measurements were done according to Ilharco & van Harten (1987) and Blackman & Eastop (2006). Measurements are given in millimeters (Supplementary tables 1–4).

**Abbreviations**

- **ANT** = antennae or their lengths
- **ANT I–VI** = antennal segments I, II, III, IV, V, VI or their lengths (ratios between antennal segments are simply given as e.g. ‘VI: III’)
- **BASE** = basal part of last antennal segment or its length
- **BD III** = basal articular diameter of ANT III
- **BL** = body length (from anterior border of the head to the end of cauda)
- **FEMORA III** = hind femora length
- **FEMORA III LS** = longest setae on hind femora
- **GP** = genital plate
- **PHT** = posterior seta (hair) of hind trochanter
- **HW** = greatest head width across compound eyes
- **HT II** = second segment of hind tarsus or its length
- **LS ANT III** = length of longest setae of ANT III
- **MAX W** = maximal width of abdomen
- **PT** = processus terminalis of last antennal segment or its length
- **MTu** = marginal tubercles

**SIPH L** = siphunculi length
**SIPH W** = maximum width of siphunculus
**TIBIAE III** = hind tibiae length
**URS** = ultimate segments of rostrum (IV + V) or their length

**apt.** = apterous viviparous female
**al.** = alate viviparous female
′♀′ = oviparous female
′♂′ = male

**Depositories of the material examined**

- **DZUS** = Hemiptera Collection of the Department of Zoology, University of Silesia in Katowice, Poland
- **IECA** = Biology Centre of the Czech Academy of Sciences, Institute of Entomology, České Budějovice, Czech Republic;
- **ZMPA** = Zoological Institute, Polish Academy of Sciences, Warsaw, Poland

**RESULTS**

**Shared characters of Aphis species feeding on Knautia spp.**

Body egg or pear-shaped. Head slightly sclerotized with very small and slightly visible ANT tubercles and subconvex frons. Head and body sclerotization often with microsculpture. ANT 5 or 6-segmented. ANT III without secondary rhinaria, ANT V with small ciliated rhinaria. ANT VI with small ciliated major rhinaria, 5–6 visible additional rhinaria and 4 apical setae. Ultimate rostral segment with 2 (sometimes 4) accessory setae. First segments of tarsi with 3–3–2 ventral setae. Dorsum of thorax membranous, sometimes with more or less visible sclerotic plates on marginal areas. Dorsum of thorax and abdomen covered by a few short, rigid setae with blunt apices. Abdomen membranous. ABD I and VII always with MTu. Siphunculi short, cylindrical, slightly tapering. Cauda short, tongue-shaped. Alate viviparous females with small number of secondary rhinaria on ANT III and IV. Abdomen with marginal sclerotic plates on ABD II–IV. ABD VI with wide postsiphuncular sclerites. Oviparous females with more or less swollen hind tibiae with rounded or slightly oval pseudosensoria on almost whole length and genital plate divided into two separated sclerotic parts. Males apterous with small number of secondary rhinaria on ANT III–V. They are small, rounded with sclerotic rings. Male genitalia with wide and lobate parameres with a large number of long and pointed setae. Basal part of the phallus short and hooked-shaped.
Morphological characteristics of species

*Aphis* (*Aphis*) *confusa* Walker, 1849

Walker, 1849: XLV

Figs 1–7; Supplementary tables 1–4; Tables 1–2

Apterous viviparous female (n=27).

Colour in life: apterae are pale yellow, yellowish green, green or dark green, depending on location on host (Blackman & Eastop 2019); pigmentation on slide: head sclerotized, brown. Antennae light brown with lighter ANT and basal part of ANT IV or ANT III, and basal part of ANT IV and V. Legs yellow to pale brown with brown distal parts of tibiae and tarsi (sometimes only slightly visible). Abdomen yellow with brown to dark brown SIPH and light brown cauda and anal plate (Fig. 1a).

HW 0.36–0.40 × ANT. Head setae 0.015–0.025 mm long, 0.75–0.90 × BD III. ANT 0.51–0.58 × BL. ANT IV slightly shorter, as long as or slightly longer than ANT V. ANT VI with PT 2.45–3.00 × BASE. Other antennal ratios: VI:III 1.28–1.52, V:III 0.56–0.69, IV:III 0.56–0.76, PT:III 0.87–0.91, PT:IV 1.42–1.71, PT:V 1.55–1.80. ANT bearing very short and blunt setae (Fig. 5a). ANT III setae shorter than the width of the segment, 0.010–0.015 mm long, LS III 0.50–0.75 × BD III. ANT I with 4–5, ANT II with 3–5, ANT III with 4–9, ANT IV with 2–4, ANT V with 2–5, ANT VI with 2–3 basal setae. Rostrum reaching hind coxae. URS 0.37–0.50 × ANT III, 0.27–0.34 × ANT VI, 0.37–0.46 × PT, 1.09–1.37 × BASE and 1.00–1.22 × HT II. Mesosternal furca wide, fused basally. III FEMORA bearing long, slightly rigid setae with blunt or slightly expanded apices (Fig. 5b), 0.015–0.032 mm long, III FEMORA LS 0.63–0.76 ×

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Fig. 1. *Apterous viviparous females of* *Knautia* feeding *Aphis* species. (a) *A. confusa*; (b) *A. holmani* sp. nov.; (c) *A. longini*; (d) *A. thomasi*.

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trochantero-femoral suture length. Posterior seta on hind trochanter 0.76–1.00 × trochantero-femoral suture length (Fig. 5c). III TIBIAE bearing long and rigid setae with slightly blunt apices, 0.017–0.030 mm long. HT II 0.37–0.44 × ANT III, 0.27–0.30 × ANT VI, 0.37–0.42 × PT and 1.00–1.12 × BASE. Abdomen with very small MTu on ABD IV. SIPH 1.60–1.88 × cauda, 0.13–0.18 × BL, and 1.09–1.30 × ANT III. Setae on ABD I–V 0.015–0.020 mm long, about 0.85 × BD III. Setae on ABD VI–VIII 0.017–0.025 mm long, 0.85–1.13 × BD III. Genital plate anterior setae 0.035–0.042 mm long, 1.75–2.00 × BD III. Cauda with 5–8 setae (Fig. 6a, b).

Alate viviparous female (n=4).

Colour in life: unknown; pigmentation on slide: head and thorax sclerotized, brown to dark brown. Antennae brown to light brown with paler basal half of ANT III, IV and V. Wings light brown with darker venation. Fore

Fig. 2. Known alate viviparous females of *Knautia* feeding *Aphis* species. (a) *A. confusa*; (b) *A. holmani* sp. nov.; (c) *A. thomasi*.

Fig. 3. Known oviparous females of *Knautia* feeding *Aphis* species. (a) *A. confusa*; (b) *A. holmani* sp. nov.; (c) *A. thomasi*. 
and middle femora uniformly yellow to light brown, hind femora yellow to light brown with darker distal half. Tibiae yellow to light brown with brown distal ends and tarsi. Abdomen pale with brown sclerite, plates, SIPH, cauda and anal plate (Fig. 2a). HW 0.34–0.36 × ANT. Head setae 0.012–0.015 mm long, 0.76–0.88 × BD III. ANT 0.62–0.67 × BL. ANT III with 4–5 secondary rhinaria, ANT IV slightly shorter or slightly longer than ANT V. ANT VI with PT 2.28–2.90 × BASE. Other antennal ratios: VI:III 1.32–1.70, V:III 0.57–0.77, IV:III 0.62–0.69, PT:III 0.92–1.20, PT:IV 1.33–1.93, PT:V 1.55–1.70. ANT bearing very short and blunt setae. ANT III setae shorter than the width of the segment, 0.010–0.012 mm long, LS III 0.58–0.83 × BD III. ANT I with 4–5, ANT II with 4–5, ANT III with 5–7, ANT IV with 4–6, ANT V with 4–6, ANT VI with 2–3 basal setae. Rostrum reaching mesosternum. URS 0.42–0.45 × ANT III, 0.26–0.31 × ANT VI, 0.37–0.45 × PT, 0.90–1.10 × BASE and 1.10–1.17 × HT II. III FEMORA bearing medium sized to long, slightly rigid setae with blunt apices, 0.017–0.027 mm long, III FEMORA LS 0.59–0.67 × trochantero-femoral suture length. Posterior seta on hind trochanter 0.40–0.81 × trochantero-femoral suture length. III TIBIAE bearing long and rigid setae with blunt apices, 0.017–0.027 mm long. HT II 0.38–0.39 × ANT III, 0.22–0.28 × ANT VI, 0.32–0.41 × PT and 0.77–0.95 × BASE. Abdomen with solid sclerotic bar on ABD I, small spinal and spinopleural sclerites on ABD ABD II–V. ABD V without presiphuncular sclerites. ABD VI with large spinal plate. ABD VII with small spinal plate (Fig. 7a). SIPH 1.50–1.61 × cauda, about 0.13 × BL, and 0.87–0.95 × ANT III. Setae on ABD I–V 0.010–0.015 mm long, 0.66–0.88 × BD III. Setae on ABD VI–VIII 0.015–0.020 mm long, 0.88–1.17 × BD III. Genital plate anterior setae 0.020–0.040 mm long, 1.47–2.35 × BD III. Cauda with 5–7 setae.

Oviparous female (n=4).

Colour in life: unknown; pigmentation on slide: head slightly sclerotized, yellow to light brown. Antennae yellow or pale with ANT I, ANT II, apical part of ANT V, BASE and PT light brown. Legs yellow with light brown distal parts of tibiae and tarsi. Hind tibiae uniformly light brown. Abdomen yellow with brown SIPH, cauda and anal plate (Fig. 3a). HW 0.47–0.50 × ANT. Head setae 0.010–0.012 mm long, 0.58–0.62 × BD III. ANT about 0.48 × BL. ANT IV slightly shorter than ANT V. ANT VI with PT about 2.50 × BASE. Other antennal ratios: VI:III 2.00–2.33, V:III 0.85–0.91, IV:III 0.64–0.83, PT:III 1.42–1.66, PT:IV 2.20–2.22, PT:V 1.66–1.81. ANT bearing very short and blunt setae. ANT III setae shorter than the width of the segment, 0.007–0.010 mm long, LS III 0.58–0.62 × BD III. ANT I with 5, ANT II with 3, ANT III with 5–6, ANT IV with 2, ANT V with 3–4, ANT VI with 2–3 basal setae. Rostrum reaching hind coxae. URS 0.67–0.83 × ANT III, 0.33–0.35 × ANT VI, 0.47–0.50 × PT, 1.18–1.25 × BASE and 1.18–1.33 × ANT.

Fig. 4. Known males of *Knautia* feeding *Aphis* species. (a) *A. confusa*; (b) *A. holmani* sp. nov.; (c) *A. thomasi*.
× HT II. Mesosternal furca separated or slightly fused, wide. Posterior seta on hind trochanter 0.64–1.00 × trochantero-femoral suture length. III FEMORA with 60–89 pseudosensoria, bearing medium sized to long, slightly rigid setae with slightly blunt apices which are mostly pointed on the dorsal side, 0.010–0.075 mm long. III FEMORA LS 0.59–0.77 × trochantero-femoral suture length. III TIBIAE with 60–89 mostly circular, different in size pseudosensoria and with long and mostly rigid setae with blunt apices, 0.010–0.030 mm long. HT II 0.57–0.62 × ANT III, 0.26–0.28 × ANT VI, 0.37–0.40 × PT and 0.93–1.00 × BASE. Abdomen with small marginal tubercles on ABD I, V and VII. SIPH 1.23–1.28 × cauda, about 0.11 × BL, and 1.28–1.33 × ANT III. Setae on ABD I–V 0.010–0.015 mm long, about 0.62–0.88 × BD III. Setae on ABD VI–VIII 0.015–0.025 mm long, 0.93–1.00 × BD III. Genital plate anterior setae 0.026–0.035 mm long, 1.52–2.18 × BD III. Cauda with 6–7 setae.

**Male** (n=5).

**Colour in life:** unknown; pigmentation on slide: head sclerotized, light brown. Antennae light brown with

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**Table 1.** Morphological differences between apterous and alate viviparous females of *Aphis holmani* sp. nov. and *A. confusa*.

<table>
<thead>
<tr>
<th>Character</th>
<th><em>Aphis holmani</em> sp. nov.</th>
<th><em>Aphis confusa</em></th>
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<tbody>
<tr>
<td>Femora setae</td>
<td>pointed</td>
<td>with blunt apices</td>
</tr>
<tr>
<td>Head setae</td>
<td>pointed</td>
<td>with blunt apices</td>
</tr>
<tr>
<td>URS</td>
<td>0.13–0.16</td>
<td>0.10–0.12</td>
</tr>
<tr>
<td>III FEMUR LS</td>
<td>0.045–0.050</td>
<td>0.030–0.045</td>
</tr>
<tr>
<td>Head LS</td>
<td>0.030–0.035</td>
<td>0.015–0.025</td>
</tr>
<tr>
<td>Frontal setae</td>
<td>0.030–0.035</td>
<td>0.017–0.025</td>
</tr>
<tr>
<td>ABD VIII setae</td>
<td>0.025–0.030</td>
<td>0.017–0.025</td>
</tr>
<tr>
<td>GP anterior setae L</td>
<td>0.045–0.050</td>
<td>0.035–0.042</td>
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<tr>
<td>PT/BASE</td>
<td>1.75–2.20</td>
<td>2.45–3.00</td>
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<tr>
<td>URS/HT II</td>
<td>1.40–1.52</td>
<td>1.00–1.22</td>
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<tr>
<td>URS/ANT VI</td>
<td>0.40–0.43</td>
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<td>URS/PT</td>
<td>0.59–0.66</td>
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<td>0.83–0.90</td>
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<tr>
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<td>0.90–1.11</td>
<td>0.63–0.76</td>
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<td>GP anterior setae/BD III</td>
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<td>1.75–2.00</td>
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<td>ABD VIII setae/BD III</td>
<td>1.11–1.76</td>
<td>0.85–0.90</td>
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<table>
<thead>
<tr>
<th>Character</th>
<th><em>Aphis holmani</em> sp. nov.</th>
<th><em>Aphis confusa</em></th>
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<tr>
<td>URS</td>
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<td>0.100–0.110</td>
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<td>0.51–0.59</td>
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<td>SIPH/CAUDA</td>
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<td>0.16</td>
<td>0.08–0.11</td>
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Table 2. Morphological differences between sexual morphs of *Aphis holmani* sp. nov. and *A. confusa*.

<table>
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<th>Character</th>
<th><em>Aphis holmani</em> sp. nov.</th>
<th><em>Aphis confusa</em></th>
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<td><strong>Oviparous females</strong></td>
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<td>Tibiae setae</td>
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<td>Pseudosensoria</td>
<td>25–42</td>
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<td>1.37–1.43</td>
<td>1.18–1.25</td>
</tr>
<tr>
<td>SIPH/CAUDA</td>
<td>1.07–1.12</td>
<td>1.23–1.28</td>
</tr>
<tr>
<td>SIPH/BL</td>
<td>0.08–0.09</td>
<td>0.11</td>
</tr>
<tr>
<td>SIPH/ANT III</td>
<td>0.87–0.96</td>
<td>1.28–1.33</td>
</tr>
<tr>
<td>III FEMUR LS/TFS</td>
<td>0.84–1.00</td>
<td>0.57–0.77</td>
</tr>
<tr>
<td>GP anterior setae/BD III</td>
<td>2.50–3.23</td>
<td>1.52–2.18</td>
</tr>
<tr>
<td>Head setae/BD III</td>
<td>0.85–1.47</td>
<td>0.58–0.62</td>
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<tr>
<td>ABD I–V setae/BD III</td>
<td>1.10–1.29</td>
<td>0.62–0.88</td>
</tr>
<tr>
<td>ABD VI–VIII setae/BD III</td>
<td>1.88–2.00</td>
<td>0.93–1.00</td>
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<table>
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<tr>
<th>Males</th>
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<tr>
<td><em>Aphis holmani</em> sp. nov.</td>
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<td></td>
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<tr>
<td>ANT IV rhinaria</td>
<td>12–18</td>
<td>2–12</td>
</tr>
<tr>
<td>ANT V rhinaria</td>
<td>11–13</td>
<td>4–10</td>
</tr>
<tr>
<td>TFS</td>
<td>0.032–0.037</td>
<td>0.040–0.045</td>
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<tr>
<td>ABD I–V setae</td>
<td>0.022–0.027</td>
<td>0.010–0.013</td>
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<tr>
<td>ABD VI–VIII setae</td>
<td>0.030–0.052</td>
<td>0.015–0.030</td>
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<td>ANT/BL</td>
<td>0.87–1.06</td>
<td>0.76–0.80</td>
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<td>0.82–0.88</td>
<td>0.61–0.71</td>
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<tr>
<td>ANT IV/ANT V</td>
<td>1.00–1.06</td>
<td>0.80–0.89</td>
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<tr>
<td>URS/HT II</td>
<td>1.33–1.35</td>
<td>1.21–1.30</td>
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<td>URS/ANT III</td>
<td>0.55</td>
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<td>SIPH/CAUDA</td>
<td>0.88–0.90</td>
<td>1.00–1.20</td>
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<td>SIPH/ANT III</td>
<td>0.47–0.50</td>
<td>0.57–0.64</td>
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<td>III FEMUR LS/TFS</td>
<td>1.06–1.08</td>
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<td>Head setae/BD III</td>
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<td>0.50–0.76</td>
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<td>Frontal setae/BD III</td>
<td>1.33</td>
<td>0.60–0.96</td>
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<td>ABD I–V setae/BD III</td>
<td>1.46–1.80</td>
<td>0.50–0.076</td>
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<td>ABD VI–VIII setae/BD III</td>
<td>2.00–2.46</td>
<td>0.75–1.15</td>
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</table>

Slightly paler basal part of ANT III. Legs with yellow or light brown femora and pale to yellow tibiae with brown distal parts and tarsi. Abdomen pale with light brown SIPH, cauda and genitalia (Fig. 4a). HW 0.39–0.40 × ANT. Head setae 0.010–0.017 mm long, 0.50–0.76 × BD III. ANT 0.76–0.80 × BL. ANT III with 0 (on one segment)–14, ANT IV shorter, than ANT V with 2–12, ANT V with 1–11 secondary rhinaria. ANT VI with PT.
Fig. 5. Key morphological differences between apterous viviparous females of *Knautia* feeding *Aphis* species. *A. confusa*. (a) ANT III seta with blunt apex; (b) hind femora inner setae with blunt apices; (c) long hind trochanter seta; *A. holmani* sp. nov.: (d) ANT III seta with pointed apex; (e) hind femora inner setae with pointed apices; (f) very long hind trochanter seta; *A. longini*: (g) ANT III long and pointed setae; (h) hind femora inner setae with pointed apices; (i) long hind trochanter seta; *A. thomasi*: (j) ANT III and IV very short setae with blunt apices; (k) very short hind trochanter inner setae with blunt apices; (l) very short hind trochanter seta.

2.64–2.73 × BASE. Other antennal ratios: VI:III 1.64–1.77, V:III 0.76–0.80, IV:III 0.61–0.71, PT:III 1.20–1.28, PT:IV 1.80–1.95, PT:V 1.57–1.60. ANT bearing very short and blunt setae. ANT III setae shorter than the width of the segment, about 0.010 mm long. LS III 0.50–0.76 × BD III. ANT I with 4–5, ANT II with 3, ANT III with 4–5, ANT IV with 3, ANT V with 1–3, ANT VI with 1–2 basal setae. Rostrum reaching from hind coxae to ABD I. URS 0.48–0.50 × ANT III, 0.27–0.30 × ANT VI, 0.37–0.41 × PT, 1.00–1.33 × BASE and 1.21–1.30 × HT II. Mesosternal furca separated. Posterior setae on hind trochanter 1.00–1.40 × trochantero-femoral suture length. III FEMORA bearing short to medium sized and rigid setae with mostly blunt apices which are pointed on the dorsal side, 0.015–0.032 mm long. III FEMORA LS 0.78–0.80 × trochantero-femoral suture length. III TIB-IAE bearing short to medium sized and rigid setae with blunt apices, 0.010–0.025 mm long. HT II 0.38–0.40 × ANT III, 0.22–0.23 × ANT VI, about 0.31 × PT and 0.82–0.86 × BASE. Abdomen with small marginal tubercles on ABD IV. SIPH 1.00–1.22 × cauda, 0.09–0.11 × BL, and 0.57–0.64 × ANT III. Setae on ABD I–V 0.010–0.013 mm long, 0.50–0.76 × BD III. Setae on ABD VI–
VIII 0.015–0.030 mm long, 0.75–1.15 × BD III. Cauda with 4–6 setae.


**Biology.** This is a monoeocious and holocyclic species with sexuales in September and October. The aphids occur on upper parts of stems and inflorescences or on undersides of leaves and at base of stems or on roots (Heie 1986).

**Distribution.** *Aphis confusa* is a common and widely distributed species in Europe (except Balkans).

**Aphis (Aphis) holmani** sp. nov.

*Aphis knautiae* Holman in Holman & Pintera, 1981: 50 (nomen nudum)
Figs 1–7, Supplementary tables 1–4; Tables 1–2

**Description.**

**Apterous viviparous female** (n=63).

**Colour** in life: unknown; pigmentation on slide: head and thorax sclerotized, brown. ANT light brown with brown ANT I and ANT II and slightly paler basal half of ANT III–V. Fore and middle legs light brown with slightly darker distal parts of tibiae. Hind legs with brown femora with paler proximal parts and light brown tibiae with darker distal part of tibiae and tarsi. Wings with light brown pterostigma and veins. Abdomen pale with light brown sclerotization, brown SIPH and cauda (Fig. 2b). HW about 0.32 × ANT. Head setae 0.017–0.027 mm long, 0.11–0.14 × BD III. ANT 0.65–0.76 × BL. ANT III with 4–6 secondary rhinaria. ANT IV as long as or slightly shorter, as long as than ANT V with 0–1 secondary rhinaria. ANT VI with PT 2.40–2.47 × BASE. Other antennal ratios: VI:III 1.40–1.61, V:III 0.57–0.66, IV:III 0.51–0.61, PT:III 1.00–1.14, PT:IV 1.73–1.84, PT:V 1.71–1.73. ANT bearing very short and blunt setae. ANT III setae shorter than the width of the segment, 0.012–0.015 mm long, LS III 0.80–1.00 × BD III. ANT I with 4–5, ANT II with 3–5, ANT III with 6–10, ANT IV with 3–6, ANT V with 4–6, ANT VI with 2 basal setae. Rostrum reaching from hind coxae to ABD I. URS 0.36–0.54 × ANT III, 0.40–0.43 × ANT VI, 0.59–0.66 × PT, 1.16–1.30 × BASE and 1.40–1.52 × HT II with 2–4 accessory setae. Mesosternal furca separated or slightly fused, wide. III FEMORA bearing long, fine, hair-like setae with pointed apices (Fig. 5e), 0.015–0.050 mm long, III FEMORA LS 0.40–0.50 mm long, 0.90–1.11 × trochantero-femoral suture length. Posterior seta on hind trochanter, 1.00–1.22 × trochantero-femoral suture length (Fig. 5f). III TIBIAE bearing long setae with pointed apices, 0.010–0.040 mm long. HT I with 3–3–2 ventral setae, HT II 0.26–0.35 × ANT III, 0.26–0.30 × ANT VI, 0.38–0.47 × PT and 0.83–0.90 × BASE. Abdomen membranous, with well-developed marginal tubercles on ABD I and ABD VII and sometimes small marginal tubercles on ABD IV. SIPH tubular, very slightly tapering towards apex, 1.05–1.50 × cauda, 0.09–0.14 × BL, and 0.59–0.91 × ANT III. Dorsal setae very short and pointed, 0.015–0.030 mm long, 0.83–1.25 × BD III on ABD I–V and 0.020–0.055 mm long, 1.11–1.76 × BD III on ABD VI–VIII. Anterior setae on genital plate 0.045–0.050 mm long, 2.25–2.94 × BD III. Cauda with 6–9 setae (Fig. 6c, d).

*Alate viviparous female* (n=5).

**Colour** in life: unknown; pigmentation on slide: head and thorax sclerotized, brown. ANT light brown with brown ANT I and ANT II and slightly paler basal half of ANT III–V. Fore and middle legs light brown with slightly darker distal parts of tibiae. Hind legs with brown femora with paler proximal parts and light brown tibiae with darker distal part of tibiae and tarsi. Wings with light brown pterostigma and veins. Abdomen pale with light brown sclerotization, brown SIPH and cauda (Fig. 2b). HW about 0.32 × ANT. Head setae 0.017–0.027 mm long, 0.11–0.14 × BD III. ANT 0.65–0.76 × BL. ANT III with 4–6 secondary rhinaria. ANT IV as long as or slightly shorter, as long as than ANT V with 0–1 secondary rhinaria. ANT VI with PT 2.40–2.47 × BASE. Other antennal ratios: VI:III 1.40–1.61, V:III 0.57–0.66, IV:III 0.51–0.61, PT:III 1.00–1.14, PT:IV 1.73–1.84, PT:V 1.71–1.73. ANT bearing very short and blunt setae. ANT III setae shorter than the width of the segment, 0.012–0.015 mm long, LS III 0.80–1.00 × BD III. ANT I with 4–5, ANT II with 3–5, ANT III with 6–10, ANT IV with 3–6, ANT V with 4–6, ANT VI with 2 basal setae. Rostrum reaching from hind coxae to ABD I. URS 0.36–0.54 × ANT III, 0.40–0.43 × ANT VI, 0.59–0.66 × PT, 1.16–1.30 × BASE and 1.40–1.52 × HT II with 2–4 accessory setae. Mesosternal furca separated or slightly fused, wide. III FEMORA bearing long, fine, hair-like setae with pointed apices (Fig. 5e), 0.015–0.050 mm long, III FEMORA LS 0.40–0.50 mm long, 0.90–1.11 × trochantero-femoral suture length. Posterior seta on hind trochanter, 1.00–1.22 × trochantero-femoral suture length (Fig. 5f). III TIBIAE bearing long setae with pointed apices, 0.010–0.040 mm long. HT I with 3–3–2 ventral setae, HT II 0.26–0.35 × ANT III, 0.26–0.30 × ANT VI, 0.38–0.47 × PT and 0.83–0.90 × BASE. Abdomen membranous, with well-developed marginal tubercles on ABD I and ABD VII and sometimes small marginal tubercles on ABD IV. SIPH tubular, very slightly tapering towards apex, 1.05–1.50 × cauda, 0.09–0.14 × BL, and 0.59–0.91 × ANT III. Dorsal setae very short and pointed, 0.015–0.030 mm long, 0.83–1.25 × BD III on ABD I–V and 0.020–0.055 mm long, 1.11–1.76 × BD III on ABD VI–VIII. Anterior setae on genital plate 0.045–0.050 mm long, 2.25–2.94 × BD III. Cauda with 6–9 setae (Fig. 6c, d).

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Fig. 6. End of abdomen (left column) and ABD VIII setae (right column) of *Knautia* feeding *Aphis* species. (a–b) *A. confusa*, (c–d) *A. holmani* sp. nov.; (e–f) *A. longini*; (g–h) *A. thomasi*. 
A new *Aphis* species from Europe

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0.59 × ANT III, about 0.36 × ANT VI, 0.51–0.52 × PT, 1.25–1.28 × BASE and 1.50–1.56 × HT II. III FEMORA bearing long, fine and pointed setae, 0.012–0.032 mm long, III FEMORA LS 0.80–0.86 × trochantero-femoral suture length. Posterior setae on hind trochanter 0.80–1.00 × trochantero-femoral suture length. III TIBIAE bearing long, fine and pointed setae, 0.012–0.032 mm long. HT II 0.34–0.38 × ANT III, 0.23–0.26 × ANT VI, 0.33–0.34 × PT and 0.80–1.00 × BASE. Abdomen with sclerite on ABD I, small spinal sclerites on ABD ABD II–IV. ABD V with solid or broken presiphuncular sclerites. ABD VI with large spinal plate. ABD VII with wide spino-pleural plate. ABD IV and VI with small MTu (Fig. 7b). SIPH 1.14–1.636 × cauda, 0.09–0.10 × BL, and about 0.57 × ANT III. Setae on ABD I–V 0.020–0.025 mm long, about 1.33 × BD III. Setae on ABD VI–VIII 0.025–0.040 mm long, about 1.66 × BD III. Genital plate anterior setae 0.030–0.040 mm long, 2.00–2.66 × BD III. Cauda with 8 setae.

**Oviparous female** (n=47).

*Colour* in life: unknown; pigmentation on slide: head sclerotized, brown. Antennae pale with ANT I, ANT II, apical part of ANT V and ANT VI brown. Legs yellow with slightly darker very apical parts and tarsi. Abdomen yellow with brown SIPH, cauda and anal plate (Fig. 3b). HW 0.44–0.46 × ANT. Head setae 0.017–0.040 mm long, 0.85–1.47 × BD III. ANT 0.51–0.56 × BL. ANT IV shorter than ANT V. ANT VI with PT 2.68–3.06 × BASE. Other antennal ratios: VI:III 2.00–2.18, V:III 0.87–0.92, IV:III 0.70–0.85, PT:III 1.48–1.51, PT:IV 1.86–2.09, PT:V 1.64–1.75. ANT bearing very short and pointed setae. ANT III setae shorter than the width of the segment, 0.011–0.015 mm long, LS III 0.60–0.88 × BD III. ANT I with 4–5, ANT II with 4, ANT III with 3–4, ANT IV with 2–3, ANT V with 2–3, ANT VI with 2–3 basal setae. Rostrum reaching from hind coxae to ABD I. URS about 0.55 × ANT III, 0.29–0.31 × ANT VI, 0.40–0.41 × PT, 1.17–1.35 × BASE and 1.33–1.35 × HT II. III FEMORA bearing long, fine and pointed setae, 0.017–0.040 mm long, III FEMORA LS 1.06–1.08 × trochantero-femoral suture length. Posterior seta on hind trochanter 1.00–1.06 × trochantero-femoral suture length. III TIBIAE bearing long, fine and pointed setae, 0.012–0.032 mm long. HT II about 0.41 × ANT III, 0.22–0.23 × ANT VI, about 0.30 × PT and 0.88–1.00 × BASE. Abdomen with small marginal tubercles on ABD VI. SIPH 0.88–0.90 × cauda, 0.08–0.10 × BL, and 0.47–0.50 × ANT III. Setae on ABD I–V 0.022–0.027 mm long, 1.46–1.80 × BD III. Setae on ABD VI–VIII 0.030–0.052 mm long, 2.00–2.46 × BD III. Cauda with 5–6 setae.

**Diagnosis**

From so far known *Aphis* species feeding on *Knautia*, apterous viviparous females of *A. holmani* sp. nov. are most similar to *A. confusa* by hind femora and hind trochanter setae lengths (which are longer than 0.50 × trochantero-femoral suture length) and genital plate anterior setae lengths (which are longer than 1.00 × BD III). Both species differ from *A. thomasi* in those characters (0.20–0.50 × trochantero-femoral suture length and 0.20–0.50 × BD III respectively). The new species differ from *A. confusa* by:

- Pointed setae on femora, head and antennae (setae with blunt apices in *A. confusa*)
- longer anterior setae on the genital plate, 2.25–2.94 × BD III (1.00–2.00 in *A. confusa*)
- higher ratio of URS/HT II, 1.40–1.52 (1.00–1.22 in *A. confusa*)
- lower ratio of PT/BASE, 1.75–2.20 (2.45–3.00 in *A. confusa*)
- lower ratio of SIPH/cauda, 1.05–1.50 (1.60–1.88 in *A. confusa*)

Male (n=16).

*Colour* in life: unknown; pigmentation on slide: head slightly sclerotized, brown. Antennae light rown to brown with yellow ANT III, basal part of ANT IV and ANT V. Legs yellow with light brown very distal parts of tibiae and tarsi. Abdomen pale with light brown to brown SIPH, cauda and anal plate (Fig. 4b). HW 0.31–0.36 × ANT. Head setae 0.017–0.025 mm long, 1.11–1.33 × BD III. ANT 0.87–1.06 × BL. ANT III with 10–16 secondary rhinaria. ANT IV as long as or slightly longer than ANT V with 12–18 secondary rhinaria. ANT V with 11–13 secondary rhinaria. ANT VI with PT 2.94–3.28 × BASE. Other antennal ratios: VI:III 1.76–1.86, V:III 0.82–0.83, IV:III 0.82–0.88, PT:III 1.35–1.38, PT:IV 1.56–1.64, PT:V 1.64–1.66. ANT bearing very short and pointed setae. ANT III setae shorter than the width of the segment, 0.011–0.012 mm long, LS III about 0.83 × BD III. ANT I with 4–5, ANT II with 4, ANT III with 4–5, ANT IV with 3, ANT V with 2–3, ANT VI with 2 basal setae. Rostrum reaching from hind coxae to ABD I. URS about 0.55 × ANT III, 0.29–0.31 × ANT VI, 0.40–0.41 × PT, 1.17–1.35 × BASE and 1.33–1.35 × HT II. III FEMORA bearing long, fine and pointed setae, 0.017–0.040 mm long, III FEMORA LS 1.06–1.08 × trochantero-femoral suture length. Posterior seta on hind trochanter 1.00–1.06 × trochantero-femoral suture length. III TIBIAE bearing long, fine and pointed setae, 0.012–0.032 mm long. HT II about 0.41 × ANT III, 0.22–0.23 × ANT VI, about 0.30 × PT and 0.88–1.00 × BASE. Abdomen with small marginal tubercles on ABD VI. SIPH 0.88–0.90 × cauda, 0.08–0.10 × BL, and 0.47–0.50 × ANT III. Setae on ABD I–V 0.022–0.027 mm long, 1.46–1.80 × BD III. Setae on ABD VI–VIII 0.030–0.052 mm long, 2.00–2.46 × BD III. Cauda with 5–6 setae.

0.59 × ANT III, about 0.36 × ANT VI, 0.51–0.52 × PT, 1.25–1.28 × BASE and 1.50–1.56 × HT II. III FEMORA bearing long, fine and pointed setae, 0.012–0.032 mm long, III FEMORA LS 0.80–0.86 × trochantero-femoral suture length. Posterior setae on hind trochanter 0.80–1.00 × trochantero-femoral suture length. III TIBIAE bearing long, fine and pointed setae, 0.017–0.045 mm long. HT II 0.50–0.62 × ANT III, 0.24–0.29 × ANT VI, 0.32–0.39 × PT and 1.00–1.12 × BASE. SIPH 1.07–1.12 × cauda, 0.08–0.09 × BL, and 0.87–0.96 × ANT III. Setae on ABD I–V 0.022–0.027 mm long, 1.10–1.29 × BD III. Setae on ABD VI–VIII 0.032–0.075 mm long, 1.88–2.00 × BD III. Genital plate anterior setae 0.050–0.055 mm long, 2.50–3.23 × BD III. Cauda with 6–10 setae.

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Detailed morphological differences between particular morphs of both species are given in Tables 1 and 2.

**Etymology.** The authors have the pleasure to give the name to honour the late Jaroslav Holman (1931–2014) – an outstanding European aphidologist and a long-time employee of the Biology Centre CAS in České Budějovice, Czech Republic.

**Biology and distribution.** The new aphid species is associated with *Knautia drymeia* Heuff., from which it was collected in Central (the Czech Republic) and South-Eastern Europe (Bulgaria and Romania). It is a holocyclic aphid with the sexual phase in September.

**Material examined.** HOLOTYPE: CZECH REPUBLIC, Jihomoravský kraj, Pustý žleb, Moravský kras, 20 June 1967, on *Knautia drymeia*, J. Holman leg., 1 apt, 10838 B (apt. 8), IECA. PARATYPES: CZECH REPUBLIC, the same data as in the holotype, 11 slides (1 apt on each slide), 10838 B (apt. 1–7, 9–12); Macocha, 19 May 1967, on *K. drymeia*, J. Holman leg., 1 apt, 10877 (apt. 1), 16 apt (two on each slide), 10877 (apt. 2–17), IECA, slide no apt.2 DZUS; Pustý žleb, 22 September 1970, on *K. drymeia*, J. Holman leg., 40 ♀ (four on each slide), 12885 ♀ 21–48, ♀ 61–68 6 ♀, 10877 (73–78); 12 ♂ (four on each slide), 12885 ♂ 1–12, 1 ♂, 4 ♂ (♂ 13–16, ♀ 49), IECA; BULGARIA, Mt. Vitoša nr. Simenovo, 22 May 1990, on *K. drymeia*, J. Holman leg., 2 apt, 21725 A (apt. 1–2), 4 apt, 21725 (apt. 3–6), 16 apt (four on each slide), 21722 B (apt. 1–16), 2 al, 21722 B (al. 1–2), 3 al, 21722 B (al. 3–5), IECA; ROMANIA, Băile Herculane jud. Caraș-Sev, 20 July 1976, on *K. drymeia*, J. Holman leg., 12 apt (six per each slide), 16309 (apt. 1–12), IECA.

### Aphis (Aphis) longini Huculak, 1968

Huculak, 1968: 333

**Figs 1, 5, 6; Supplementary table 1**

**Apterous viviparous female (n=5).**

**Colour in life:** matt dirty green to olive brown (Huculak, 1968); pigmentation on slide; head sclerotized, brown. Antennae brown with yellow ANT III and basal part of ANT IV. Femora of legs brown with lighter basal parts, tibiae light brown to yellow with brown to dark brown distal and apical parts and tarsi. Abdomen yellow to light brown SIPH brown with lighter basal part, cauda and anal plate brown to dark brown (Fig. 1c). HW 0.34–0.35 × ANT. Head setae 0.015–0.045 mm long, 0.60–1.00 × BD III. ANT 0.65–0.67 × BL. ANT IV as long as or longer than ANT V. ANT VI with PT 3.58–4.27 × BASE. Other antennal ratios: VI:III 2.07–2.11, V:III 0.61–0.67, IV:III 0.67–0.80, PT:III 1.65–1.67, PT:IV 2.04–2.47, PT:V 2.47–2.68. ANT bearing long, fine and pointed. ANT III setae as long as and longer than the width of the segment (Fig. 5g), 0.030–0.040 mm long, LS III 1.20–2.00 × BD III. ANT I with 4–5, ANT II with 5, ANT III with 1417, ANT IV with 11–12, ANT V with 7, ANT VI with 2 basal setae. Rostral reaching from hind coxae to ABD I. URS 0.57–0.59 × ANT III, 0.27–0.28 × ANT VI, 0.34–0.36 × PT, 1.29–1.45 × BASE and 1.14–1.19 × HT II. Mesosternal furca robust, fused and wide. III FEMORA bearing long, fine and pointed setae (Fig 5h), 0.025–0.055 mm long, III FEMORA LS 1.00–1.10 × trochantero-femoral suture length. Posterior seta on hind trochanter about 0.90 × trochantero-femoral suture length (Fig. 5i). III TIBIAE bearing long, fine and pointed setae, 0.050–0.055 mm long, III FEMORA LS 1.00–1.10 × trochantero-femoral suture length (Fig. 5i). III TIBIAE bearing long, fine and pointed setae, 0.050–0.055 mm long. HT II about 0.50 × ANT III, 0.23–0.24 × ANT VI, 0.29–0.30 × PT and 1.08–1.27 × BASE. Abdomen with small marginal tubercles on ABD IV. SIPH about 1.33 × cauda, 0.09–0.10 × BL, and 0.76–0.78 × ANT III. Setae on ABD I–V 0.010–
0.015 mm long, 0.40–0.62 × BD III. Setae on ABD VI–VIII 0.015–0.032 mm long, 0.70–0.75 × BD III. Genital plate anterior setae 0.060–0.070 mm long, about 3.50 × BD III. Cauda with 16–17 setae (Fig. 6e, f).

Remarks: Despite Huculak (1968) gave short descriptions of oviparous females and males in the original description, no material has been found in the ZMPA collection. The alate viviparous females are unknown. Measurements of the specimens examined in this study vary from those given by Huculak in the original description (1968) and in Blackman & Eastop (2019). The differences are maybe due to the fact that Huculak measured more specimens which were not available for us.

Material examined. Holotype: POLAND: Trzebinia, 26 August 1967, on Knautia arvensis, L. Olesiński leg., 1 apt, APH-1469, ZMPA; Paratype: the same data as holotype, 1 apt, APH-1479, ZMPA, 1 apt, APH-1477; other material: Trzebinia, 01 October 1967, on K. arvensis, L. Olesiński leg., 1 apt. 2651, R621, ZMPA;

Host plants. The species is known only from K. arvensis (Holman 2009).

Biology. It is a monoeocious and holocyclic species with sexual generation in October. The aphids form large, ant-attended colonies on the bases of stems on the plant (Huculak 1968).

Distribution. Poland, Russia (Holman, 2009). Olesiński & Szeclegiewicz (1974) provided that this species was also found in “Czechoslovakia” but without existing material it was impossible to determine if it was the Czech Republic or Slovakia.

Aphis (Aphis) thomasi (Börner, 1950)

Doralina thomasi Börner, 1950: 7 Figs 1–7; Supplementary tables 1–4

Apterous viviparous female (n=12).

Colour in life: straw yellow (Blackman & Eastop, 2019); pigmentation on slide: head sclerotized, brown. Antennae yellow or light brown with paler basal parts of ANT III–VI BASE. Femora of legs uniformly light brown with pale distal parts. Tibiae pale with light brown distal parts of tibiae and light brown tarsi. Abdomen pale with light brown SIPH, cauda and anal plate (Fig. 2c). HW 0.35–0.36 × ANT. Head setae 0.008–0.010 mm long, about 0.66 × BD III. ANT 0.62–0.65 × BL. ANT III with 8–10 secondary rhinaria. ANT IV as long as or shorter than ANT V, with 2–4 secondary rhinaria. ANT V sometimes with one secondary rhinarium. ANT VI with PT 2.30–2.53 × BASE. Other antennal ratios: VI:III 1.43–1.52, V:III 0.59–0.65, IV:III 0.56–0.59, PT:III 1.00–1.09, PT:IV 1.76–1.84, PT:V 1.53–1.84. ANT bearing very short and blunt setae. ANT III setae shorter than the width of the segment, 0.005–0.010 mm long. LS III 0.25–0.65 × BD III. ANT I with 3–6, ANT II with 3–5, ANT III with 4–6, ANT IV with 2–3, ANT V with 1–4, ANT VI with 1–2 basal setae. Rostrum reaching to ANT I. URS 0.65–0.80 × ANT III, 0.38–0.46 × ANT VI, 0.50–0.70 × PT, 1.40–1.60 × BASE and 1.31–1.66 × HT II. Mesosomal furca slightly fused, wide. III FEMORA bearing very short, rigid and blunt setae (Fig. 5k), 0.005–0.007 mm long, III FEMORA LS 0.12–0.25 × trochantero-femoral suture length.

Alate viviparous female (n=2).

Colour in life: unknown; pigmentation on slide: head sclerotized, brown. Antennae yellow or light brown with paler basal parts of ANT III–VI BASE. Femora of legs uniformly light brown with pale distal parts. Tibiae pale with light brown distal parts of tibiae and light brown tarsi. Abdomen pale with light brown SIPH, cauda and anal plate (Fig. 1d). HW 0.47–0.58 × ANT. Head setae 0.005–0.010 mm long, 0.25–0.29 × BD III. ANT 0.49–0.54 × BL. ANT IV as long as or shorter than ANT V. ANT VI with PT 2.00–3.20 × BASE. Other antennal ratios: VI:III 1.42–2.10, V:III 0.50–0.69, IV:III 0.46–0.60, PT:III 1.00–1.60, PT:IV 1.90–2.66, PT:V 1.66–2.26. ANT bearing very short and blunt setae (Fig. 5j). ANT III setae shorter than the width of the segment, 0.003–0.007 mm long, LS III 0.25–0.65 × BD III. ANT I with 3–6, ANT II with 3–5, ANT III with 4–6, ANT IV with 2–3, ANT V with 1–4, ANT VI with 1–2 basal setae. Rostrum reaching to ANT I. URS 0.65–0.80 × ANT III, 0.38–0.46 × ANT VI, 0.50–0.70 × PT, 1.40–1.60 × BASE and 1.31–1.66 × HT II. Mesosomal furca slightly fused, wide. III FEMORA bearing very short, rigid and blunt setae (Fig. 5k), 0.005–0.007 mm long, III FEMORA LS 0.12–0.25 × trochantero-femoral suture length. Posterior seta on hind trochanter 0.18–0.25 × trochantero-femoral suture length. Posterior seta on hind trochanter 0.18–0.25 × trochantero-femoral suture length (Fig. 5l). III TIBIAE bearing short rigid and blunt setae, 0.005–0.025 mm long. HT II 0.43–0.60 × ANT III, 0.25–0.35 × ANT VI, 0.37–0.50 × PT and 0.92–1.20 × BASE. SIPH 1.09–1.60 × cauda, 0.11–0.16 × BL, and 0.80–1.53 × ANT III. Setae on ABD I–V 0.006–0.010 mm long, 0.30–0.44 × BD III. Setae on ABD VI–VIII 0.007–0.025 mm long, 0.37–0.73 × BD III. Genital plate anterior setae 0.010–0.035 mm long, 0.50–1.47 × BD III. Cauda with 6–8 setae.
on ABD I–V 0.007–0.012 mm long, 0.50–0.66 × BD III. Setae on ABD VI–VIII 0.010–0.017 mm long, about 0.66 × BD III. Genital plate anterior setae 0.012–0.015 mm long, 0.83–1.00 × BD III. Cauda with 5–8 setae (Fig. 7c).

Oviparous female. Description (n=9).

Colour in life: unknown; pigmentation on slide: head sclerotized, light brown. Antennae yellow or light yellow with ANT I, ANT II, ANT V and ANT VI light brown. Femora yellow or light brown with paler proximal parts. Fore and middle tibiae yellow or light brown with darker distal parts and tarsi. Hind tibiae light uniformly light brown or with slightly darker apical half. Abdomen yellow with light brown SIPH, cauda and anal plate (Fig. 3c).

HW 0.51–0.56 × ANT. Head setae 0.005–0.011 mm long, 0.28–0.37 × BD III. ANT 0.44–0.48 × BL. ANT IV as long as or slightly shorter than ANT V. ANT VI with PT 2.13–2.56 × BASE. Other antennal ratios: VI:III 2.35–2.59, V:III 0.75–0.81, IV:III 0.60–0.81, PT:III 1.60–1.86, PT:IV 2.27–2.66, PT:V 2.00–2.27. ANT bearing very short and blunt setae. ANT III setae shorter than the width of the segment, 0.005–0.075 mm long, LS III 0.28–0.58 × BD III. ANT I with 4–6, ANT II with 3–5, ANT III with 3–5, ANT IV with 3, ANT V with 3–4, ANT VI with 2–3 basal setae. Rostrum reaching hind coxae. URS 0.91–1.10 × ANT III, 0.36–0.46 × ANT VI, 0.51–0.68 × PT, 1.29–1.46 × BASE and 1.31–1.46 × HT II. Mesosternal furca poorly visible almost separated. III FEMORA bearing very short, rigid and blunt setae, 0.005–0.017 mm long.


Biology. Aphis thomasi is a monoecious and holocyclic species with sexual phase in the end of September. The aphids live on basal parts on the host plants.

Distribution. Bulgaria, Czech Republic, Germany, Poland, Romania, Slovakia, Spain, Switzerland, Ukraine, probably Hungary (de Jong et al. 2014).

Key to Knautia feeding Aphis based on Blackman & Eastop (2019)

1. ANT tubercles undeveloped or weakly developed. ABD TERG 1 and 7 with marginal tubercles (MTu) ................................................................................................................. 2
   – ANT tubercles well developed. ABD TERG 1 and 7 without MTu ................................................................................................................................. 4
2. Cauda with 14–24 hairs. Longest hairs on hind femur as long as or longer than diameter of trochantero-femoral suture. Well-developed MTu present on
ABD TERG 2–4 as well as 1 and 7. ANT PT/BASE 3–4

Cauda with 4–9 hairs. Longest hairs on hind femur 0.15–0.7 of diameter of trochantero-femoral suture. Small M’Tu present or absent from ABD TERG 2–4(–5). ANT PT/BASE 1.5–3.3

3. Posterior hair on hind trochanter 0.2–0.5 × diameter of trochantero-femoral suture. Hairs on anterior half of subgenital plate 0.2–0.5 × ANT BD III

Posterior hair on hind trochanter 0.2–1.1 × diameter of trochantero-femoral suture. Hairs on anterior half of subgenital plate 1.0–3.0 × ANT BD III

4. Hairs on hind femora and antennae pointed. Hairs on anterior half of subgenital plate 2.25–2.94 × ANT BD III, R IV+V 1.40–1.52 × HT II

Posterior hair on hind femora and antennae blunt apices. Hairs on anterior half of subgenital plate 1.00–2.00 × ANT BD III, R IV+V 0.90–1.10 × HT II

4. Hairs on hind femora and antennae pointed. Hairs on anterior half of subgenital plate 2.25–2.94 × ANT BD III, R IV+V 1.40–1.52 × HT II

5. Head and SIPH black. ANT III with 7–25 rhinaria. SIPH with polygonal reticulation on distal 0.1–0.2 of length (8 or more rows of closed cells)

Head and SIPH pale. ANT III with 0–3 rhinaria. SIPH without polygonal reticulation or with only 1–4 rows of closed cells

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APPENDIX I

(electronic supplement, available at www.bonnzoologicalbulletin.de)

Suppl. table 1. Measurements (in mm) of apterous viviparous females of Knautia feeding Aphis species; *measurements of ANT III for specimens with 5-segmented antennae. **measurements of ANT III for specimens with 6-segmented antennae.

Suppl. table 2. Measurements (in mm) of known alate viviparous females of Knautia feeding Aphis species.

Suppl. table 3. Measurements (in mm) of available for examination oviparous females of Knautia feeding Aphis species.

Suppl. table 4. Measurements (in mm) of available for examination males of Knautia feeding Aphis species (male of A. thomasi with 5-segmented antennae).