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The Jumping Plant-Louse *Colophorina baphiosis* sp. nov. (Hemiptera: Psyllidae) Associated with *Baphiosis parvifolia* (Fabaceae) in Cameroon

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Abstract: Psyllids are sap-sucking insects commonly called Jumping plant lice. Many psyllid species of Cameroon remain not described. Recent field works carried out in some localities of Cameroon, permitted to collect a non described psyllid species *Colophorina baphiopsis* sp. nov. associated with *Baphiopsis parvifolia* a valuable timber tree. The aim of this survey was to describe and identify psyllid of *B. parvifolia* which is a contribution of the study of psyllid biodiversity of Cameroon fauna. The psyllid induces damages on the host plant, such as rolling and distortion of leaves and stunted growth of buds. The diagnostic characters of *Colophorina baphiopsis* are: the fifth instar immature with 1+1 pointed sectasetae on terminal abdominal margin; anus in terminal position, circumanal consisting of a single row of pores; additional pore fields developed, convulted, extending much onto abdominal dorsum and consisting of a single row of wax pores; adult genal processes short and broad with divergent relatively pointed apices; forewing pattern in which surface covered by large brown band with light white area; Female terminalia with triangular proctiger ending by rounded large apex, circumanal ring ovoidal with two rows of elongate pores, subgenital plate triangular with broad proximal part and the third apical part tapering with pointed apex. According to above discriminative characters and comparison with previously described species, *Colophorina baphiopsis*, can be considered as new afrotropical psyllid species in *Colophorina* genus.

Keywords: *Baphiopsis*, Cameroon, Phytophagous, Psyllid, Taxonomy

1. Introduction

Insects are the largest, diverse group of organisms in which a large portion is phytophagous. Psyllids or jumping plant lice (Hemiptera: psylloidea) are sap sucking insects that are typically monophagous or oligophagous. They are pest insects of forest plants and crops; all of them cause direct feeding damages and some transmit pathogens to their host plants. Psyllids are often associated with Dicotyledonous plants and related host taxa [1]. Higher psyllids taxa are typically associated with a single plant taxon [2, 3], but a few members develop on unrelated plants suggesting an evolutionary process that includes both co-speciation and host shift [4]. Presently almost 4000 psyllids species have been described from all biogeographic regions of the world. Most species are recorded from tropical and south temperate regions [5]. There are big gaps of knowledge on the afrotropical and neotropical fauna [6]. The number of non described psyllid species is estimated to be about 5000 species [7]. So far, psyllid species have been recorded in

Cameroon and few of them have been described. Previously in Cameroon, the published taxonomic works of psyllids were focused on Triozidae family with 18 described species [8-12]; Ciriacreminae sub-family with 14 described species [13]; Carsidaridae family with 6 described species [14]; Diclidophlebia genus with 6 described species [15, 16]; Pseudoeriopsylla genus with 3 described species [17]; Paurocephala genus with 2 described species [18]; Pseudophacopteron genus with 10 described species [19, 20]; Homotoma genus with 7 described species [21], Phytolyma and Euryconus genera with 1 described species each [22, 23]; Cacopsylla genus with 2 described species [24]. Many species remain unknown such as the psyllid of *B. parvifolia*. It belongs to the genus *Colophorina*, sub-family Macrocorsinae, family Psyllidae [25]. According to Burckhardt, D., & Mifsud, D.; Capener, A. L. [26, 27], the genus *Colophorina* is characterized by forewing with distinct black pattern, head and thorax with white and brown pattern. Clypeus is pyriform and labium short. Forewing with short pterostigma; somewhat convex, slightly more than twice as long as wide, without nodal break, veins strong, R_1 sinuate and curving upwards to sub-costal margin at tip, M vein strongly sinuate, M_{1+2} and M_{3+4} rather short. Hindwing with ungrouped costal setae. Metatibia without genual spine and four grouped apical spurs and a pair of similar spurs on first segment of tarsus. Male with unipartite proctiger, paramere about two thirds its height, aedeagus robust. Few number of *Colophorina* species have been described in the world, particular in Cameroon there is no previously described species in *Colophorina* genus. The main objective of this work is to describe and identify the psyllid of *B. parvifolia* from Cameroon. In Cameroon *B. parvifolia* is found mostly in the forest, and it is a multiple-used species. The wood is used locally for handles of implements and tools such as hoes, axes and saws. *Baphiopsis parvifolia* timber is among the carpentry timber which is used to make beds, windows, doors, tables and house roof.

2. Materials and Methods

Adult psyllids were captured with entomological sweep net of 0.5 mm mesh size and mouth aspirator. Instar immatures were sampled directly from buds and leaves of the host plant. The specimens were collected in some localities of Cameroon such as Kala mountain (latitude: 03°50'121''N, longitude: 11°26'004''E, altitude: 1122 m); Nkomilong mountain (latitude: 03°49'954''N, longitude: 11°20'504''E, altitude: 1161 m); Nkoemvon (latitude: 02°82'N, longitude: 11°14'E, altitude: 583 m); Bipindi (latitude: 03°06'N, longitude: 10°04'E, altitude: 79 m); Soa (latitude: 03°58'112''N, longitude: 11°35'435''E, altitude: 674 m). The specimens were collected on the field during the period of January 2006 to December 2007. The specimens were preserved dry and slide-mounted or in 70% ethanol and were deposited in Laboratory of Zoology, Higher Teacher's Training College, University of Yaounde I (LZUY), and Naturhistorisches Museum Basel, Switzerland (NHMB). The host plant was identified at National herbarium of Yaounde (NHY) and deposited in LZUY. The measurements of adults and fifth instar immatures were done with the use of a stereomicroscope having an ocular micrometer graduated from 0 to 10 micrometric units. Measurements done on the 5th instar immatures, were: body length (BL), body width (BW), antenna length AL), forewing-pad length (WL), metatibia length (TL). While for adults they were: body length (BL), body width (BW), head width (HW), antenna length (AL), first flagellomere length (F_1L), genal process length (GPL), forewing length (WL), forewing width (WW), hindwing length (wL), hindwing width (wW), metatibia length (MTL), metafemur length (MFL), male proctiger length (MPL), paramere length (PL), distal segment of aedeagus length (DAEL), female proctiger length (FPL), female subgenital plate length (FSPL). The 5th instar immatures and adults were preceding treated; for that they were maintained in a solution of sodium hydroxide (NaOH) at 100g/l for about 4 hours. This solution dissolved the internal organs and softened the chitinous cuticle. The different organs to describe in adults were dissected with the aid of two fine needles mounted on wooden handles. The mounting was done under the stereomicroscope mark LEICA L2. The dissected organs were mounted on an objective slide in polyvinyl drop and covered with an objective slide cover. The drawings (diagrams) were realized under a microscope equipped with a drawing tube mark LEICA DM. 1000. Morphological terminology follows Burckhardt, D., & Mifsud, D.; Capener, A. L.; Burckhardt, D., & Queiroz, D. L. [26-28].

3. Results and Discussion

3.1. Results

Fifth instar immature

Colouration: the overall body yellowish, the distal portion of abdomen yellow brown than the anterior part; abdominal sclerites with brown bands indicating the abdominal segmentation; intersegmental membranes yellowish; eyes reddish.

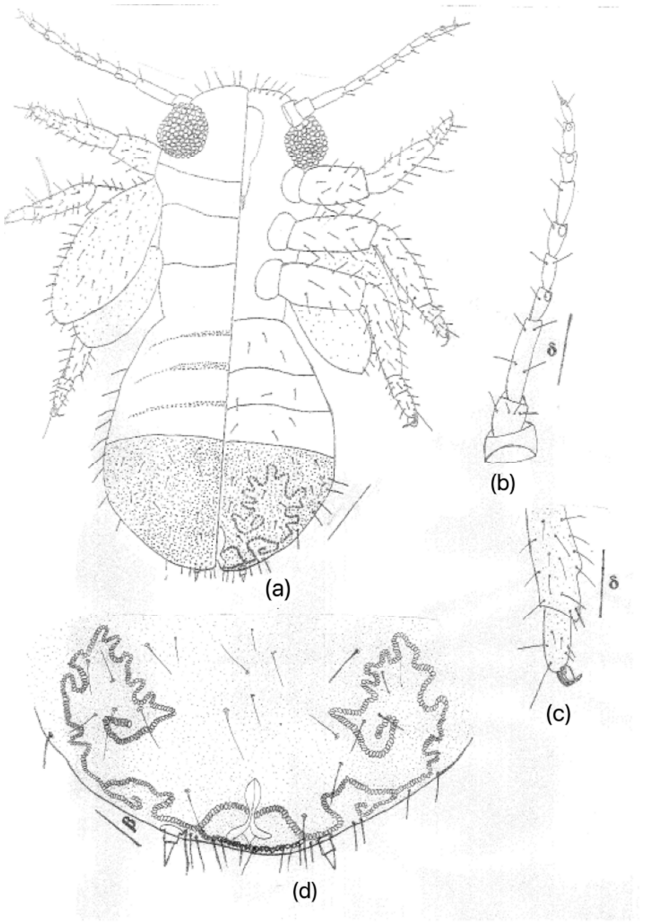
Structure: fifth instar immature dorsoventrally flattened "figure 1 (a)". Antenna relatively long with ten segments, flagellum with a single rhinarium on the flagellomere 2, 4, 6 and 7 "figure 1 (b)". Head bearing five pairs of simple setae. Each wing pad sparse of simple setae without sectasetae. Hind leg bearing simple setae with globular arolium "figure 1 (c)". Terminal abdominal margin with 1+1 pointed strong sectasetae and several simple setae. Anus oval in terminal position; circumanal ring irregular consisting of a single row of pores; additional pores fields developed, convulted, extending much onto abdominal dorsum and consisting of a single row of elongate wax pores "figure 1 (d)". Measurements found in "table 1".

Adults

Colouration: overall body dark-brown; thorax darker than abdomen; abdominal sclerites brown separated by yellowish

intersegmental membrane. Eyes dark with reddish spot, ocelli lighter whitish. Antenna yellowish, flagellomere 1-6 with bark tip and fagellomeres 9 and 10 completely dark. Forewing surface covered by large brown band with light white area on *c+sc*, r_1, r_2, cu_1 and cu_2 cells; the distal part of r_2 and m_1 cells carrying small light white areas, pteriostigma black. Hindwing yellowish with brown veins. Metatibia and metabasitarsus with black spurs.

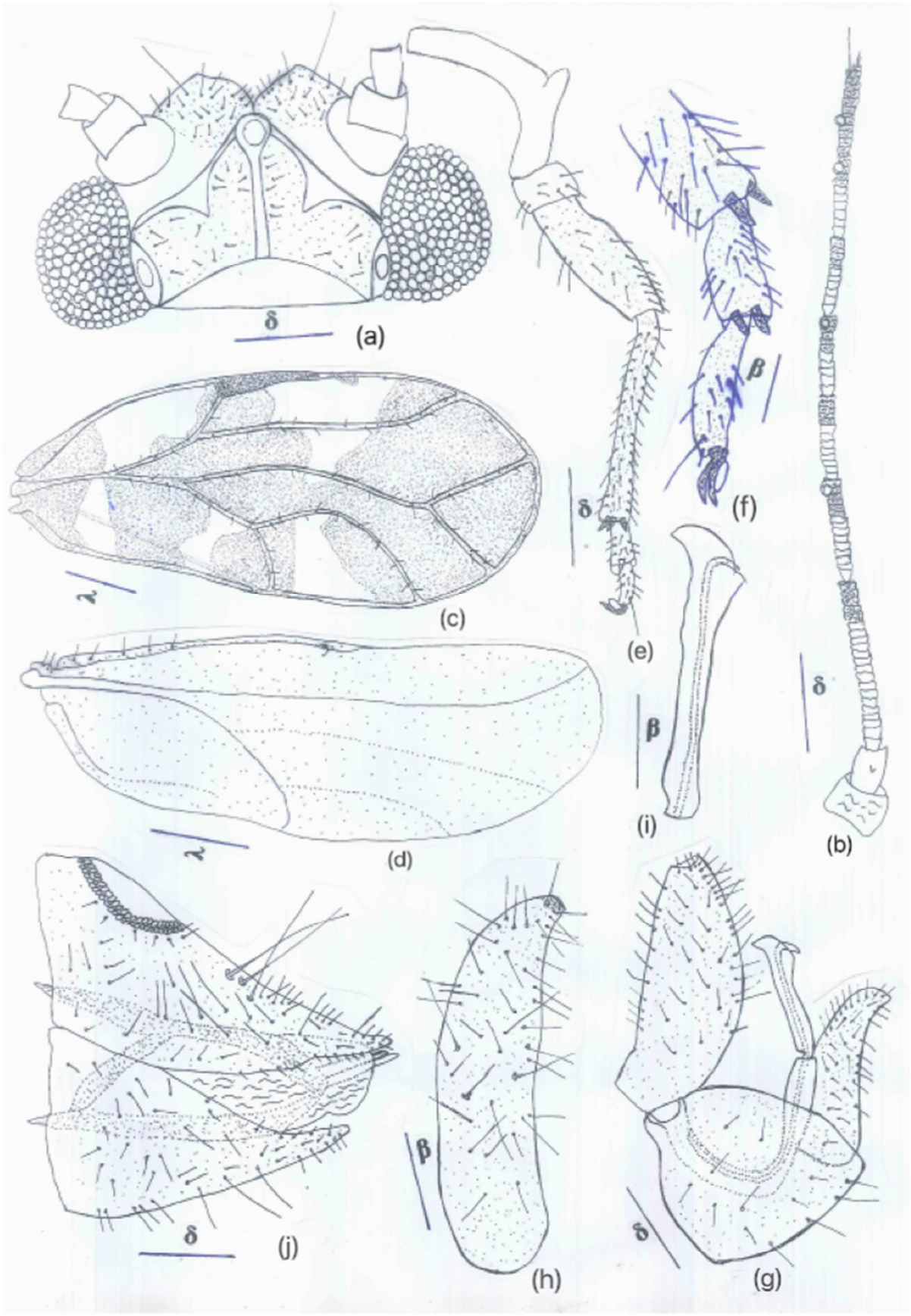
Structure: head strongly inclined from longitudinal body axis resulting in an arched dorsal outline of the thorax and wider than pronotum; vertex trapezoidal, 0.5 times as long as wide, covered by inconspicuous short setae; genal processes short and broad with divergent relatively pointed apices bearing a single long simple seta and short simple setae each "figure 2 (a)". Antenna relatively long 1.64-1.81 times as long as head width, first flagellomere the longest, single simple subapical rhinarium on antennal segments 4, 6, 8 and 9, terminal seta short and truncate while sub-terminal seta long and not truncate "figure 2 (b)". Prothorax the smallest thorax segment while mesothorax the biggest thorax segment. Forewing "figure 2 (c)" elongate rounded apically, 2.12-2.22 times as long as wide, 3.44-3.85 times as long as head width; pterostigma relatively long and triangular ending at the level of Rs vein midlength; dorsal surface of veins with short hairs; cu_1 cell 0.6 times higher than wide. Hindwing "figure 2 (d)" with 2 setae before the costal break and 5 evenly spaced setae after the costal break; vein R+M+Cu splitting into R and M+Cu, vein M+Cu splitting into M and Cu, vein Cu splitting into Cu_{1a} and Cu_{1b}. The hind leg with long coxa carrying short conical meracanthus; metatibia without conspicuous genual spine, metatibia 1.23-1.41 times as long as metafemur and 0.74-1.00 times as long as head width; metatibia with regularly spaced apical spurs arranged as 2+3 (2 internal face and 3 external face); metabasitarsus with 2 lateral sclerotised spurs; and hind leg ending by an oval arolium "figures 2 (e), (f)". Male terminalia "figure 2 (g)" proctiger unipartite, tubular sparsely covered of simple setae with bloated internal margin and straight dorsal margin; male proctiger 0.60 times as long as head width and 2.0 times as long as wide; male subgenital plate trapezoidal with inconspicuous simple setae. Paramere "figure 2 (h)" elongate, subapical external margin incurved inward, basal two third slightly broad and apical third slightly slender with rounded apex, paramere sparsely covered with simple setae. Distal segment of aedeagus relatively short and proximal segment 2 times longer than distal segment and 0.39 times as long as head width; distal segment of aedeagus strongly inflated apically; distal dilatation irregularly oval, sclerotised end tube of ductus ejaculatorius relatively long and thick "figure 2 (i)". Female terminalia "figure 2 (j)" relatively long, proctiger triangular with rounded large apex and bearing three long simple setae; circumanal ring ovoidal with two rows of elongate pores; circumanal 0.3 times as long as proctiger and proctiger 0.90 times as long as head width; subgenital plate triangular with broad proximal part and the third apical part tapering with pointed apex; female subgenital plate 0.70 times as long as female proctiger; ovipositor well developed; valvula lateralis bluntly rounded apically; valvula dorsalis and valvula ventralis straight. Measurements found in "table 2".



Figures 1. *Colophorina baphiopsis: (a), fifth instar immature, dorsal view (left), ventral view (right); (b), larval antenna; (c), metatarsal end with claws and arolium; (d), ventral view of fifth instar immature caudal plate. Scale bars: λ= 0.24 mm; δ = 0.12 mm; β = 0.06 mm.*

Table 1. *Measurements (in mm) of fifth instar immature of Colophorina babiopsis species of Cameroon (N= number of measured specimens).*

Parameters	N	min	max	mean
BL	30	2.94	3.52	3.16
BW	30	0.88	1.35	1.09
AL	30	1.11	1.41	1.31
WL	30	1.05	1.47	1.21
MTL	30	0.70	0.82	0.76
BL/BW	30	3.34	2.60	2.89



Figures 2. *Colophorina baphiopsis: (a), adult head dorsal view; (b) adult antenna; (c) adult forewing; (d), adult hindwing;. (e), (f), adult hind leg; (g), male terminalia in profile; (h), paramere in external face; (i), distal segment of aedeagus; (j), female terminalia in profile. Scale bars: λ= 0.24 mm; δ = 0.12 mm; β = 0.06 mm.*

Table 2. *Measurements (in mm) of males and females of Colophorina baphiopsis species of Cameroon (N= number of measured specimens).*

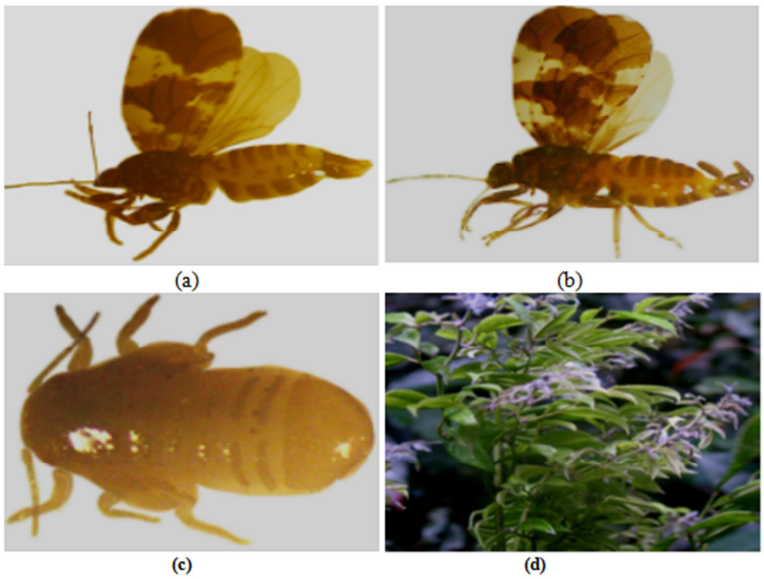
Parameters	Males				Females			
	N	min	max	mean	N	min	max	mean
BL	22	1.70	2.29	2.05	30	2.00	2.88	2.45
BW	22	0.58	0.88	0.70	30	0.64	0.94	0.77
HW	22	0.47	0.58	0.54	30	0.47	0.64	0.58
GPL	22	0.05	0.1	0.07	30	0.05	0.11	0.07
AL	22	1.00	1.05	1.02	30	0.76	1.05	0.94
F_1L	22	0.11	0.23	0.18	30	0.17	0.23	0.18
WL	22	1.70	2.00	1.82	30	1.88	2.47	2.16
WW	22	0.82	0.94	0.87	30	0.88	1.11	1.03
wL	22	1.17	1.52	1.37	30	1.47	1.94	1.72
wW	22	0.47	0.58	0.52	30	0.52	0.70	0.60
MTL	22	0.41	0.58	0.48	30	0.35	0.64	0.53
MFL	22	0.29	0.41	0.36	30	0.29	0.52	0.33
MPL	22	0.23	0.35	0.29	-	-	-	-
FPL	-	-	-	-	30	0.47	0.58	0.52
PL	22	0.11	0.17	0.16	-	-	-	-
DAEL	22	0.11	0.23	0.16	-	-	-	-
FSPL	-	-	-	-	30	0.29	0.41	0.37
BL/BW	22	2.93	2.60	2.92	30	3.12	3.06	3.18
WL/WW	22	2.07	2.12	2.09	30	2.13	2.22	2.09
WL/wL	22	1.45	1.31	1.32	30	1.27	1.27	1.25
wL/wW	22	2.48	2.62	2.63	30	2.82	2.77	2.86
MTL/HW	22	0.87	1.00	0.88	30	0.74	1.00	0.91
WL/HW	22	3.61	3.44	3.37	30	4.00	3.85	3.72
MPL/HW	22	0.48	0.60	0.53	-	-	-	-
AL/F_1L	22	9.09	4.56	5.66	30	4.47	4.56	5.22
PL/HW	22	0.23	0.29	0.29	-	-	-	-
DAEL/HW	22	0.23	0.39	0.29	-	-	-	-
FPL/HW	-	-	-	-	30	1.00	0.90	0.89
FSPL/HW	-	-	-	-	30	0.61	0.64	0.63

Etymology: species name refers to its host plant genus name *Baphiopsis*.

Host plant: *Baphiopsis parvifolia* (Fabaceae)

Material examined. Holotype ♂, *Cameroon:* mountain Kala, 1122 m altitude, 16 ii 2007, *Baphiopsis parvifolia* (W. Yana and J. L. Tamesse) (slide mounted).

Paratypes. *Cameroon:* Kala mountain: 4♂, 5♀, 3 larvae, 16 ii 2007 same data as holotype (LZUY, NHMB, 70% ethanol); 7♂, 7♀, 18 larvae, 25 i 2007; 1♂, 1♀, 3, 20 vii 2007; 2♂, 3♀, 5 larvae, 23 ii 2006; 5♂, 6♀, 5 larvae, 23 iii 2006; 1♂, 2♀, 1 larva, 27 iv 2006; 2♂, 5♀, 12 larvae, 27 xii 2006. Nkomilong mountain: 10♂, 10♀, 7 larvae, 29 i 2007; 2♂, 3♀, 15 larvae, 19 ii 2007; 1♂, 2♀, 1 larva, 29 xi 2007; 3♂, 3♀, 6 larvae, 25 ii 2006; 3♂, 4♀, 24 iii 2006; 2♂, 12♀, 4 larvae, 26 v 2006; 2♂, 3♀, 1 larva, 29 vii 2006. Soa: 2♂, 9♀, 14 larvae, 12 ii 2007. Bipindi: 5♂, 9♀, 3 larvae, 27 ii 2007. Nkoemvon: 3♂, 4♀, 27 i 2006; 22♂, 11♀, 6 larvae, 25 iv 2007.



Figures 3. *a) female of C. baphiopsis; b) male of C. baphiopsis; c) fifth instar immature of C. baphiopsis; d) host plant (Baphiopsis parvifolia).*

Biology and damage: the adults and immature stages of *Colophorina baphiopsis* "figures 3 (a), (b), (c)" are sucking sap of the host plant and this slow down its growing. Adults feed on both sides of young leaves and they are not more mobile as other psyllid species easily to be captured; when the rain is falling they are hidden under the leaves. In Cameroon the highest densities of adults and larvae were observed during the months of January and April. Sometime damages of the host plant are not perceptible but during the proliferation period of the pest there is rolling, distortion of leaves and stunting of buds. Larvae secrete waxy filaments and honeydew which attracting ants and inducing development of fungi "figure 3 (d)".

3.2. Discussion

Colophorina baphiopsis described in this work differs from *C. cassiae* described by Capener, A. L. [27] in South Africa in that the former lacks longitudinal stripes on mesoscutum while the latter has a pair of indistinct slightly darker longitudinal stripes on mesoscutum on each side of median line; genal process with a single long simple seta in *C. baphiopsis* while in *C. cassiae* genal process with several long simple setae; in the former the forewing veins are not sinuate but with short setae while in the latter forewing veins lack setae, Rs sinuate and curving upwards to subcostal margin at tip, M strongly sinuate, M_{1+2} and M_{3+4} rather short; in the former female genitalia with ventral valve distinctly longer than dorsal valve while in the latter ventral valve distinctly shorter than dorsal valve and sharply pointed apically; male proctiger of *C. baphiopsis* is elongate with truncate apex while in *C. cassiae* proctiger somewhat pear-shaped, rounded apically; the circumanal of *C. baphiopsis* fifth instar larva is composed of a convulted single pore ring without additional pore fields while in *C. cassiae* the circumanal of the fifth instar larva is convulted with additional pore fields.

Colophorina baphiopsis differs mostly from the four previous species described by Burckhardt, D., & Queiroz, D. L. [28] from Brazil in forewing pattern, type of genal process for adults and the morphology of the circumanal, distribution of abdominal sectasetae in the fifth instar larva. The genal processes of *Colophorina baphiopsis* are short and broad with divergent relatively pointed apices while in *C. bororo* of Brazil the genal processes are narrow, anteriorly deeply incised, forming two subequal tubercles; in *C. guarani* genal processes are relatively broad, anteriorly shallowly incised, forming a narrower and longer submedian and a broader and shorter lateral tubercle, respectively; in *C. tapuio* and *C. tupi* genal processes are broad, anteriorly deeply incised, forming a narrower submedian and a broader lateral tubercle, respectively. In *Colophorina baphiopsis* the forewing surface is covered by large brown band with light white area on *c+sc* cell, r_1 and r_2 cells, cu_1 cell and cu_2 two; the distal part of r_2 and m_1 cells carrying small light white areas while in *C. tupi* the forewing is coriaceous, dark brown to almost black with light irregular spots and transverse light band at base which is separated from rest of wing by dark brown oblique streak. In *C. tapuio* forewing is semitransparent; ground colour reddish brown with dark brown, partially confluent spots covering the entire membrane but slightly denser anteriorly and apically. In *C. guarani* forewing is coriaceous, almost opaque; ground colour dirty greyish to ochreous with dark brown base and patch distal to bifurcation of vein R+M+Cu, most of the remainder beset with dark, often confluent dots, particularly towards the apical wing margin; cell cu_2, apart from base, conspicuously lacking dark colour with a narrow transverse white band at base, otherwise mostly ochreous; basal part conspicuously different from remainder of wing. For *C. bororo*, forewing is coriaceous, almost opaque; dark brown or black with whitish spots slightly denser basally; basal part not conspicuously different from remainder of wing. In *Colophorina baphiopsis* the fifth instar larva is relatively long with ten segments; wing pad without sectasetae; circumanal irregular and composed of a convulted single pore ring consisting of elongate pores without additional pore fields; the distal margin of abdomen carrying 1+1 pointed strong sectasetae while in the four species described by Burckhardt, D., & Queiroz, D. L. [28], the antenna of fifth instar larva are composed of eight segments, marginal sectasetae of hindwing pads 0+0 or 1+1, abdomen 3+3 or 4+4, circumanal with additional pore fields present as 1+1 convoluted loops.

Colophorina baphiopsis differs from *C. flavivittata* described by Li, F. [6] in China also recorded in Korea [29] by the forewing pattern and structure of genal processes. Forewing surface covered by large brown band with light white area on *c+sc* cell, r_1 and r_2 cells, cu_1 cell and cu_2 two; the distal part of r_2 and m_1 cells carrying small light white areas for the former and forewing surface dirty with brown patches on the middle and distal parts for the latter. Forewing veins lack stripe in the former while in the latter forewing veins present white light and brown stripe. Genal processes are broad with divergent relatively pointed apices in the former while in the latter genal processes are well developed with truncate apices. Also forewing pattern of *C. baphiopsis* differs from *C. robinae* [6] in that only the distal part the forewing is covered by a black band and veins with white light and black stripe for the latter.

4. Conclusion

Colophorina baphiopsis sp. nov. described in this work is morphologically different from the other species described previously elsewhere. The morphological difference is based mostly on the forewing pattern, genal processes, female genitalia and the circumanal of the fifth instar larva. In Cameroon *C. baphiopsis* is the first described species of *Colophorina* genus and increases the number of afrotropical known species of the genus. Considering the economic importance of the host pant *B. parvifolia* (Fabaceae) it is necessary to put in place a strategy which will permits to protect the host plant against the pest insect identified in this

survey. This consists to find natural enemies (predators or parasitoids) of *C. baphiopsis* which can be used to control its population.

5. Recommendations

After the description and identification of *Colophorina baphiopsis* as new pest insect species associated to *Baphiopsis parvifolia*, the protection of the host plant is needed. Biological control should be the adequate strategy to control this pest though natural enemies such as predators and parasitoids.

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