Jumping plant-lice of the family Phacopteronidae (Hemiptera: Psylloidea) from the Center Region of Cameroon: biodiversity and host plants.

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Abstract
A survey of Phacopteronidae in the Center Region of Cameroon from January 2006 to December 2007 documented 11 species belonging to the genus Pseudophacopteron. Two species are new records: Pseudophacopteron sp.1 from Fagara macrophylla and Pseudophacopteron sp.2 from an unknown host plant. Abundance of all species appeared to depend on the phenology of host plants, with the production of new plant growth during the rainy season. Damage to their host plants includes distortion and folding of leaves, induction of galls, drying of terminal buds, defoliation, necrosis and production of honey dew.

Keywords: biodiversity, psyllids, Phacopteronidae, host plants, Center Region, Cameroon.

Résumé

Mots clés: biodiversité, psylles, Phacopteronidae, plantes hôtes, Région du Centre, Cameroun.

Introduction
Cameroon is situated between latitudes 2–13° N and longitudes 9–16° E. It is divided into ten administrative regions: Adamawa, Centre, East, Far-North, Littoral, North, North-West, West, South and South-West. The Center Region (68953 km²) is dominated by an equatorial climate with four seasons: two seasons of high rainfall (August–November and March–July) and two dry seasons (November–March and July–August). In the Center Region, the vegetation consists mainly of forest and savannah, both with rich and diverse vegetation. Some of the plants are used as commercial timber or for pharmaceutical and ethnomedical purposes. These plants, in particular new growth and young plants, are often attacked by a variety of insects or pests.

Among these pests are the plant sap-sucking jumping plant-lice or psylloids (Hemiptera, Psylloidea) which are predominantly associated with dicotyledons (Hodkinson 1974, Burckhardt 1994, Burckhardt 2005, Hollis 2004). The most serious damage is caused by nymphs (Anneck & Cilliers 1963) or by adults transmitting plant diseases. Psyllids can cause damage to their hosts in various ways: the removal of large quantities of plant sap when psyllid populations are high; the induction of leaf necrosis or abortive terminal buds; the deformation of leaves, buds or flowers including induction of galls; the soiling of leaves, flowers or fruits by secreting honeydew which stimulates fungal growth; and, the
transmission of phytoplasmal or viral diseases.

The world fauna comprises currently some 3000–3500 described psyllloid species, though this may represent less than half the number of existing species. Psylloids are probably most rich species in the tropics and south temperate regions but the fauna from these regions is only incompletely known. For the Afrotropical region relatively few taxonomic studies are available: Vondráček (1963), Capener (1968, 1970, 1973), Hollis (1973, 1976, 1984, 1987), Hollis and Broomfield (1989), Burckhardt and Mifsud (2003), Burckhardt et al. (2006b), Aléné et al. (2007) and Malenovsky & Burckhardt (2009). For Cameroon, very few comprehensive studies exist. These include: Messi and Nguefang (1993), Messi et al. (1998a, 1998b), Tamesse (2005), Tamesse et al. (2007), Malenovsky et al. (2007), and Dzokou et al. (2009). Sixty eight psyllloid species have been recorded from Cameroon by Tamesse (2005); thirty seven species of the family Triozidae (Tamesse et al., 2007) and thirty seven species of the Psyllidae from the West Region of Cameroon (Dzokou et al. 2009).

In this study we report the results from regular surveys of the Phacopteronidae from the Center Region of Cameroon from 2006-2007. The Phacopteronidae currently comprise a small family, with a pantropical distribution and characteristic venation of the forewing: C+S vein straight, costal break present and distant from junction of R₁ with costal margin, pterostigma absent, veins Rs and M₁+₂ touching, cell Cu₁₃ small or absent (Brown & Hodkinson, 1988; Malenovsky et al., 2007). This survey details the life histories of species of genus Pseudophacopteron from Center Region of Cameroon, a genus that has recently been revised by Malenovsky et al., (2007, 2009); providing additional information on insect faunistic and phenology of host plants.

**Material and methods**

The psyllids were sampled during a period of 24 months (January 2006 – December 2007) in six different localities of the Center Region of Cameroon (Table 1). The following four sites were chosen for regular monthly prospections: Kala, Minkoameyos, Nkomilong and Soa. Kala and Nkomilong are two mountains in which the vegetation is secondary forest, Minkoameyos is cultivated land, and Soa is secondary forest. The other two localities namely were visited occasionally. All localities have a similar equatorial climate.

Adult psyllids were captured with a sweep net of 0.5 mm mesh size and an aspirator. Larvae were sampled directly from buds and leaves of the host plant. All specimens were preserved in 70 % ethanol.

<table>
<thead>
<tr>
<th>Divisions</th>
<th>Subdivisions</th>
<th>Localities</th>
<th>Altitudes</th>
<th>Latitude</th>
<th>Longitude</th>
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</thead>
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<tr>
<td>Mefou &amp; Akono</td>
<td>Mbankomo</td>
<td>Nkomilong</td>
<td>756 m</td>
<td>3°47’N</td>
<td>11°24’E</td>
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<td></td>
<td></td>
<td>Kala</td>
<td>756 m</td>
<td>3°47’N</td>
<td>11°24’E</td>
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<td>Mfoundi</td>
<td>Yaounde 7</td>
<td>Minkoameyos</td>
<td>725 m</td>
<td>3°51’N</td>
<td>11°31’E</td>
</tr>
<tr>
<td>Mefou &amp; Afamba</td>
<td>Soa</td>
<td>Soa</td>
<td>600 m</td>
<td>3°57’N</td>
<td>11°36’E</td>
</tr>
<tr>
<td>Lekié</td>
<td>Okola</td>
<td>Leboth</td>
<td>206 m</td>
<td>3°38’N</td>
<td>10°47’E</td>
</tr>
<tr>
<td>Nyong &amp; Kelle</td>
<td>Eseka</td>
<td>Di-Libellingoi</td>
<td>447 m</td>
<td>4°33’N</td>
<td>11°23’E</td>
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<td>Mbam-et-Kim</td>
<td>Mbangassina</td>
<td>Bialanguena</td>
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</table>

The damage caused by the psyllids on the host plants was recorded and photographed. Plant specimens were identified by Prof. B. Sonke (University of Yaounde I) and Dr. Tadjoute botanic technician (National Herbarium, Yaounde). Insects were examined under a stereomicroscope, sorted by species and provisionally identified at the Laboratory of Zoology of the Higher Teacher’s Training College of the University of
Yaounde I. Representatives of most species were examined at the Naturhistorisches Museum Basel, Switzerland, where detailed taxonomic studies were done. A collection of dry and slide mounted specimens as well as material preserved in 70% ethanol is preserved in this institution at Yaounde.

Results
During the survey 1686 specimens (726 males, 650 females and 310 larvae) of Phacopteronidae were recorded, representing 11 species of the genus Pseudophacopteron. Host plants of 10 psyllid species were recorded; host plant of one psyllid species remain unknown. Adults of Pseudophacopteron species are illustrated by figure 1.

Species recorded and specimens examined

1- Psyllid: Pseudophacopteron nothospondiadiis Malenovsky et al.
Host plant: Nothospondias staudtii, Anacardiaceae.
Nkomilong: 29 viii 2006, 3 males, 1 female, 4 larvae; 29 ix 2006, 11 males, 7 females; 24 x 2006, 2 males, 7 females, 12 larvae; 28 xi 2006, 6 males, 9 females, 8 larvae; 29 xii 2006, 6 males, 6 females; 29 i 2007, 8 males, 7 females, 5 larvae; 19 ii 2007, 3 males, 3 females, 6 larvae; 29 iii 2007, 2 males, 9 larvae; 30 iv 2007, 5 males, 4 females, 38 larvae; 26 v 2007, 3 males, 4 females; 29 vi 2007, 1 male, 3 females; 21 vii 2007, 1 female; 22 viii 2007, 2 males, 1 female. Kala: 27 vi 2007, 1 male, 1 female.

2- Psyllid: Pseudophacopteron cuniculus Malenovsky et al.
Host plant: Blighia unijugata, Sapindaceae.

3- Psyllid: Pseudophacopteron morion Malenovsky et al.
Host plant: Santiria trimera, Burseraceae.
Nkomilong: 29 viii 2006, 6 males, 4 females, 11 larvae; 29 ix 2006, 1 male; 24 x 2006, 6 males, 4 females, 1 larva; 28 xi 2006, 11 males; 29 xii 2006, 5 males, 1 female; 29 i 2007, 6 males, 7 females; 29 ii 2007, 1 male; 30 iv 2007, 5 males, 1 female; 26 v 2007, 4 males, 1 female; 29 vi 2007, 2 males, 2 females; 21 vii 2007, 3 males, 2 females; 22 vii 2007, 11 larvae; 26 vi 2007, 7 males, 10 females.

4- Psyllid: Pseudophacopteron electum Capener.
Host plant: Ekebergia benguelensis, Meliaceae.
Kala: 1 male.

5-Psyllid: Pseudophacopteron fusivenosum Malenovsky et al.
Host plant: Deinbollia sp, Sapindaceae.
Kala: 27 xii 2006, 21 males, 16 females, 5 larvae; 25 i 2007, 5 males, 4 females; 16 ii 2007, 8 males, 3 females; 23 iii 2007, 9 males, 5 females, 2 larvae; 27 iv 2007, 5 males; 25 v 2007, 19 males, 7
females, 1 larva; 27 vi 2007, 11 males, 5 females, 8 larvae; 20 vii 2007, 3 males, 3 females; 23 viii 2007, 12 larvae; 22 ix 2007, 3 males, 3 females; 27 xii 2007, 1 female.

6-Psyllid: *Pseudophacopteron pusillum* Malenovsky et al.
Host plant: *Dacryodes edulis*, Burseraceae.


7-Psyllid: *Pseudophacopteron eastopi* Malenovsky et al.
Host plant: *Dacryodes edulis*, Burseraceae.


8-Psyllid: *Pseudophacopteron tamessei* Malenovsky & Burckhardt.
Host plant: *Dacryodes edulis*, Burseraceae.

Minkoameyos: 1 v 2006, 1 male, 2 females; 25 v 2006, 3 males, 2 females, 7 larvae; 26 vi 2006, 9 males, 6 females; 30

Host plant: *Dacryodes edulis*, Burseraceae

**Kala:** 16 ii 2007, 1 male, 1 female; 20 vii 2007, 2 males.
**Minkoameyos:** 1 v 2006, 1 male, 5 females; 25 v 2006, 1 female; 30 vii 2006, 3 males, 5 females; 30 ix 2006, 51 males, 48 females, 2 larvae; 26 x 2006, 2 males, 3 females; 26 xi 2006, 2 females, 2 larvae; 29 vii 2006, 8 males, 10 females; 26 I 2006, 1 male, 3 females; 18 ii 2007, 4 males, 1 female; 31 iii 2007, 1 male, 8 females; 29 iv 2007, 2 males, 2 females; 27 v 2007, 4 males, 2 females; 28 vi 2007, 3 males, 5 females; 24 vii 2007, 4 males, 6 females; 27 viii 2007, 11 males, 20 females; 26 ix 2007, 4 males, 7 females; 31 x 2007, 2 males, 2 females, 1 larva; 25 xi 2007, 4 males, 6 females; 30 xii 2007, 9 males, 10 females.

**Nkomilong:** 27 vii 2006, 2 males, 6 females; 29 ix 2006, 1 male, 1 female.

**Soa:** 17 vii 2007, 1 male, 1 female.

10-Psyllid: *Pseudophacopteron sp.1*
Host plant: *Fagara macrophylla*, Rutaceae.

**Di-libellingoï:** 7 vii 2007, 2 males, 3 females, 10 larvae.
**Kala:** 23 iii 2007, 5 males, 6 females, 17 larvae; 27 iv 2007, 4 males, 2 females, 3 larvae; 27 vi 2007, 2 females; 20 vii 2007, 1 female, 1 larva; 22 ix 2007, 1 male, 7 larvae; 24 x 2007, 2 males, 2 females; 17 xi 2007, 5 males, 1 female; 27 xii 2007, 9 males, 6 females.

**Nkomilong:** 19 ii 2007, 14 males, 11 females, 18 larvae; 29 iii 2007, 8 males, 3 females; 30 iv 2007, 3 males, 1 female, 10 larvae; 26 v 2007, 2 males; 29 vi 2007, 2 males, 3 females; 21 vii 2007, 1 male, 2 females; 22 viii 2007, 4 males, 4 females, 17 larvae; 24 xi 2007, 1 male, 2 females.

11-Psyllid: *Pseudophacopteron sp.2*
Host plant: unknown.

**Kala:** 16 ii 2007, 1 male, 4 females; 23 iii 2007, 1 male, 1 female, 2 larvae; 23 vii 2007, 1 male, 2 females; 22 ix 2007, 4 males; 17 xi 2007, 1 male, 1 female.

**Discussion and conclusion**

**Faunistics**
In the Center Region of Cameroon 11 species of Phacopteronidae were recorded during a survey from January 2006 to December 2007. Tamesse (2005) listed 8 species of Phacopteronidae from the entire territory of Cameroon known up to 2005. Among the 11 species collected during the present survey two species of Phacopteronidae remain unnamed and 6 are reported for the first time from the Center Region.

Nine species were common, being collected at least 10 times: *Pseudophacopteron morion* (26 times), *P. serrifer* (24 times), *P. eastopi* (20 times), *P. pusillum* (19 times), *Pseudophacopteron sp.1* (17 times), *P. nothospondiadis* and *P. cuniculus* (14 times), *P. fuscivenosum* and *P. tamessei* (11 times). One species was collected only once: *P. electum* and *Pseudophacopteron sp.2* were each collected five times.

**Phenology**
The population of most species of *Pseudophacopteron* appeared to be closely linked with climatic factors and plant phenology. From January 2006 to December 2007, *P. nothospondiadis* was collected 13 times at Nkomilong (Fig. 2). Developmental stages were observed on its host plant, *Nothospondias staudtii* on most occasions. The highest number of individuals was noted during the rainy season from March to May 2007, which coincided with the production of new plant growth.
From January 2006 to December 2007, *P. cuniculus* was collected 6 times at Soa (Fig. 3). Development stages were observed on its host, *Blighia unijugata* on most occasions. The highest number of individuals was noted during the rainy season from March to April 2007, which coincided with the production of new plant growth. From January 2006 to December 2007, *P. morion* was collected 15 times at Nkomilong (Fig. 4). Most of the time adults were observed on its host but the larvae were collected only at July and August during the survey period. The highest number of individuals was noted at August 2006, July and December 2007. The fluctuations of the population of this psyllid appeared to be influenced by climatic factors, as during the rainy season, a proliferation of psyllids was noted. From January 2006 to December 2007, *P. fuscivenosum* was collected 11 times at Kala (Fig. 5). Most of the time all developmental stages were observed on its host, *Deinbolla* sp. The highest number of individuals was noted at December 2006 and May 2007, which coincided with the production of new plant growth. From January 2006 to December 2007, *P. pusillum* was collected 16 times at Minkoameyos (Fig. 6). The highest population was observed at a single peak in October 2006. Larvae were collected only in July 2006, which coincided with the rainy season and production of new growth. From January 2006 to December 2007, *Pseudophacopteron tamessei* was collected 11 times at Minkoameyos (Fig. 8). The highest population was observed at a single peak in September 2006. Larvae were collected only in May 2006, which coincided with the rainy season and production of new growth. From January 2006 to December 2007, *Pseudophacopteron serrifer* was collected 19 times at Minkoameyos (Fig. 9). The highest population was observed at a single peak in September 2006. Larvae were not observed during the survey. The highest population coincided with the rainy season and production of new growth. From January 2006 to December 2007, *Pseudophacopteron sp.1* was collected 8 times at Nkomilong (Fig. 10). Developmental stages were observed on its host plant *Fagara macrophylla* on most occasions. The highest number of individuals was noted from February to May 2007 and from July to November 2007, which coincided with the production of new plant growth.

<table>
<thead>
<tr>
<th>Host family</th>
<th>Host plant species</th>
<th>Species of <em>Pseudophacopteron</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Burseraceae</td>
<td>Dacryodes edulis</td>
<td><em>P. eastopi, P. pusillum, P. tamessei</em></td>
</tr>
<tr>
<td></td>
<td>Santiria trimera</td>
<td><em>P. morion</em></td>
</tr>
<tr>
<td>Anacardiaceae</td>
<td>Nothospondias staudtii</td>
<td><em>P. nothopondiadis</em></td>
</tr>
<tr>
<td>Sapindaceae</td>
<td><em>Blighia unijugata</em></td>
<td><em>P. cuniculus</em></td>
</tr>
<tr>
<td></td>
<td>Deinbolla sp</td>
<td><em>P. fuscivenosum</em></td>
</tr>
<tr>
<td>Miliaceae</td>
<td>Ekebergia bengueensis</td>
<td><em>P. electum</em></td>
</tr>
<tr>
<td>Rutaceae</td>
<td><em>Fagara macrophylla</em></td>
<td><em>Pseudophacopteron sp.1</em></td>
</tr>
</tbody>
</table>

From January 2006 to December 2007, *P. pusillum* was collected 16 times at Minkoameyos (Fig. 6). The highest number of individuals was noted in October 2006 and September 2007, which coincided with the rainy season and production of new growth. Larvae were collected only during these two peaks. From January 2006 to December 2007, *P. eastopi* was collected 16 times at Minkoameyos (Fig. 7). The highest population was observed at a single peak in October 2006. Larvae were collected only in July 2006, which coincided with the rainy season and production of new growth. From January 2006 to December 2007, *Pseudophacopteron tamessei* was collected 11 times at Minkoameyos (Fig. 8). The highest population was observed at a single peak in September 2006. Larvae were collected only in May 2006, which coincided with the rainy season and production of new growth. From January 2006 to December 2007, *Pseudophacopteron serrifer* was collected 19 times at Minkoameyos (Fig. 9). The highest population was observed at a single peak in September 2006. Larvae were not observed during the survey. The highest population coincided with the rainy season and production of new growth. From January 2006 to December 2007, *Pseudophacopteron sp.1* was collected 8 times at Nkomilong (Fig. 10). Developmental stages were observed on its host plant *Fagara macrophylla* on most occasions. The highest number of individuals was noted from February to May 2007 and from July to November 2007, which coincided with the production of new plant growth.

**Host plants**

Host plants are known for 10 of the 11 species reported from the Center Region (Table 2).
Fig. 2: Numbers of larvae, males and females of *P. nothospondiadis* collected at Nkomilon on *Nothospondias staudtii.*

Fig. 3: Numbers of larvae, males and females of *P. cuniculus* collected at Soa on *Blighia unijuga.*

Fig. 4: Numbers of larvae, males and females of *P. morion* collected at Nkomilon on *Santiria trimera.*

Fig. 5: Numbers of larvae, males and females of *P. fucivenosum* collected at Kala on *Deinbolia sp.*

Fig. 6: Numbers of larvae, males and females of *P. pusillum* collected at Minkoameyos on *Dacryodes edulis.*

Fig. 7: Numbers of larvae, males and females of *P. eastopi* collected at Minkoameyos on *Dacryodes edulis.*

Fig. 8: Numbers of larvae, males and females of *Pseudophacopteron tamessei* collected at Minkoameyos on *Dacryodes edulis.*

Fig. 9: Numbers of larvae, males and females of *Pseudophacopteron serrifer* collected at Minkoameyos on *Dacryodes edulis.*
Most of the species discussed here are monophagous on their respective hosts. The host plants of Phacopteronidae in the Center Region of Cameroon included 7 species of 5 families. The family Burseraceae includes 2 species of host plants (Santiria trimera and Dacryodes edulis). The family of Sapindaceae includes 2 species of host plants (Blighia unijugata and Deinbollia sp). The family of Anacardiaceae includes one species of host plant (Nothospondias staudtii). The family of Miliaceae includes one species of host plant (Ekebergia bengueiensis). The family of Rutaceae includes one species of host plant (Fagara macrophylla). The host plants of one species of psyllid remain unknown. The larvae of P. fuscivenosum feeding on Deinbollia sp. provoked the appearance of galls on the leaves (Fig. 11A). Damage caused by Pseudophacopteron sp.1 on F. macrophylla (Fig. 11B), P. nothospondiadiis on N. staudtii (Fig. 11C), four species on Dacryodes edulis (Fig. 11D), and P. cuniculus on B. unijugata (Fig. 11E) was similar. The damage consists of distortion and deformation of leaves as well as leaf rolling, and the larvae secreted a white waxy filament on their host plants. The larvae of P. morion (Fig. 11F) live in deep but open pit galls which leave their dorsum exposed. Some of the affected plants have various economic, pharmacological, and ethnobotanical uses. The host plants species: B. unijugata, Deinbollia sp, N. staudtii, E. bengueiensis, S. trimera are widely used in traditional medicine throughout tropical Africa and there is interest in researching their qualities for biochemical extracts and modern medicine (Malenovsky et al., 2007). Dacryodes edulis or safou (also known as African plum, African pear, or bush butter), is a multipurpose tree presently undergoing domestication in central Africa and the countries bordering the Gulf of Guinea. Its fruits are an important item in local diets and are widely marketed (Malenovsky et al., 2007). It is therefore important to pursue this work in the other regions of Cameroon and to also study the taxonomy of new species of Phacopteronidae. The study of the biology of these pests would be very important for an integrated pest management program in Cameroon.

Acknowledgments

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