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***Periphyllus californiensis* SHINJI, 1917 (Hemiptera: Aphidoidea)  
– an invasive aphid species new to Poland**

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**ABSTRACT.** *Periphyllus californiensis* SHINJI, 1917, an aphid species associated with *Acer palmatum* and *A. japonicum*, was recorded in the Botanic Garden of the Jagiellonian University, Kraków, in 2009 and 2010. This invasive species, new to Poland, is presented (apterous viviparous female, alate viviparous female) and described in detail. A key to the Polish species of the genus *Periphyllus* VAN DER HOEVEN, 1863 is provided.

**KEY WORDS:** Aphidoidea, Chaitophorinae, *Periphyllus californiensis*, invasive species.

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INTRODUCTION

The genus *Periphyllus* VAN DER HOEVEN, 1863 belongs to the subfamily Chaitophorinae and consists of approximately 50 monoecious and holocyclic species associated with *Acer* spp. (maples), exceptionally with *Koelreuteria* spp. or *Aesculus* spp. (BLACKMAN & EASTOP 1994). 7 species have been recorded so far in Poland: *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* (FERNIE, 1852) (WĘGIEREK & WOJCIECHOWSKI 2004, OSIADACZ & HAJAJ 2009). Of these, only *P. testudinaceus* is associated both with numerous *Acer* spp. and sometimes with *Aesculus* spp. (BLACKMAN & EASTOP 1994).

*P. californiensis* (the California maple aphid) was described for the first time from *A. macrophyllum* PURSH (Oregon maple) in California (United States) by SHINJI (1917),

although its original range of distribution was in east Asia (China, the Russian Far East, Japan, Korea, Taiwan, India). This species was introduced to North America, Australia and New Zealand with the progressive dispersal of Asian ornamental maples (BLACKMAN & EASTOP 1994). In Europe, it was first recorded in England (STROYAN 1955), and lately it has also been reported from the Netherlands (BLACKMAN & EASTOP 1994), Italy (COLOMBO et al. 1996), Denmark (HEIE 1999), Croatia (GOTLIN ČULJAK & IGRC BARČIĆ 2002), Germany (THIEME & EGGERS-SCHUMACHER 2003) and Switzerland (LAMPEL & MEIER 2003). The distribution of the California maple aphid in Europe is probably wider; however, it is easy to confuse this species with *P. testudinaceus*. ESSIG & ABERNATHY (1952) provided detailed redescriptions of these two species, their host plants and life cycles, and STROYAN (1955) highlighted the morphological differences between them.

In its new areas, *P. californiensis* feeds not only on Asian ornamental maples but can infest native species of *Acer* spp.; it is thus treated as an alien invasive aphid species (MATTSON et al. 2007).

#### STUDY AREA AND MATERIAL EXAMINED

In May 2009 colonies of apterous and alate viviparous females were observed on the underside of leaves of *Acer palmatum* THUNB. ex MURRAY var *thunbergii* “Crispum”. In June 2010 alate viviparous females and numerous aestivating dimorphs of *P. californiensis* were observed on the underside of leaves of *A. palmatum* var *thunbergii* “Crispum” and *A. japonicum* THUNB. ex MURRAY “Aconitifolium” in the Botanic Garden of the Jagiellonian University, Kraków.

The specimens were examined using a Nikon Eclipse 600 light microscope and the drawings made with the aid of a camera lucida. A magnified view of each of the drawings is provided.

The material has been deposited in the collection of the Department of Zoology, University of Silesia: 12 apterous viviparous females, 10 alate viviparous females, Poland, Kraków, 11 V 2009, *A. palmatum* var *thunbergii* “Crispum”, leg. Ł. Junkiert, det. Ł. Junkiert, K. Wieczorek; 2 alate viviparous females, 11 aestivating dimorphs, Poland, Kraków, 09 VI 2010, *A. palmatum* var *thunbergii* “Crispum”, leg. Ł. Junkiert, K. Wieczorek, det. Ł. Junkiert, K. Wieczorek; 16 aestivating dimorphs, Poland, Kraków, 09 VI 2010, *A. japonicum* THUNB. ex MURRAY “Aconitifolium”, leg. Ł. Junkiert, K. Wieczorek, det. Ł. Junkiert, K. Wieczorek.

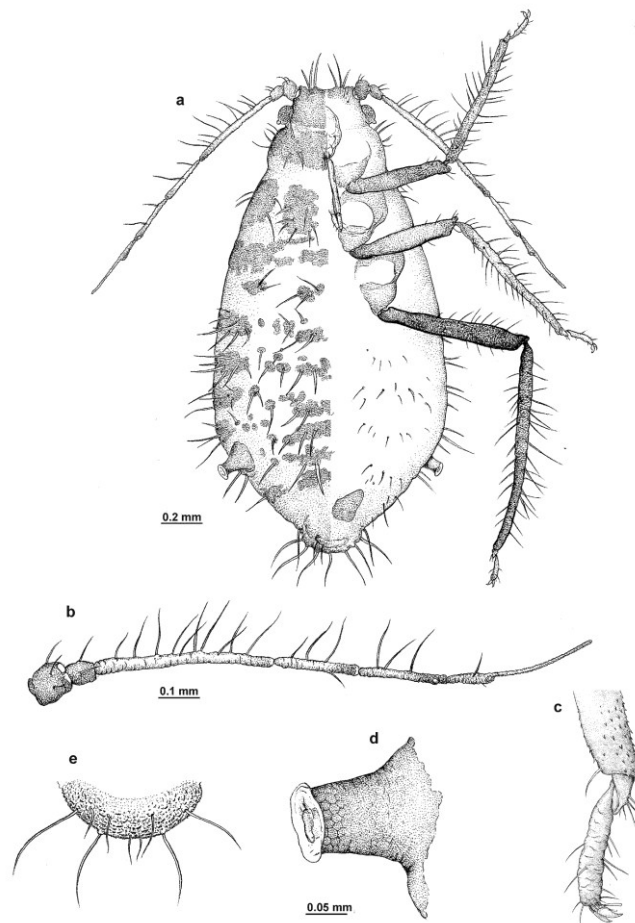
#### *Periphyllus californiensis* SHINJI, 1917

*Thomasia californiensis* SHINJI, 1917: 61

#### **Apterous viviparous female** (Fig. 1a)

Coloration of live specimens: body olive green with head, antennae (except basal part of antennal segment III which is brown), dorsal sclerites, apical part of femora and tibiae

black; pigmentation when mounted: antennal segments I-II, head, dorsal sclerites, hind legs, siphunculi dark; antennal segment VI, forelegs, tarsi dusky; antennal segments III-V pale. Body oval, slightly elongated 2.55-2.79 mm long. Thorax and abdomen with large, oval marginal sclerites, pleural and spinal ones as transverse plates, on abdominal tergites IV-VII fused. Dorsal chaetotaxy: setae arranged in visible rows, pale, pointed, 0.08-0.20 mm long. Head chaetotaxy: pointed hairs 0.16-0.20 mm long, arranged concentrically. Antennae (Fig. 1b) 6-segmented, reaching as far as abdominal segment I, about 0.60 times body length. Terminal process (VIb) about twice as long as base (VIa); other antennal ratios: VIb:III 0.49-0.61, VI:III 0.72-0.10, V:III 0.50-0.64, IV:III 0.47-0.58.



**Fig. 1.** *P. californiensis* – apterous viviparous female. a – overall view, b – antenna, c – hind tibia and tarsus, d – siphunculus, e – cauda.

Antennal chaetotaxy: segm. I with 3 hairs, segm. II with 2-3 hairs, segm. III with 9-17 hairs, segm. IV with 3 hairs, segm. V with 3 hairs. Antennal hairs 0.11-0.18 mm long; the longest antennal hair III 4.50-5.00 times basal articular diameter of this segment. Longer hair on segm. VIa 0.04-0.05 mm long, shorter hair on segm. VIa about 0.01 mm long (in some specimens poorly visible), as long as or shorter than basal articular diameter of VIb, not reaching primary rhinarium of VIa. Rostrum short, reaching second coxae, apical segment of rostrum (ARS) blunt, about 0.12 mm long, with 6 secondary hairs, 0.20-0.30 times antennal segment III and 0.70-0.85 times segment II of hind tarsus (HT II). Rows of short spinules arranged on inner margin of 1/3 distal part of hind tibiae, first tarsal chaetotaxy 5:5:5, empodial hairs spatulate (Fig. 1c). Siphunculi 0.14-0.18 mm long with 1-2 rows of reticulation in apical part (Fig. 1d). Cauda broadly rounded, 0.20 mm wide, with about 12 pointed hairs 0.125-0.16 mm long (Fig. 1e).

Measurements of one specimen (in mm): (Poland, Kraków, 11 V 2009, *A. palmatum* var *thunbergii* "Crispum", leg. Ł. Junkiert) body: 2.55, ant.: 1.53, ant. segm. (III-VI): 0.39:0.23:0.25:(0.12+0.24), ARS: 0.12, HT II: 0.14.

#### **Alate viviparous female**

Coloration of live specimens: abdomen olive green with dark abdominal dorsal sclerites, head, thorax, antennae (except basal part of antennal segment III, which is brown), apical part of femora and tibiae black; pigmentation when mounted: head, thorax, antennal segments I-II, hind legs and siphunculi dark, antennal segments III-VI, dorsal sclerites dusky. Body about 2.21-2.27 mm long. Abdominal tergites with rather small, oval marginal sclerites and fused pleural and spinal sclerites (Fig. 2a). Head and dorsal chaetotaxy as in apterous viviparous female. Antennae (Fig. 2b) reaching abdominal segment I, about 0.70 times body length. VIb about twice as long as VIa; other antennal ratios: VIb:III 0.61-0.64, VI:III 0.94-0.95, V:III 0.60-0.64, IV:III 0.62-0.69. Antennal chaetotaxy: segm. I with 3-4 hairs, segm. II with 2-3 hairs, segm. III with 13-15 hairs, segm. IV with 3 hairs, segm. V with 3 hairs. Antennal hairs 0.10-0.15 mm long; the longest antennal hair III 4.00-5.00 times basal articular diameter of this segment. Longer hair on segm. VIa 0.04-0.08 mm long, shorter hair on segm. VIa about 0.01-0.02 mm long, slightly longer than basal articular diameter of VIb. Segment III with 10-23 oval rhinaria. Forewings with pale pterostigma. Siphunculi 0.10-0.14 mm long, uniformly reticulate (Fig. 2c). Other characters as in apterous viviparous female.

Measurements of one specimen (in mm): (Poland, Kraków, 11 V 2009, *A. palmatum* var *thunbergii* "Crispum", leg. Ł. Junkiert) body: 2.21, ant.: 1.49, ant. segm. (III-VI): 0.39:0.27:0.25:(0.12+0.24), ARS: 0.07, HT II: 0.14.

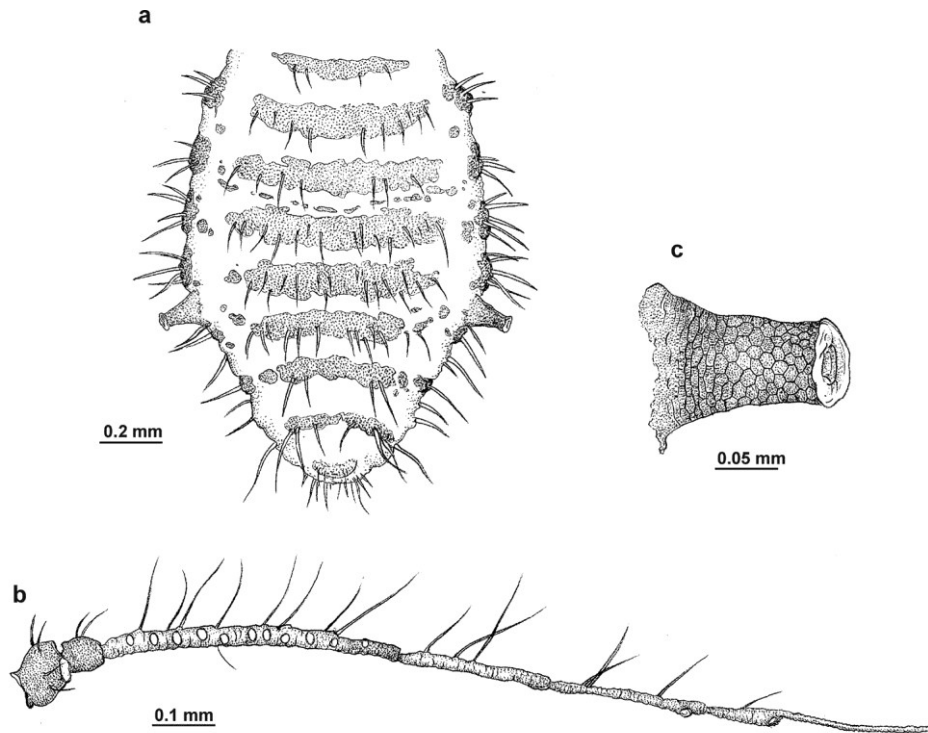


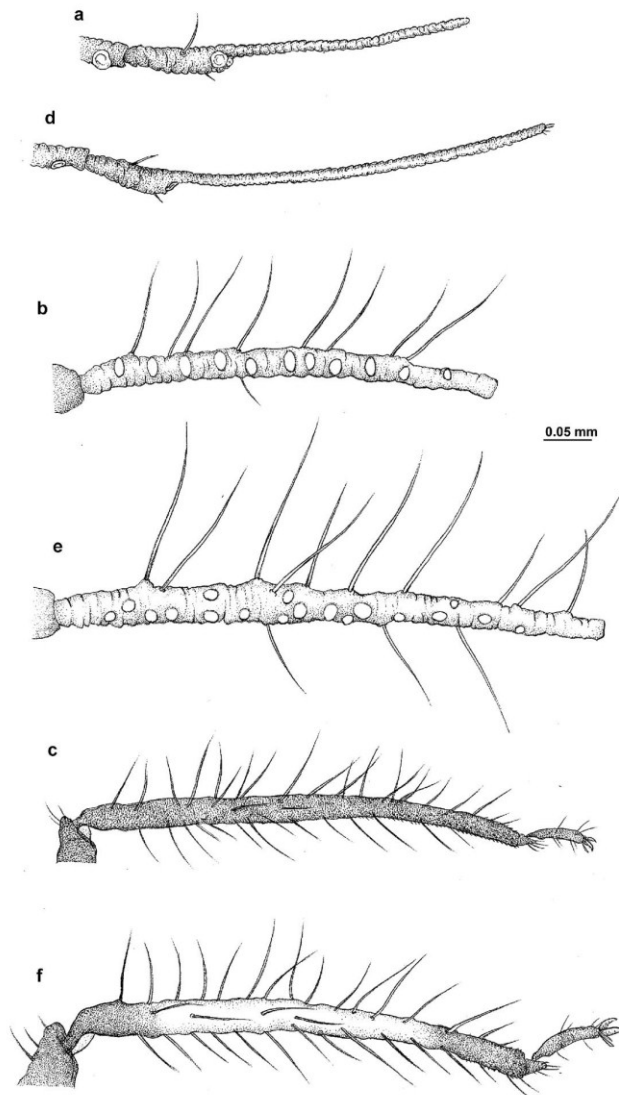
Fig. 2. *P. californiensis* – alate viviparous female: a – abdomen, b – antenna, c – siphunculus.

### Ecology and host plants

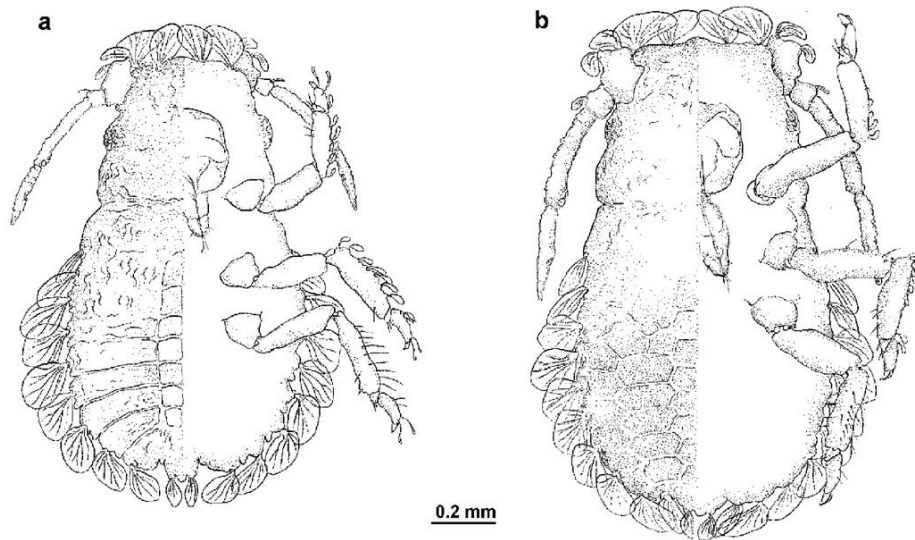
The California maple aphid lives on the undersides of leaves along the veins, usually in small colonies. Foliate marginal hairs are present in aestivating dimorphs. This oligophagous species is associated with *A. campestre* L., *A. carpinifolium* SIEB & ZUCC., *A. circinatum* PURSH, *A. japonicum* THUNB. ex MURRAY, *A. macrophyllum* PURSH, *A. miyabei* MAXIM., *A. mono* MAXIM., *A. negundo* L., *A. oblongum* WALL. ex DC., *A. palmatum* THUNB. ex MURRAY, *A. platanoides* L., *A. pseudosieboldianum* (PAX) KOM., *Aesculus californica* (SPACH) NUTT. and *A. turbinata* BLUME (PARK & PARK 1995).

### Remarks

Among the Polish species of the genus *Periphyllus*, the California maple aphid is the only species with uniformly black hind tibiae. On the other hand the morphological characters and the ecology of *P. californiensis* and *P. testudinaceus* are similar. The differences between these two species are shown in Table 1 and Figures 3-4.



**Fig. 3.** *P. californiensis* (a-c), *P. testudinaceus* (d-f). a – antennal segment VI of apterous viviparous female, b – antennal segment III of alate viviparous female, c – hind leg of apterous viviparous female, d – antennal segment VI of apterous viviparous female, e – antennal segment III of alate viviparous female, f – hind leg of apterous viviparous female.



**Fig. 4.** Aestivating dimorphs, a – *P. californiensis*, b – *P. testudinaceus*.

**Table 1.** *P. californiensis* and *P. testudinaceus* – morphological differences (1, 3, 4, 6, 7, 8, 9 – apterous viviparous female; 2, 5, 10 – alate viviparous female, 11 – aestivating dimorphs).

No	Morphological character	<i>P. californiensis</i>	<i>P. testudinaceus</i>
1	Terminal process (VIb): base (VIa)	VIb about 2.0 times longer than VIa (Fig. 3a)	VIb about 4.0 times longer than VIa (Fig. 3d)
2	Longest hair on antennal segment III	0.12-0.14 mm	0.16-0.21 mm
3	Longer hair on antennal segment VIa	0.04-0.05 mm (Fig. 3a)	0.03-0.04 mm (Fig. 3d)
4	Longer hair on antennal segment VIa	about 3.0 times as long as basal articular diameter of VIb (Fig. 3a)	about 2.0 times as long as basal articular diameter of VIb (Fig. 3d)
5	Secondary rhinaria on antennal segment III	10-23, oval (Fig. 3b)	15-32, circular (Fig. 3e)
6	Reticulation on middle part of thorax	present	absent



7	Colour of dorsal sclerites	dark, paler than hind legs	as dark as knees of hind legs
8	Colour of hind tibiae	uniformly black (Fig. 3c)	dark at base and apex, pale in middle part (Fig. 3f)
9	Rows of short spinules	on inner margin of 1/3 distal part of hind tibiae (Fig. 3c)	1-2 rows on distal part of hind tibiae (Fig. 3f)
10	Number of hairs across abdominal tergite V	10-12	6
11	Pattern of dorsum	abdominal segments I-VI with 2 pairs of separate plates (Fig. 4a)	abdominal segments I-VI with 3 pairs of separate plates (Fig. 4b)

**Key to the Polish species of the genus *Periphyllus* (apterous viviparous female)**

1. Hind tibiae uniformly black..... *P. californiensis* (SHINJI)
- Hind tibiae pale, slightly darkened or dark only at base and apex..... 2
2. Hind tibiae dark on base and apex, pale in middle part; longer hair on antennal segment VIa about 2.0 times as long as basal articular diameter of VIb..... *P. testudinaceus* (FERNIE)
- Hind tibiae pale or slightly darkened; longer hair on antennal segment VIa at least 3.0 times as long as 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 antennal segment VIa 3.0-5.0 times longer than basal articular diameter of VIb, not reaching primary rhinarium of VIa; siphunculus at base wider than its length, without distinct flange..... *P. acericola* (WALKER)
- Shorter hair on antennal segment VIa 2.5-3.0 times longer than basal articular diameter of VIb, reaching past primary rhinarium of VIa; siphunculus at base as wide as its length or longer, with distinct flange..... *P. aceris* (LINNAEUS)

**Key to the Polish species of the genus *Periphyllus* (alate viviparous female)**

1. Abdomen with dark, ventral plates..... *P. testudinaceus* (FERNIE)
- Abdomen without dark, ventral plates..... 2
2. Abdominal tergites with large 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 antennal segment VIa reaching past primary rhinarium of VIa;  
siphunculus at base as wide as its length..... *P. obscurus* MAMONTOVA
- Shorter hair on antennal segment VIa not reaching primary rhinarium of VIa;  
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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