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Biology of *Pseudophacopteron pusillum* and *Pseudophacopteron eastopi* (Hemiptera-Psylloidea: Phacopteronidae), pest of *Dacryodes edulis* (Burseraceae) in Yaounde, Cameroon

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Abstract
Dacryodes edulis (Burseraceae) is an important plant native from Central Africa. In Cameroon, it is cultivated in almost all regions for economic, medicinal and nutritional purposes. *D. edulis* is visited by four psyllid species: *Pseudophacopteron serrifer*, *P. tamessei*, *P. eastopi* and *P. pusillum*. Those psyllids cause important damages on their host plant, necessitating to put in place an integrated pest control against them. The aim of this survey is to study the biology of *P. pusillum* and *P. eastopi* on *D. edulis* in the nursery, which is helpful for an integrated pest management. The study was carried out from April 2011 to March 2012 through daily observations. It is observed that the two psyllid species are sharing different sites on their host plant to lay eggs. The eggs hatching and develop through five instar larval stages before become adult. The fertility, adult life span, sexual maturity, and the developmental duration of each instar larva were determined.

Keywords: biology, psyllid, species, *Dacryodes, edulis*

Introduction
Psyllids or jumping plant lice (Hemiptera- Psylloidea) are considered as important pests for their host plants. They attack forestry and cultivated plants with have economic, pharmaceutical, or ornamental importance (Dzokou *et al.*, 2020) [1]. The biological study of some psyllids species were carried out on some plants in Cameroon such as cacao psyllid, *Mesohomotoma tessmanni* (Messi, 1984) [2]; citrus psyllid, *Trioza erytreae* (Tamesse, 1996) [3]; *Ricinodendron heudelotii* psyllid, *Diclidophlebia xuani* (Alene *et al.*, 2005) [4]; *Triplochiton scleroxylon* psyllids *D. eastopi* and *D. harrisoni* (Noubissi *et al.*, 2014) [5]; and *Eucalyptus globolus* psyllid, *Blastopsylla occidentalis* (Soufo, 2016) [6].The damages caused by psyllids are mainly curling, swelling, deformation, discoloration with necrosis and drying of said leaves (Dzokou *et al.*, 2009) [7]. Psyllids are vectors of many plant diseases, where they transmitting viruses, bacteria and mycoplasmas (Hodkinson, 1974) [8]. Among the plants attacked by psyllids, *Dacryodes edulis* (G. Don.) is listed.
Dacryodes edulis belong to Burseraceae family, produces consumable fruit as food and oil. *Dacryodes edulis* is an African origin tree, with nutritional, economic and industrial potential (Kengne, 1990) [9]. It plays an important role as food for household consumption and generating income for the countries which are cultivating the plant (Ikhatua and Okeke, 2011) [10]. It also considers as one of the most important fruit tree species in West and Central Africa (Tchoundjeu *et al.*, 2002) [11]. In Cameroon, it is the third most important fruit cultivated after bananas and cola, in terms of production (Temple, 1999) [12]. The quantity of *D. edulis* fruits marketed in 1997 in Cameroon was estimated at 11,000 tons for a value of 7.5 million US dollars (Awono *et al.*, 2002) [13]. The use of other parts of the plant such as leaves and bark in traditional pharmacopoeia is quite widespread and prescriptions vary from one region to another (Kengue, 2002) [14]. In addition those parts also like most species of Burseraceae family secrete myrrh, frankincense and elemis with industrial and pharmaceutical importance (Kengue, 2002) [14].
The african plum tree has suffered serious damages caused by pest insects, but the biology

study of these insects is not yet been carried out. Recent taxonomic studies carried out in Cameroon indicated that four different psyllids species of the Phacopteronidae develop and feed on *D. edulis* causing important damages. They are: *Pseudophacopteron serrifer* (Malénovsky and Burckhardt, 2009) [15], *Pseudophacopteron tamessei* (Malénovsky and Burckhardt, 2009) [15], *Pseudophacopteron eastopi* (Malénovsky *et al.*, 2007) [16] and *Pseudophacopteron pusillum* (Malénovsky *et al.*, 2007) [16]. Phacopteronidae family has pan-tropical distribution and is associated to Rutales / Sapindales orders, Anacardiaceae, Burseraceae, Meliaceae and Sapindaceae families and Gentianales order, Apocynaceae family (Hollis, 2004) [17]. *Dacryodes edulis* farmers are facing difficulties to cultivate this plant because two of the four psyllid species inducing serious damages especially when the plants are still young. Those two species are *P. pusillum* and *P. eastopi*. The larvae of *P. pusillum* induced gall formation on the leaves and those of *P. eastopi* produced whitish flocculent waxy secretions. All stage development of these two species feed on the sap of *D. edulis* plant. They produced necrosis and drop of buds. The growth and the development of the plant, are greatly reduced. No control measures have been taken so far to fight against the *D. edulis* pest insects in Cameroon and no biology study have been done.

The aim of this survey is to study the biology of *Pseudophacopteron pusillum* and *P. eastopi*, on young trees of *D. edulis*. This study could provide exploitable information to set up an integrated pest management program to control these pests in Cameroon.

Materials and Methods

The study of the biology of *Pseudophacopteron pusillum* and *P. eastopi* was conducted from April 2011 to March 2012, in the campus of the Higher Teachers' Training College of the University of Yaounde I, on nursery plants of *D. edulis* (fig. 1). The geographical coordinates of the study site are: 784 m, 03°51'654" N 11 ° 30'597" E.

Fig 1: Young plants of *Dacryodes edulis* used for biological studies of psyllids

This study was carried out to determine in each species: the mating process, eggs laying site, embryonic and larval development, sex ratio at emergence, female fertility, and adults life span. *D. edulis* seedlings were obtained from fruit program of the Institute of Agronomic Research for Development (IARD), Nkolbisson, Yaounde (Cameroon).

Fifty young plants were selected and used for this survey. Two weeks after the acquisition, seedlings were ready for the study. The seedlings were infested, separately by *P. pusillum* and *P. eastopi* adults, collected in an experimental orchard of IARD Yaounde branch. No insecticide treatment was applied during the observation period.

The infestation was made by adults of *P. pusillum* and *P. eastopi* aged of 2 days. The infested plants were protected by white and light cages with 0.01mm mesh to avoid adults escaping after last moult. These adults were isolated in transparent cages at the emergence for better observation. After the fledgling, two couples of each psyllid species were isolated on young buds protected with transparent cages to study the fertility. We avoided to associate different species on the same plant. Fecundity of females was assessed on 33 couples for each species by counting the number of eggs laid for each infestation, during the life span of the female. The mating procedures and courtship were studied by observing newly emerged adults. Generally, psyllids present five larval stages and adult stage. For the study of the life cycle of the two psyllid species, couples of each species were maintained on young leaves during 72 hours after infestation. Daily observations permitted to determine the individual number and developmental duration of each larval stage and adult stage on each of the experimental plant. The larval stages identification was based on the following characteristics: number of antennal segments and rhinaria, absence and presence with size of wing buds, and larval body size. For the two species, the first larval stage is characterized by the lacking of wing buds, antenna with three segments. The second larval stage characterized by presence of wing buds, antenna with four segments carrying rhinaria on segment 3 and 4. The third larval stage is characterized by the wing buds more developed than that on the second larval stage, antenna with six segments carrying rhinaria on segment 4 and 5 for *P. pusillum*; three rhinaria on segment 3, 4, and 5 for *P. eatopi*. The fourth larval stage is characterized by the wing buds more developed than that on the third larval stage, antenna with eight segments carrying rhinaria on segment 4 and 6 for *P. pusillum* and three rhinaria on segment 3, 5, and 7 for *P. eatopi*. The fifth larval stage is characterized by the wing buds more developed than that on the fourth larval stage, antenna with ten segments carrying single rhinaria on segment 6, 7 and 8, and two rhinaria on segment 9 for *P. pusillum* while in *P. eastopi* segment 6 carries two rhinaria and segments 7, 8 and 9 with single rhinarium. The number of days before first

mating was determined, adult life span was evaluated by counting the number of days from adult infestation aged of 2 days to its death day. The life cycle and sex ratio of the two psyllid species were evaluated. The nature of the damages caused by each species of psyllid on their host plant was also evaluated.

Results

Biology of *Pseudophacopteron pusillum*

Mating

After the metamorphosis of the nymphal stages, once sexually mature, adults of *P. pusillum* can mate. For the mating process, the male is coming closer to the female; the two individuals are touching each other through their antennae; the male turns, lies down near the female and laterally grips its genitalia to the female genitalia. A couple can spend hours in that position and the two individuals are moving around together.

Egg laying sites

This part of the study was carried in the field with the old host plants. From May 2010 to April 2011, 103 eggs of *P. pusillum* were collected on mature trees of *D. edulis* with 91.26% collected on young leaves, 8.74% on buds and no egg was found on the old leaves of *D. edulis*. During the same period, we collected from the young plants of *D. edulis*, 126 eggs of *P. pusillum* with 91.27% on the young leaves, 8.73% on the buds and no eggs on the old leaves. From May 2011 to April 2012, 46 eggs of *P. pusillum* were collected on the adult plants of *D. edulis* with 100% collected on young leaves. On young plants, 156 eggs of *P. pusillum* were collected with 94.87% on young leaves, 5.13% on buds and no egg was collected on old leaves (fig. 2). These results show that females of *P. pusillum* lay preferentially on the underside of young leaves of *D. edulis* probably in order to protect their eggs from adverse weather. The eggs are mostly laid along the main and secondary leaf veins, and rarely on the buds and not at all on old leaves of *D. edulis*.

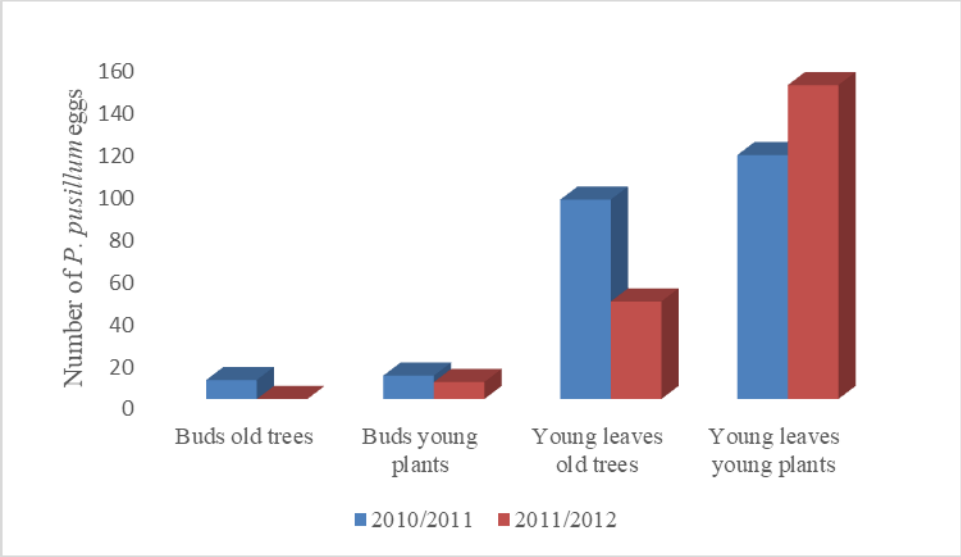

Fig 2: Number of eggs laid by *Pseudophacopteron pusillum* on old trees and young plants of *Dacryodes edulis* from May 2010 to April 2012.

Female fecundity

Female fecundity of *P. pusillum* was evaluated through the first instar larval hatching from the laying eggs. From April 2011 to March 2012, 30 females of *P. pusillum* coupled with males on the plants of *D. edulis* and the first instar larvae hatching from the eggs were recorded. A minimum of 7.00 eggs and a maximum of 72.00 eggs with average of 31.00 eggs per female of *P. pusillum* were recorded (table 1).

Table 1: Number of laying eggs per female of *Pseudophacopteron pusillum* from April 2011 to March 2012 in the field

Number of couples	Minimum of eggs	Maximum eggs	Total	Average	Standard deviation
30	7.00	72.00	938	31	3.14

Embryonic development

Before the larval development which is taken place when the egg hatches, there is embryonic development from fertilization to the hatching of the first instar larva. The duration of embryonic development is 8 to 15 days with the average of 10.08±0.63 days.

Larval development

The informations related to the duration of each larval development were recorded from isolated 30 females coupled with males on young host plants and are found on table 2. After hatching, the first instar larvae of *P. pusillum* take 3 to 8 days with an average of 4.87 ± 0.24 days to give the second instar larvae. The second instar larvae take 3 to 9 days with an average of 4.93 ± 0.32 days to give the third instar larvae. The third instar larvae take 3 to 9 days, with an average of 5.53 ± 0.33 days to give the fourth instar larvae. The fourth instar larvae also take 3 to 9 days with an average of 5.33 ± 0.37 days to give the fifth instar larvae, the fifth instar larvae take 3 to 9 days with an average of 5.00 ± 0.37 days to become adults. It appears from these results that the larval development of *P. pusillum* is taken 15 to 44 days with an average of 25.65 days to give adult. The results related to larval development duration of each instar larva of *P. pusillum* are found in table 2.

Sexual maturity

After the imaginal molt or the metamorphosis of the fifth

instar larva, the young adult of *P. pusillum* is very fragile and less mobile with whitish colour. After larval metamorphosis, the young adult needs 1 to 4 days with the average of 2.43 ± 0.12 days, to become strong, and acquire the normal colour and mobility. After the above duration, the new adult is able to mate.

Table 2: Duration (in days) of each larval development of *Pseudophacopteron pusillum* between April 2011 and March 2012 in the experimental site

Development stages	Number of individuals	Minimum	Maximum	Average	Standard deviation
First instar larvae	30	3.00	8.00	4.87	0.24
Second instar larvae	30	3.00	9.00	4.93	0.32
Third instar larvae	30	3.00	9.00	5.53	0.33
Fourth instar larvae	30	3.00	9.00	5.33	0.37
Fifth instar larvae	30	3.00	9.00	5.00	0.37
Adults	97	1.00	4.00	2.43	0.12

Sex-ratio

Among the 430 individuals on which the observations were made in studied site, 200 males and 230 females were recorded, with percentages of 46.51% and 53.49% respectively. The sex ratio SR= 0.86 is bias in favour of the females.

The field studied carried out in *D. edulis* orchard of Minkoameyos, during the first year a total of 91 adults of *P. pusillum* were recorded on the old trees of *D. edulis*. Among the 91 adults, 44 males and 47 females were recorded with percentage of 48.35% and 51.65% respectively. The sex ratio SR= 0.93 is bias in favour of females. In the second year 22 males and 23 females were recorded with 48.89% and 51.11% respectively. The sex ratio SR= 0.95 is bias in favour of females. For the young plants of *D. edulis* orchard during the first year, 82 adults of *P. pusillum* were recorded with 36 males and 46 females, percentage of 43.90% and 56.10% respectively. The sex ratio SR= 0.78 was bias in favour of females. In the second year 62 males and 88 females were recorded with 41.33% and 58.67% respectively. The sex ratio SR= 0.78 is bias in favour of females. The number of females and males recorded, sex ratio of *P. pusillum* of the two studied sites are found in Table 3.

Table 3: Number of adults and ratio of *Pseudophacopteron pusillum* of nursery site and field site

Site (s)		Years	Number of *P. pusillum* individuals			Sex ratio (SR)
			Males	Females	Totals	
Nursery plants		2011/2012	200 (46.51%)	230 (53.49%)	430	0.86
Orchard of Minkoa meyos	Adult plants	2010/2011	44 (48.35%)	47 (51.65%)	91	0.93
		2011/2012	22 (48.89%)	23 (51.11%)	45	0.95
	Young plants	2010/2011	36 (43.90%)	46 (56.10%)	82	0.78
		2011/2012	62 (41.33%)	88 (58.67%)	150	0.78

***Pseudophacopteron pusillum* adult life span**

A total of 60 young adults obtained just after larval metamorphosis were used to determine the life span of *P. pusillum* adults; then 30 males and 30 females were followed up. The males live 5 to 20 days, with an average of 12.53 ± 0.70 days while the females live 5 to 26 days, with an average of 15.50 ± 0.85 days. According to the above results, females of *P. pusillum* have higher life span than males. The adult life span informations of *P. pusillum* are found in Table 4.

Table 4: Adults of *Pseudophacopteron pusillum* life span (days) on *Dacryodes edulis*

Sexes	Number	Minimum	Maximum	Average	Standard deviation
Males	30	5.00	20.00	12.53	0.70
Females	30	5.00	26.00	15.50	0.85

Biology of *Pseudophacopteron eastopi*

Mating

Mating begins when male and female meet up together, and the courtship is started when the two antennae of the couple are touching each other. The courtship takes few seconds, after the male turns and positions its genitalia near the female genitalia to introduce the eadaegus in the female genital tract. As in *P. pusillum*, the couple can spend hours in that position and the two individuals are moving around together.

Egg-laying site

The adults of *P. eastopi* like to lay their eggs on the buds of *D. edulis*. From May 2010 to April 2011, at the IRAD orchard of Minkoameyos, 327 eggs of *P. eastopi* were collected, with 84.40% on buds and 15.60% on young leaves of old trees of *D. edulis*. On young plants, 836 eggs were collected with 84.09% on the buds and 15.01% on the young leaves. From May 2011 to April 2012, 191 eggs of *P. eastopi* were collected on the old trees of *D. edulis*, with 77.47% on the buds and 22.53% on the young leaves. On the young plants of *D. edulis*, 418 eggs were collected, with 81.10% on the buds, 18.90% on the young leaves and 0% on the old leaves. According to the above results, unlike *P. pusillum*, females, *P. eastopi* females preferentially lay their eggs on the buds of *D. edulis*. When the buds become scarce, they lay eggs on young leaves. During the two years of study, eggs were not found on old leaves. Informations relating to the egg-laying sites of females of *P. eastopi* are found in figure 3.

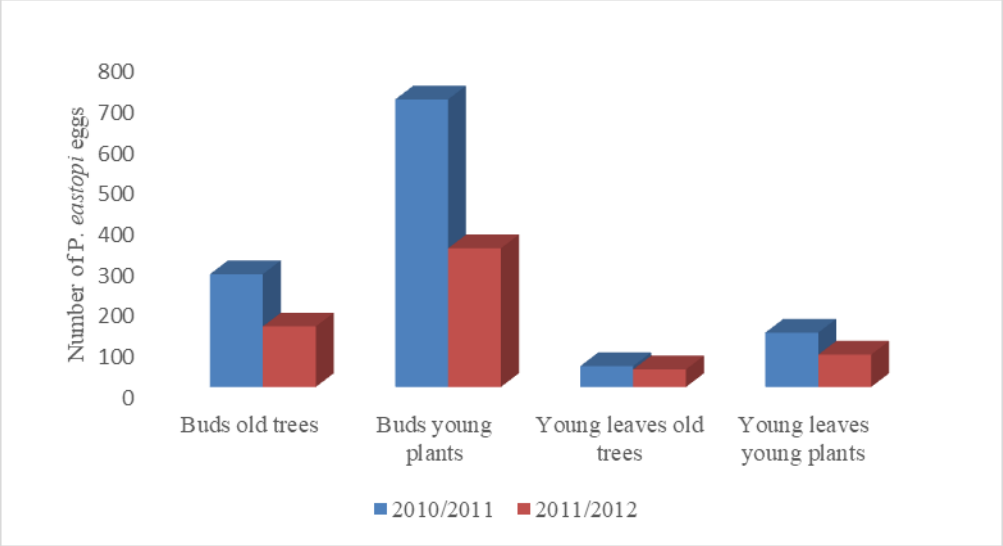

Fig 3: Number of *P. eastopi* eggs laid on old trees and young plants of *D. edulis* from May 2010 to April 2012 in Minkoameyos orchard.

Female fecundity

As in *P. pusillum*, female fecundity of *P. eastopi* was evaluated through the first instar larval hatching from the laying eggs. From April 2011 to March 2012, 30 females of *P. eastopi* coupled with males on the plants of *D. edulis* and the first instar larvae hatching from the eggs were recorded. A minimum of 2 eggs and a maximum of 80 eggs, with an average of 21.44 ± 03.11 eggs per female of *P. eastopi* were recorded (table 5).

Table 5: Number of laying eggs per female of *Pseudophacopteron pusillum* from April 2011 to March 2012 in the field

Number of pairs of females	Minimum of eggs	Maximum eggs	Total	Average	Standard deviation
30	2.00	80.00	643.00	21.44	03.11

Embryonic development

The embryonic development is taken place from fertilization to the hatching of the first instar larva *P. eastopi*. From the 30 repetitions carried out to follow up the duration of embryonic development we obtained that the embryo is taken 6 to 26 days with an average of 14.36±1.78 days to complete its development.

Larval development

The informations related to the duration of each larval development were recorded from isolated 30 females coupled with males on young host plants and are found on table 6. After their hatching the first instar larvae take 2 to 7 days with an average of 4.17 ± 0.28 days to give second instar laevae. The second instar larvae take 3 to 7 days with an average of 4.63 ± 0.26 days to give the third instar larvae. The third instar larvae take 4 to 8 days with an average of 5.50 ± 0.21 days to give the fourth instar larvae. The fourth instar larvae take 4 to 9 days with an average of 6.57 ± 0.32 days to give the fifth instar larvae. The fifth instar larvae take 5 to 10 days with an average of 6.93 ± 0.27 days to give the adults. It appears from these results that, the larval development of *P. eastopi* is taken 18 to 41 days with an average of 27.80 days to give adult. The results related to larval development duration of each instar larva of *P. eastopi* are found in table 6.

Sexual maturity

After the imaginal moult or the metamorphosis of the fifth instar larva, the young adult of *P. eastopi* is very fragile and less mobile with whitish colour. After larval metamorphosis, the young adult needs 1 to 2 days with an average of 1.02 ± 0.02 days, to become strong, and acquire the normal colour and mobility. After the above duration, the new adult is able to mate.

Table 6: Duration (in days) of each larval development of *Pseudophacopteron eastopi* between April 2011 and March 2012 in the experimental site

Development stages	Number	Minimum	Maximum	Average	Standard deviation
First instar larvae	30	2.00	7.00	4.17	0.28
Second instar larvae	30	3.00	7.00	4.63	0.26
Third instar larvae	30	4.00	8.00	5.50	0.21
Fourth instar larvae	30	4.00	9.00	6.57	0.32
Fifth instar larvae	30	5.00	10.00	6.93	0.27
Adults	58	1.00	2.00	1.02	0.02

Sex-ratio

Among the 315 individuals on which the observations were made in studied site, 161 males and 154 females were recorded, with a percentage of 51.11% and 48.89% respectively. The sex ratio SR= 1.04 is bias in favour of the males.

The field studied carried out in *D. edulis* orchard of Minkoameyos, during the first year a total of 137 adults of *P. eastopi* were recorded on the old trees of *D. edulis*. Among the 137 adults, 70 males and 67 females were recorded with percentage of 51.09% and 48.91% respectively. The sex ratio SR= I.04 is bias in favour of males. In the second year 30

males and 43 females were recorded with 41.10% and 58.90% respectively. The sex ratio SR= 0.69 is bias in favour of females. For the young plants of *D. edulis* orchard during the first year, 313 adults of *P. eastopi* were recorded with 148 males and 165 females, percentage of 47.28% and 52.72% respectively. The sex ratio SR= 0.89 was bias in favour of females. In the second year 128 males and 127 females were recorded with 50.20% and 49.80% respectively. The sex ratio SR= 1.007 is a bit bias in favour of males. The number of females and males recorded, sex ratio of *P. eastopi* of the two studied sites are found in Table 7.

Table 7: Number of adults and ratio of *Pseudophacopteron eastopi* of nursery site and field site

Sites		Years	Number of *P. eastopi* individuals			Sex ratio
			Males	Females	Totals	
Nursery plants		2011/2012	161 (51.11%)	154 (48.89%)	315	1.04
Orchard of Minkoa- meyos	Adult plants	2010/2011	70 (51.09%)	67 (48.91%)	137	1.04
		2011/2012	30 (41.10%)	43 (58.90%)	73	0.69
	Young plants	2010/2011	148 (47.28%)	165 (52.72%)	313	0.89
		2011/2012	128 (50.20%)	127 (49.80%)	255	1.007

***Pseudophacopteron eastopi* adult life span**

A total of 60 young adults obtained just after larval metamorphosis were used to determine the life span of *P. eastopi* adults; then 30 males and 30 females were followed up. The males live 5 to 32 days, with an average of 16.80 ± 1.38 days while the females live 5 to 36 days, with an average of 19.27 ± 1.53 days. According to the above results, males of *P. eastopi* have a life span which is a bit lower than females. The adult life span informations of *P. eastopi* are found in Table 8.

Table 8: Adult life span (days) of *Pseudophacopteron eastopi* on *Dacryodes edulis*

Sexes	Number of individuals	Minimum	Maximum	Average	Standard deviation
Males	30	5.00	32.00	16.80	1.38
Females	30	5.00	36.00	19.27	1.53

Discussion

The biological study of *P. pusillum* and *P. eastopi* was followed on *D. edulis* in nursery condition. *Pseudophacopteron pusillum* are sexually mature about 2 days after emergence, while *P. eastopi* spends one day to become sexually mature. This is similar to that of *Diclidophlebia eastopi* and *Diclidophlebia harrisoni*, psyllids of *Triplochiton scleroxilon* (0sisanya, 1974) [18]. Conytrary to *Diclipophlebia xuani* psyllid of *Ricinodendron heudelotii* and *Ctenarytaina thysanura*, psyllid of *Boronia megastigma* where mating begins approximately 15 minutes after emergence of the females (Aléné, 2007) [19] and 30 to 40 minutes after emergence of the males, (Mensah and Madden, 1993) [20] respectively. For the African citrus psyllid *Trioza erytreae* (Del Guercio), the male becomes sexually mature the same day of imaginal emergence, but the female is taken 3 days to become sexually mature (Van Den Berg *et al.*, 1991) [21].

According to Hodkinson (1974) [8], most psyllids lay their eggs on the underside of the host plant leaves similar to that of *P. pusillum*, which preferentially lays its eggs along the main and secondary veins of the underside of *D. edulis* leaves. The oviposition sites on the host plants depend of psyllid species and the age of the host plant leaves. Most psyllid species prefer to lay their eggs on young parts of the host plant such as shoots and young leaves (Guedes Corrêa Gondim *et al.*, 2005) [22]. The coexistence of the two psyllid species of this survey shows that they share different sites of oviposition. *Pseudophacopteron pusillum* prefers to lay its eggs on the young leaves while *P. eastopi* prefers to lay its eggs on the buds of the host plant. Those host plant parts are soft and provide more fluid or sap needed by the eggs to maintain their turgescence (Blowers and Moran, 1967) [23]. In addition, the young leaves promote adequate penetration of the egg peduncle into plant tissues (Tamesse and Messi, 2004) [24]. When the shoots of the host plant develop and become old, they are not more favorable for psyllid oviposition and feeding because the fluid or sap are limited in the old leaves, they are hardened difficult for attachment of eggs. When the young leaves and buds become scarce, the frequency of oviposition decreases; in this case *P. eastopi* lays its eggs on the fixation point of the leaves to the stems rarely on the old leaves. Mensah and Madden reported in 1991 [25] that the number of eggs laid by *Ctenarytaina thysanura* per terminal shoot decreases with increasing hardness of these terminal shoots. Female psyllids begin oviposition about five days after emergence (Hodkinson 1974) [8]. Female of *P. pusillum* lays an average of 31.25 eggs while female of *P. eastopi* lays an average of 21.44 eggs. The fertility of the two species is very low compared to that of *D. xuani* in which a female can lay an average of 532.2 to 758.1 eggs (Aléné, 2007) [19]; also females of *Diaphorina citri* lay an average of 857.96 ± 45.83 eggs on the grapefruit (Tsai and Liu, 2000) [26]. According to the results of this survey *P. pusillum* and *P. eastopi* do not exhibit parthenogenesis, this is in concordance with that was reported by Hodkinson (1974) [8] that, the majority of psyllid species reproduce sexually. In fact, psyllid reproduction is sexual, except for occasional cases of facultative parthenogenesis (Ossiannilsson, 1992) [27].

The psyllid life cycle depends to the psyllid species and takes at least 2 to 8 weeks (Valterova *et al.* 1997) [28]. The life cycle of the two studied species of this survey is: 23 to 59 days for *P. pusillum* and 24 to 67 days for *P. eastopi*, with respective averages of 35.73 days and 42.16 days. Compare to the life cycle of other psyllid species, *P. pusillum* and *P. eastopi* have long life cycle than *D. xuani* with 28.87 days (Aléné, 2007) [19], *E. clitoriae* with 33.7 days (Guedes Corrêa Gondim *et al.*, 2005) [22], *T. erytreae* with 36 days (Moran, 1968) [29] and *C. thysanura* with 40.50 days (Mensah and Madden, 1991) [25]. The duration of the life cycle of the two studied species of this survey is in the similar intervals with, *Euphaleurus ostreoides* and *Calophya rubra*, which complete their life cycle in 46 to 52 days and 48 to 68 days respectively (Alvarez-Zagoya and Cibrian-Tovar, 1999) [30].

Concerning the sex ratio, is in favour of females for *P. pusillum* either in the field or experimental site, young or old trees. This is I concordance with that observed to *E. clitoriae*, where the sex ratio is 0.5 (Guedes Corrêa Gondim *et al.*, 2005) [22] same to *C. spatulata*, eucalyptus psyllid, on an apple orchard, the females number exceeded the males number (Garcia *et al.*, 2014) [31]. The sex ratio of *P. eastopi* is in favour of males for young plants either in the field or nursery sites, but in favour of females for old trees.

The life span of *P. pusillum* male is shoter than females, same for *P. eastopi*, The life span of *P. pusillum* adults is shorter than the *P. eastopi* adults. The males of these two species live longer than those of *D. xuani* (Aléné, 2007) [19] and *D. harrisoni* (Osisanya, 1974) [18]. Only males of *P. eastopi* live longer than those of *D. eastopi* (Osisanya, 1974) [18] and *Ctenarytaina thysanura* (Mensah and Madden, 1993) [20]. Males of *D. eastopi* have a lifespan roughly similar to that of males of *P. pusillum*, which do not live as long as males of *C. thysanura*. Females of *P. pusillum* and *P. eastopi* have a life span shorter than those of *C. thysanura* (Mensah and Madden, 1993) [20], *D. xuani* (Aléné, 2007) [19] and *D. citri* (Tsai and Liu, 2000) [26]. Females of *P. pusillum* have a lifespan similar to that of *D. eastopi* females, but live longer than those of *D. harrisoni* (Osisanya, 1974) [18].

Conclusion

Pseudophacopteron pusillum and *P. eastopi* are multivoltine species, generations can succeed throughout the year on *D. edulis*, as long as the host plant bearing shoots. Both species share different sites of oviposition on the host plant. The average number of eggs laid per female of *P. pusillum* is higher than that of *P. eastopi* females. The duration of the life cycle of the two species is very closer. The life span of *P. pusillum* adults is shorter than the *P. eastopi* adults. Males of both species have a shorter lifespan than females. *P. eastopi* lives longer than *P. pusillum* and can even survive by feeding on old leaves, but not laying eggs. These two species, although they can complete their entire cycles on *D. edulis*, do not live exclusively on this plant in Cameroon. This study is very important to setting up an integrated control program against *D. edulis* psyllids in Cameroon.

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