

Diagnostic characters of the species of the genus  
*Periphyllus* van der Hoeven, 1863 (Hemiptera, Aphidoidea:  
Chaitophorinae) recorded in Poland

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## ABSTRACT

The main diagnostic characters of the 8 species of the genus *Periphyllus* recorded in Poland are discussed and illustrated in details. Notes on their host plants and life cycle are presented. Keys to apterous viviparous females and alate viviparous females of species of the genus *Periphyllus* recorded in Poland are provided.

**KEY WORDS:** *Periphyllus*, key, Poland

## INTRODUCTION

The genus *Periphyllus* van der Hoeven, 1863 belongs to the subfamily Chaitophorinae and consists approximately of 50 monoecious and holocyclic species associated with *Acer* spp. (maples), exceptionally with *Koelreuteria* spp. or *Aesculus* spp. (BLACKMAN & EASTOP, 1994). In Poland 7 species, associated with maples, have been recorded so far: *P. acericola* (Walker, 1848), *P. aceris* (Linnaeus, 1761), *P. coracinus* (Koch, 1854), *P. hirticornis* (Walker, 1848), *P. lyropictus* (Kessler, 1886), *P. obscurus* Mamontova, 1955 and *P. testudinaceus* (Ferne, 1852) (OSIADACZ & HAJAJ, 2009). Recently, a new species *P. californiensis* (Shinji, 1917), which originates from temperate regions of Asia, has also been recorded from Poland (JUNKIERT *et al.*, 2011).

Polish species of the subfamily Chaitophorinae have been extensively studied by SZELEGIEWICZ (1974, 1985), WIECZOREK & OSIADACZ (2007) and WIECZOREK (2007, 2010). The bionomy and dynamics of some species belonging to the genus *Periphyllus* have been investigated by MACKOŚ (2008) and WILKANIEC & SZTUKOWSKA (2008). However, aphids belonging to this genus are difficult to identify with certainty, which can be very complicated and time-consuming, and the specimens of particular species may often be confused with one another. Some species (e.g. *P. aceris* and *P. acericola* or *P. californiensis* and *P. tesudinaceus*) are very similar in morphology and bionomy.

The aim of this paper is to present the main diagnostic characters of apterous viviparous female (antennae, siphunculi, cauda, hind legs), alate viviparous female (antennae, siphunculi, cauda, hind legs, abdominal sclerites) and aestivating morphs of 8 species of the genus *Periphyllus* which have been recorded so far in Poland. Notes on their life cycle and host plants, together with keys to apterous and alate viviparous females of species belonging to this genus are provided.

## MATERIAL AND METHODS

Apterous viviparous females and alate viviparous females of the species belonging to the genus *Periphyllus* were collected from various host plants (maples) and various localities in Poland in the course of two successive years (2008 and 2009). For each species about 30 individuals of apterous and alate viviparous females were examined. The material studied has been deposited in the Department of Zoology, University of Silesia, Katowice, Poland. Some additional material for this study was borrowed from the Zoological Institute, Polish Academy of Sciences, Warsaw, Poland and the Muséum national d'Histoire naturelle, Paris, France. The specimens were examined using the light microscope Nikon Eclipse 600. Drawings were made with a camera lucida. For each of the drawings a magnified view is provided.

The following abbreviations appear throughout the paper: ant. – antenna; ant. segm. – antennal segment(s); VIa – base of antennal segment VI; VIb – terminal process of antennal segment VI; HT II – second segment of hind tarsus.

## RESULTS

### Diagnostic characters of the species of the genus *Periphyllus* recorded in Poland - apterous viviparous female

**Antennae** - 6-segmented, long, reaching to the abdominal segment III. Antennal chaetotaxy and segmental ratios vary in each species (Figs 1-2).

*P. acericola*: the length of the antennae (Fig. 1a) (ant.) equal to ca. 0.60 of the body length; the terminal process (VIb) 2.1-2.3 times as long as the base (VIa); longer hair on the antennal segment (ant. segm.) VIa, 10-12 times as long as the basal articular diameter of VIb; shorter hair on VIa, 3-5 times as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 1b).

*P. aceris*: the length of ant. (Fig. 1c) equal to c.a 0.60 of the body length; VIb 3 times as long as VIa; longer hair on the ant. segm. VIa, 10 times as long as the basal articular diameter of VIb; shorter hair on VIa, 3.5 times as long as the basal articular diameter of VIb, distinctly reaching the primary rhinarium of VIa (Fig. 1d).

*P. californiensis*: the length of ant. (Fig. 1e) equal to ca. 0.60 of the body length; VIb 2 times as long as VIa; longer hair on the ant. segm. VIa, 4-5 times as long as the basal articular diameter of VIb; shorter hair on VIa, as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 1f).

*P. coracinus*: the length of ant. (Fig. 1g) equal to ca. 0.60 of the body length; VIb 3-4 times as long as VIa; longer hair on the ant. segm. VIa, 6-7 times as long as the basal articular diameter of VIb; shorter hair on VIa, 2 times as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 1h).

*P. hirticornis*: the length of ant. (Fig. 2a) equal to ca. 0.70 of the body length; VIb 5 times as long as VIa; longer hair on the ant. segm. VIa, 10-20 times as long as the basal articular diameter of VIb; shorter hair on VIa, 3 times as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 2b).

*P. lyropictus*: the length of ant. (Fig. 2c) equal to ca. 0.70 of the body length; VIb 4.5-5 times as long as VIa; longer hair on the ant. segm. VIa, 7-9 times as long as the basal articular diameter of VIb; shorter hair on VIa, 2-2.5 times as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 2d).

*P. obscurus*: the length of ant. (Fig. 2e) equal to ca. 0.8-0.9 of the body length; VIb 4-4.5 times as long as VIa; longer hair on the ant. segm. VIa, 17-24 times as long as the basal articular diameter of VIb; shorter hair on VIa, 8-10 times as long as the basal articular diameter of VIb, distinctly reaching the primary rhinarium of VIa (Fig. 2f).

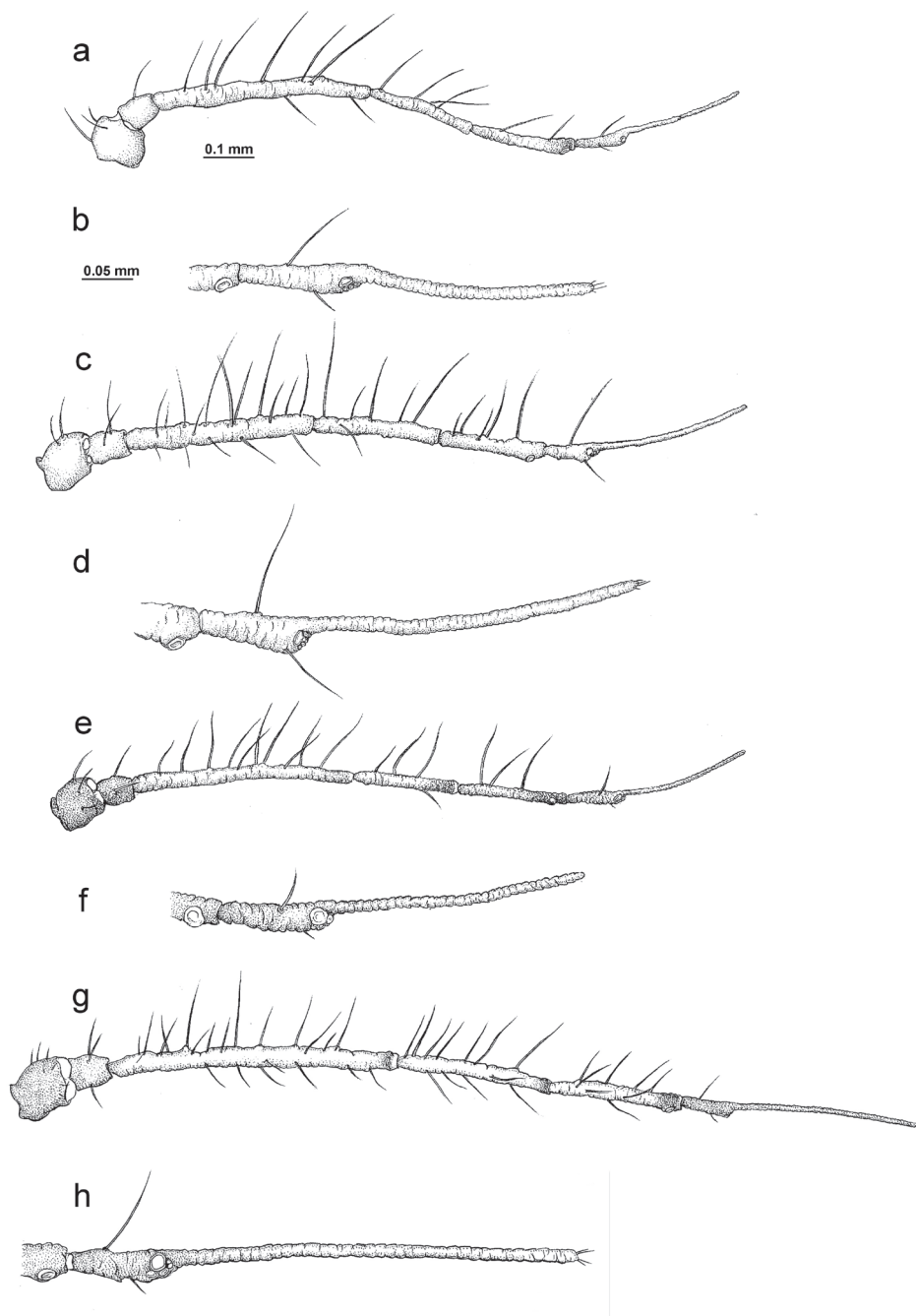
*P. testudinaceus*: the length of ant. (Fig. 2g) equal to ca. 0.70 of the body length; VIb 4-5 times as long as VIa; longer hair on the ant. segm. VIa, 2-3 times as long as the basal articular diameter of VIb; shorter hair on VIa, as long as or shorter than the basal articular diameter of VIb, not reaching the primary rhinarium of VIa (Fig. 2h).

**Cauda** – the most important diagnostic character is the shape of the cauda (Figs 3a-3h) and the number of its hairs.

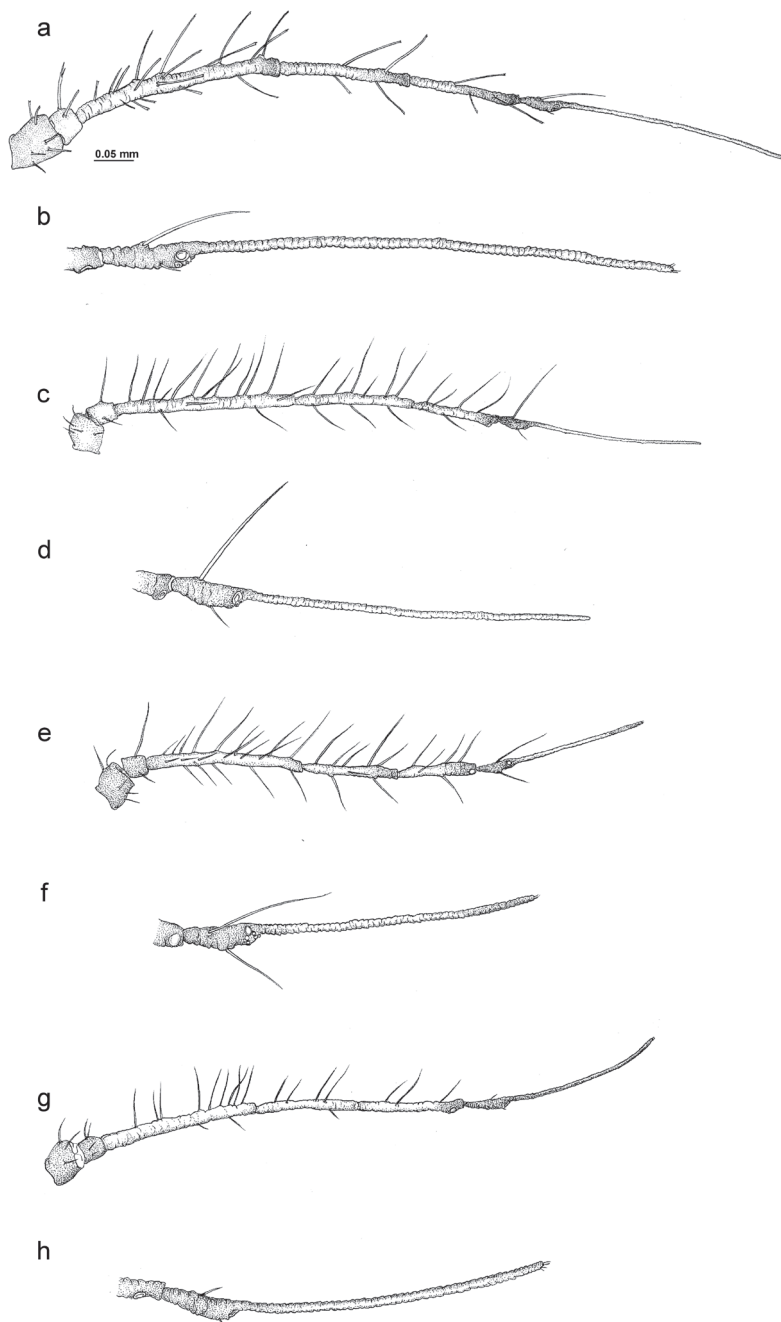
Broadly rounded (Figs 3a-3e): *P. acericola* (with 18-20 hairs), *P. aceris* (with 22 hairs), *P. californiensis* (with 8-12 hairs), *P. coracinus* (with 18-24 hairs), *P. testudinaceus* (with 10-14 hairs).

Helmet-shaped (Fig. 3f): *P. lyropictus* (with 15-24 hairs).

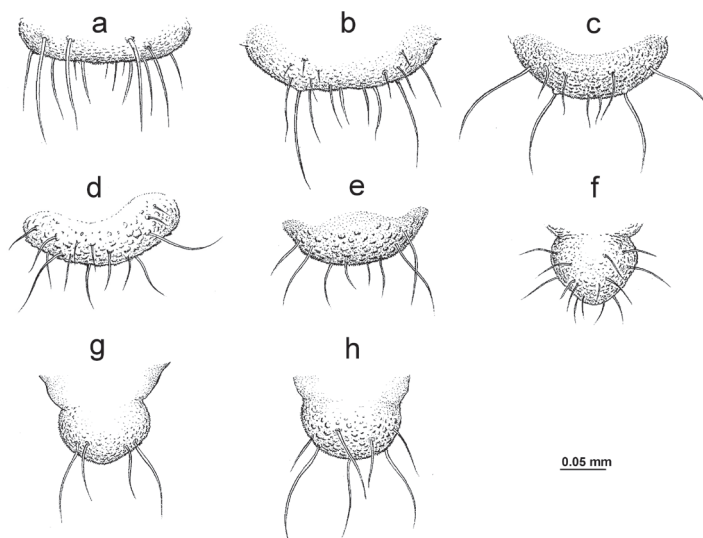
Knobbed (Figs 3g-3h): *P. hirticornis* (6-8 hairs), and *P. obscurus* (6-10 hairs).



**Figure 1.** Antenna – apterous viviparous female: **a.**, **b.** *P. acericola*; **c.**, **d.** *P. aceris*; **e.**, **f.** *P. californiensis*; **g.**, **h.** *P. coracinus*



**Figure 2.** Antenna – apterous viviparous female: **a.**, **b.** *P. hirticornis*; **c.**, **d.** *P. lyropictus*; **e.**, **f.** *P. obscurus*; **g.**, **h.** *P. testudinaceus*



**Figure 3.** Cauda - apterous viviparous female: **a.** *P. acericola*; **b.** *P. aceris*; **c.** *P. californiensis*; **d.** *P. coracinus*; **e.** *P. testudinaceus*; **f.** *P. lyropictus*; **g.** *P. hirticornis*; **h.** *P. obscurus*

**Siphunculi** (Figs 4a-4h) – more or less stump-shaped, usually with a distinct apical flange and a variable number of rows of polygonal reticulations (passing into more transverse ones towards its basal part). A useful diagnostic character is also the ratio of the length of the siphunculus to the length of the second segment of hind tarsus (HT II).

*P. acericola* (Fig. 4a): the siphunculus pale, wider at the base than its length, with slightly visible rows of reticulation in the apical part, without a distinct apical flange; shorter than HT II.

*P. aceris* (Fig. 4b): the siphunculus pale, with slightly visible reticulation in the apical part; shorter than HT II.

*P. californiensis* (Fig. 4c): the siphunculus slightly dark, with slightly visible reticulation; as long as HT II.

*P. coracinus* (Fig. 4d): the siphunculus dark, with a few rows of reticulation in the apical part; shorter than HT II.

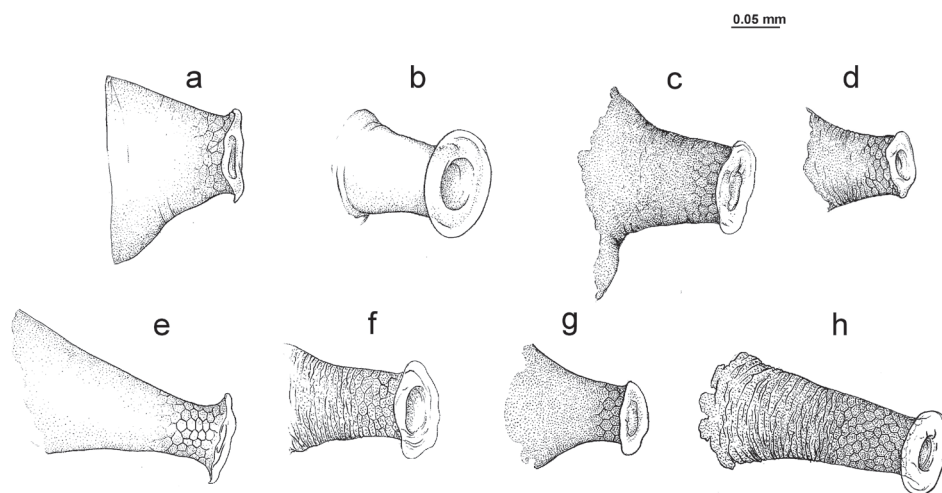
*P. hirticornis* (Fig. 4e): the siphunculus pale, with a few rows of reticulation in the apical part, longer than HT II.

*P. lyropictus* (Fig. 4f): the siphunculus slightly dark, with a few rows of reticulation, as long as or shorter than HT II.

*P. obscurus* (Fig. 4g): the siphunculus dark, with slightly visible reticulation in the apical part, a little bit shorter than HT II.

*P. testudinaceus* (Fig. 4h): the siphunculus dark, with significant reticulation; longer than HT II.

**Hind legs** – vary in colours (when mounted), however in *P. californiensis* (Fig. 8a) the femur and tibia are uniformly dark (almost black), whereas in *P. testudinaceus* (Fig. 8b) knees and the apical part of tibiae are dark and the middle parts of tibiae are pale.



**Figure 4.** Siphunculus – apterous viviparous female: **a.** *P. acericola*; **b.** *P. aceris*; **c.** *P. californiensis*; **d.** *P. coracinus*; **e.** *P. hirticornis*; **f.** *P. lyropictus*; **g.** *P. obscurus*; **h.** *P. testudinaceus*

#### Diagnostic characters of the species of the genus *Periphyllus* recorded in Poland - alate viviparous female

**Antennae** - 6-segmented, long, reaching to the abdominal segment III. Antennal chaetotaxy and segmental ratios vary in each species (Figs 5-6).

*P. acericola*: the length of the ant. (Fig. 5a) equal to ca. 0.60 of the body length; VIb 2.2-2.6 times as long as VIa; longer hair on the ant. segm. VIa, 9-10 times as long as the basal articular diameter of VIb; shorter hair on VIa, as long as or 2 times as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 5b); segm. III with 8-22 secondary rhinaria.

*P. aceris*: the length of the ant. (Fig. 5c) equal to ca. 0.50 of the body length; VIb 2.2 times as long as VIa; longer hair on the ant. segm. VIa, 10 times as long as the basal articular diameter of VIb; shorter hair on VIa, 3.5 times as long as the basal articular diameter of VIb, reaching the primary rhinarium of VIa (Fig. 5d); segm. III with 8-20 secondary rhinaria.

*P. californiensis*: the length of ant. (Fig. 5e) equal to ca. 0.70 of the body length; VIb 2 times as long as VIa; longer hair on the ant. segm. VIa, 4-8 times as long as the basal articular diameter of VIb; shorter hair on VIa, as long as the basal articu-

lar diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 5f); segm. III with 10-23 secondary rhinaria placed in 1-2 rows.

*P. coracinus*: the length of the ant. (Fig. 5g) equal to ca. 0.80 of the body length; VIb 5-6 times as long as VIa; longer hair on the ant. segm. VIa, 8-16 times as long as the basal articular diameter of VIb; shorter hair on VIa, 2.5-4 times as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 5h); segm. III with 7-10 secondary rhinaria placed in 1 row.

*P. hirticornis*: the length of the ant. (Fig. 6a) equal to ca. 0.70-0.90 of the body length; VIb 6-7 times as long as VIa; longer hair on the ant. segm. VIa, 6-11 times as long as the basal articular diameter of VIb; shorter hair on VIa, 2 times as long as the basal articular diameter of VIb, reaching the primary rhinarium of VIa (Fig. 6b); segm. III with 9-11 secondary rhinaria placed in 1 row.

*P. lyropictus*: the length of the ant. (Fig. 6c) equal to ca. 0.90 of the body length; VIb 4-8 times as long as VIa; longer hair on the ant. segm. VIa, 12-14 times as long as the basal articular diameter of VIb; shorter hair on VIa, 2-2.5 times as long as the basal articular diameter of VIb, not distinctly reaching the primary rhinarium of VIa (Fig. 6d); segm. III with 8-11 secondary rhinaria placed in 1 row.

*P. obscurus*: the length of the ant. (Fig. 6e) equal to ca. 0.90 of the body length; VIb 5 times as long as VIa; longer hair on the ant. segm. VIa, 15-20 times as long as the basal articular diameter of VIb; shorter hair on VIa, 8-10 times as long as the basal articular diameter of VIb, distinctly reaching the primary rhinarium of VIa (Fig. 6f); segm. III with 9-12 secondary rhinaria placed in 1 row.

*P. testudinaceus*: the length of the ant. (Fig. 6g) equal to ca. 0.60-0.80 of the body length; VIb 2.5 times as long as VIa; longer hair on the ant. segm. VIa, 3-4 times as long as the basal articular diameter of VIb; shorter hair on VIa, as long as or shorter than the basal articular diameter of VIb, not reaching the primary rhinarium of VIa (Fig. 6h); segm. III with 9-26 secondary rhinaria situated irregularly all over the segment.

**Cauda** - as in an apterous viviparous female.

### **Siphunculi** (Figs 7a-7h):

*P. acericola*: the siphunculus dark, with distinct reticulation (Fig. 7a); as long as HT II or shorter.

*P. aceris*: the siphunculus dark, with reticulation in its apical part (Fig. 7b); shorter than HT II.

*P. californiensis*: the siphunculus dark, with distinct reticulation (Fig. 7c); shorter than HT II.

*P. coracinus*: the siphunculus dark, with distinct reticulation (Fig. 7d); as long as HT II or longer.

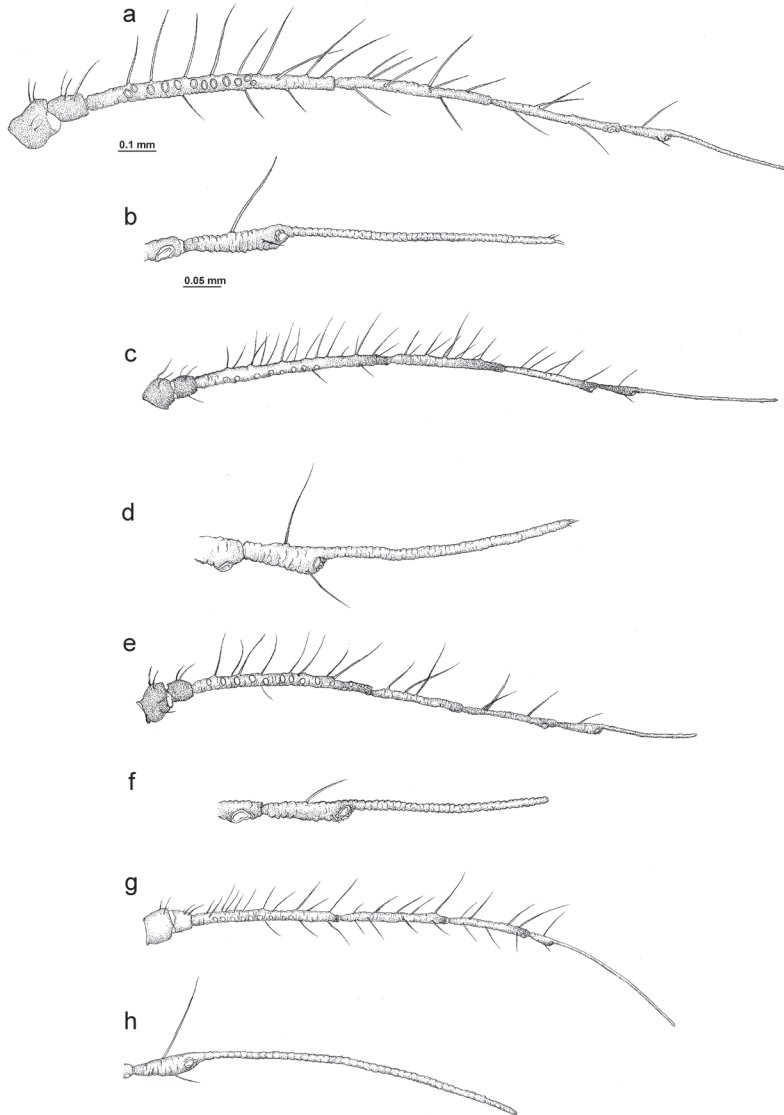
*P. hirticornis*: the siphunculus dark, with distinct reticulation (Fig. 7e); longer than HT II.



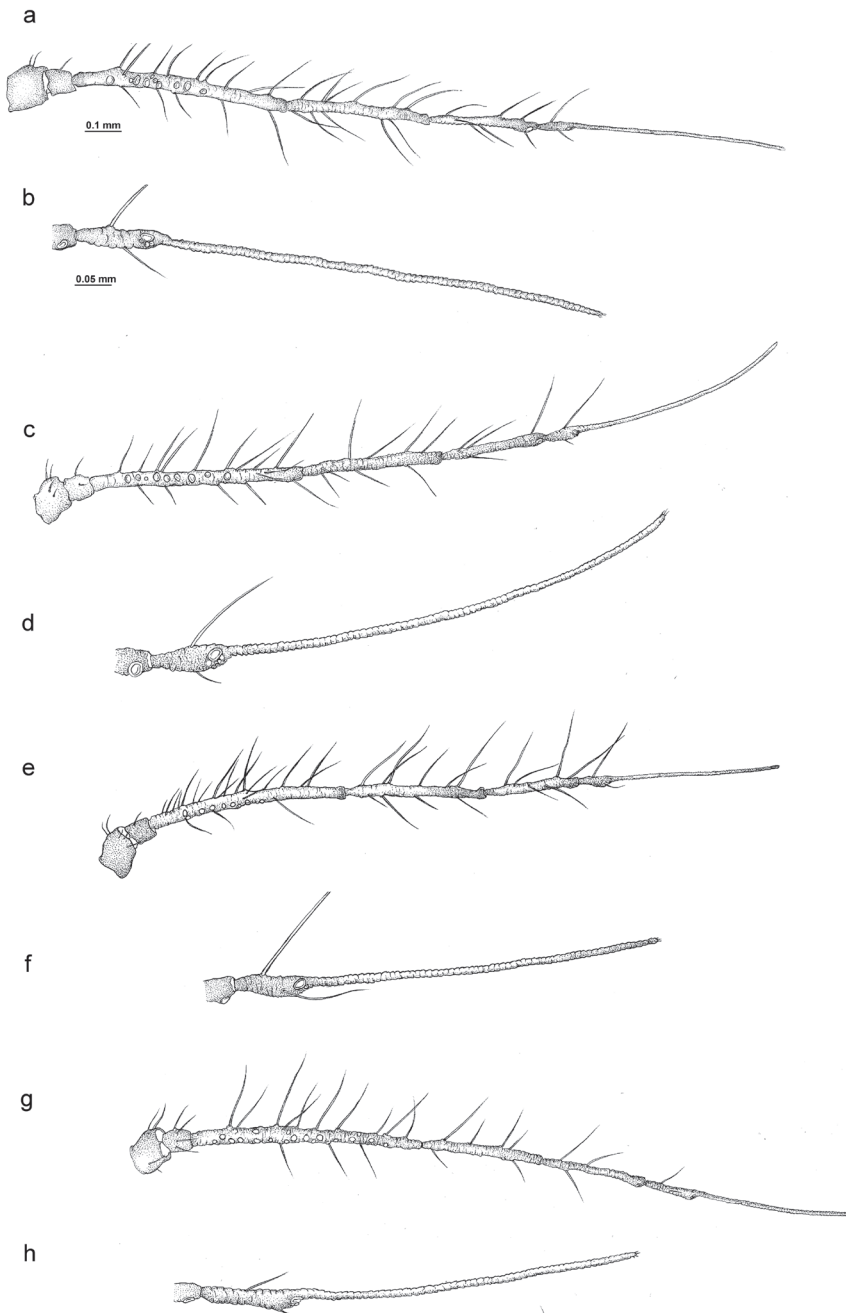
*P. lyropictus*: the siphunculus slightly dark, with distinct reticulation (Fig. 7f); as long as or shorter than HT II.

*P. obscurus*: the siphunculus dark, with reticulation (Fig. 7g); as long as HT II.

*P. testudinaceus*: the siphunculus dark, with distinct reticulation (Fig. 7h); longer than HT II.



**Figure 5.** Antenna – alate viviparous female: **a., b.** *P. acericola*; **c., d.** *P. aceris*; **e., f.** *P. californiensis*; **g., h.** *P. coracinus*



**Figure 6.** Antenna – alate viviparous female: **a.**, **b.** *P. hirticornis*; **c.**, **d.** *P. lyropictus*; **e.**, **f.** *P. obscurus*; **g.**, **h.** *P. testudinaceus*

**Hind legs** - as in an apterous viviparous female (Figs 8a-8b).

**Abdominal tergites** I/II-V/VI usually with large, oval marginal sclerites and fused pleural and spinal sclerites (cross bars), or abdominal sclerites very small; tergites VII-VIII with fused marginal, pleural and spinal sclerites.

*P. acericola*: dark cross bars, darker than marginal sclerites, broad, touching each other.

*P. aceris*: cross bars dark and narrow.

*P. californiensis*: dark cross bars; the abdominal segment V with more than 6 hairs.

*P. coracinus*: sclerites slightly dark, small, divided into small plates.

*P. hirticornis*: sclerites very small, paler than siphunculi.

*P. lyropictus*: sclerites small, divided into plates, rather paler than marginal sclerites.

*P. obscurus*: sclerites very small.

*P. testudinaceus*: contrary to the other species, it has ventral cross bars, dorsal cross bars are dark; the abdominal segment V with at least 6 hairs.

### **Diagnostic characters of the species of the genus *Periphyllus* recorded in Poland - aestivating morphs (dimorphs)**

Some species of the genus *Periphyllus* are characterized by the presence of the specialised larval aestivating morphs (dimorphs) observed during the summer. Two types of aestivating morphs are recognised – with foliate hairs or with very long fine hairs.

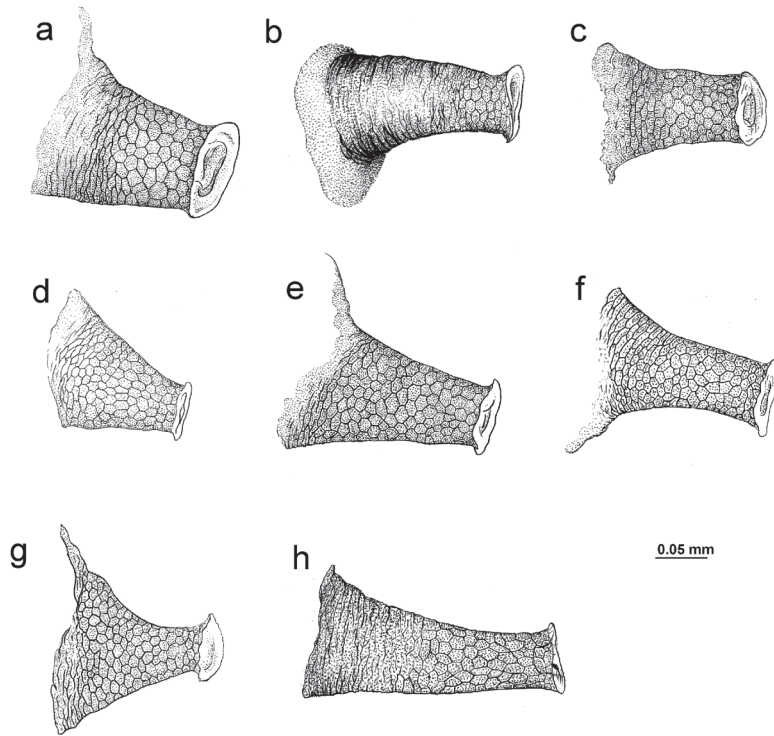
Within the life cycle, aestivating dimorphs with foliate marginal hairs are present in: *P. californiensis*, *P. hirticornis* and *P. testudinaceus*. They are flat and armoured with dorsal sclerotic plates; the body is bordered by leaf-shaped (foliate) hairs occurring also on legs and antennae. They aestivate scattered on the uppersides and undersides of leaves.

Within the life cycle, aestivating dimorphs with fine hairs are present in: *P. aceris* and *P. acericola*. Their bodies are oval and densely covered by rows of very long, pointed hairs. They aggregate in dense groups on the undersides of leaves.

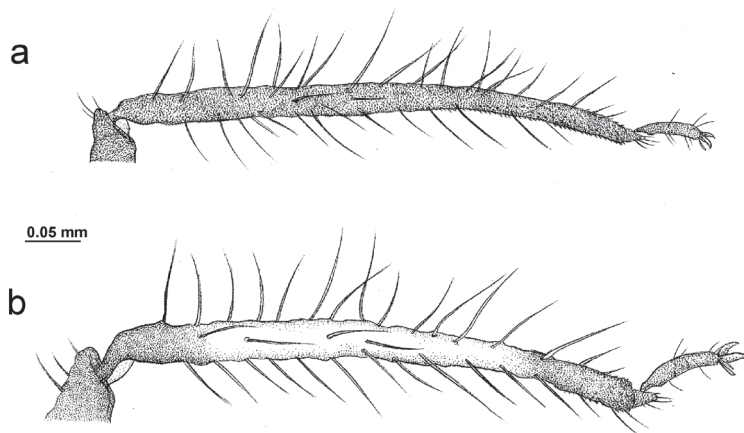
No specialised aestivating dimorphs are observed in: *P. coracinus*, *P. lyropictus* and *P. obscurus*.

### **Diagnostic characters of the species of the genus *Periphyllus* recorded in Poland - host plants**

Aphids belonging to the genus *Periphyllus* recorded so far in Poland are trophically associated exclusively with *Acer* spp. (maples) and the host plant is a valuable diagnostic character (Tab. 1.).



**Figure 7.** Siphunculus – alate viviparous female: **a.** *P. acericola*; **b.** *P. aceris*; **c.** *P. californiensis*; **d.** *P. coracinus*; **e.** *P. hirticornis*; **f.** *P. lyropictus*; **g.** *P. obscurus*; **h.** *P. testudinaceus*



**Figure 8.** Hind legs – apterous and alate viviparous female: **a.** *P. californiensis*; **b.** *P. testudinaceus*

**Table 1.** Aphids of the genus *Periphyllus* recorded in Poland and their host plants

Species	Host plant
<i>P. acericola</i>	<i>Acer pseudoplatanus</i> L.
<i>P. aceris</i>	<i>A. campestre</i> L., <i>A. platanoides</i> L., <i>A. pseudoplatanus</i>
<i>P. californiensis</i>	<i>A. palmatum</i> var <i>thunbergii</i> 'Crispum', <i>A. japonicum</i> Thunb. ex Murray 'Aconitifolium'
<i>P. coracinus</i>	<i>A. platanoides</i>
<i>P. hirticornis</i> :	<i>A. campestre</i>
<i>P. lyropictus</i>	mostly <i>A. platanoides</i> , rarely <i>A. campestre</i> , <i>A. pseudoplatanus</i>
<i>P. obscurus</i>	<i>A. campestre</i>
<i>P. testudinaceus</i>	<i>A. campestre</i> , <i>A. negundo</i> L., <i>A. platanoides</i> , <i>A. platanoides</i> 'Globosum', <i>A. pseudoplatanus</i> , <i>A. rubrum</i> L., <i>A. saccharinum</i> L.

### Key to the species of the genus *Periphyllus* recorded in Poland (apterous viviparous female)

1. Hind tibiae uniformly black ..... *P. californiensis* (Shinji)
- Hind tibiae pale, slightly dark or dark only at the base and apex ..... 2
2. Hind tibiae dark at the base and apex, pale in the middle part; longer hair on the antennal segment VIa about 2.0 times as long as the basal articular diameter of VIb ..... *P. testudinaceus* (Ferne)
- Hind tibiae pale or slightly dark; longer hair on the antennal segment VIa at least 3.0 times as long as the basal articular diameter of VIb ..... 3
3. Cauda broadly rounded ..... 4
- Cauda knobbed or helmet-shaped ..... 5
4. Abdominal tergites with small, dark sclerites ..... *P. coracinus* (Koch)
- Abdominal tergites membranous without sclerites ..... 7
5. Cauda helmet-shaped ..... *P. lyropictus* (Kessler)
- Cauda knobbed ..... 6
6. Siphunculi dark, shorter than HT II; dorsal hairs with pointed apices ..... *P. obscurus* Mamontova
- Siphunculi pale, longer than HT II; some dorsal hairs with forked apices .... *P. hirticornis* (Walker)
7. Shorter hair on the antennal segment VIa 3.0-5.0 times longer than the basal articular diameter of VIb, not reaching the primary rhinarium of VIa; the siphunculus at the base wider than its length, without a distinct flange ..... *P. acericola* (Walker)
- Shorter hair on the antennal segment VIa 2.5-3.0 times longer than the basal articular diameter of VIb, reaching past the primary rhinarium of VIa; the base of the siphunculus as wide as its length or longer, with a distinct flange ..... *P. aceris* (Linnaeus)

### Key to the species of the genus *Periphyllus* recorded in Poland (alate viviparous female)

1. Abdomen with dark, ventral plates ..... *P. testudinaceus* (Ferne)
- Abdomen without dark, ventral plates ..... 2
2. Abdominal tergites with big spinopleural plates ..... 3
- Abdominal tergites with small spinopleural plates ..... 5
3. Spinopleural plates broad, adjoining, darker than marginal sclerites ..... *P. acericola* (Walker)
- Spinopleural plates narrow, not adjoining, as dark as marginal sclerites ..... 4
4. Hind tibiae uniformly black; VIb about 2.0 times longer than VIa ..... *P. californiensis* (Shinji)
- Hind tibiae pale; VIb about 3.5 times longer than VIa ..... *P. aceris* (Linnaeus)
5. Shorter hair on the antennal segment VIa reaching past the primary rhinarium of VIa; the base of the siphunculus as wide as its length ..... *P. obscurus* Mamontova
- Shorter hair on the antennal segment VIa not reaching the primary rhinarium of VIa; the siphunculus longer than its basal width ..... 6
6. Cauda broadly rounded ..... *P. coracinus* (Koch)
- Cauda helmet-shaped or knobbed ..... 7
7. Cauda helmet-shaped; dorsal hairs with pointed apices ..... *P. lyropictus* (Kessler)
- Cauda knobbed; some dorsal hairs with blunt or forked apices .. *P. hirticornis* (Walker)

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**Cechy diagnostyczne krajowych gatunków mszyc z rodzaju *Periphyllus* van der Hoeven, 1863 (Hemiptera, Aphidoidea: Chaitophorinae)**

**STRESZCZENIE**

Praca prezentuje główne cechy diagnostyczne ułatwiające identyfikację 8 gatunków mszyc z rodzaju *Periphyllus* stwierdzonych dotychczas w Polsce. Dane te uzupełnione są szczegółowymi ilustracjami cech oraz dodatkowymi informacjami dotyczącymi roślin żywicielskich i cyklu życiowego poszczególnych gatunków. Ponadto przedstawiony jest klucz służący do oznaczania bezskrzydłych i uskrzydłych dzieworódek krajowych gatunków mszyc należących do rodzaju *Periphyllus*.

