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Trioza kala sp.n. (Hemiptera: Triozidae), a new species of psyllid associated with *Beilschmiedia obscura* (Fouilloy *et al.* 1974) (Lauraceae) from Cameroon

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Abstract
Trioza kala sp. nov. is described and illustrated from Cameroon. *Trioza kala* develops on *Beilschmiedia obscura* (Lauraceae), a valuable timber tree on which it causes serious damage by inducing leaf galls and necrosis. The main objective of this work is to describe and identify a new species of Trioza genus in Cameroonian fauna. The study was conducted in the Centre Region of Cameroon on Mount Kala from January 2006 to December 2007. *Trioza kala* is characterized by: the fifth instar larva abdomen composed of a submargin which bears truncate tubular sectasetae and distal margin without setae; in the adult, the first flagellomere is wide and elongated, bears a large number of rhinaria, the flagellomeres 3, 4, and 6 bear a single subapical rhinarium while the one on flagellomere 5 is medial; flagellomeres 2 and 7 bear two subapical rhinaria; veins of the forewings lack setae; hindwing has 3 setae before the costal break, 5 plus 2 setae and humalus after the costal break; internal margin of paramere is more incurved; distal portion of aedeagus presents a sinusoidal form. The new species is closely related to *Trioza hargreavesi* an Ugandian species described previously. The host plant and nymphs of *T. hargreavesi* were unknown. The differences between *T. kala* with other species were discussed in this study.

Keywords: Taxonomy, psyllid, pest, *Beilschmiedia obscura*, Cameroon

1. Introduction

Psyllids or jumping plant-lice are phloem feeding insects with a high degree of specificity towards their host plant [1]. They are usually associated with Dicotyledons [2] and related species often develop on related host taxa [3].

Psyllids of Triozidae family may be recognised easily, in the adult stage by unique venation and structure of the forewing. Forewing without a costal break; R_1 unbranched and pterostigma absent; M+Cu stem absent or very short so that R+M+Cu stem branches into its component veins at approximately one point; Rs not fused to M stem at any point. Fifth instar larvae of most species are also characterized as the head and body margins normally have a complete fringe of specialised wax-producing setae called sectasetae [4]. Genus *Trioza* is characterised by: median suture of vertex present basally. The forewing shape is mostly elongate ellipsoid and narrowing to a subangular apex, if with rounded apex then more than 2-3 times longer than wide; radular areas are present only in cells m_1, m_2 and cu_1; claval suture reaching hind margin of wing some distance from apex of Cu_{1b}. Basal tarsal segment of hind leg is without apical spurs. Male proctiger is unipartite [4].

In Cameroon few taxonomic works were carried out within psyllids of Triozidae family. The first taxonomic of triozids carried out are those of [4] which studied the afrotropical species of Triozidae family. The author described 68 species belonging to 4 genera: *Afrotrioza* (01 species); *Pauropsylla* (13 species); *Trichochermes* (01 species); and *Trioza* (53 species). Among the 68 afrotropical species, 14 species were recorded in Cameroon with 7 species to genus *Pauropsylla*, and 7 species to genus *Trioza*. [5] recorded 23 species of Triozidae family, 9 more species than the number recorded by [4]. Two years later [6] indicated that more than 23 species of Triozidae family exist within the Cameroon psyllids fauna. They recorded 35 species with 11 species belonging to *Pauropsylla* genus, and 24 species belonging to *Trioza* genus. Among the 35 species recorded, 13 species were recorded for the first time.

Dzokou *et al.* [7] described *Trioza messii* triozid associated with *Caloncoba welwitschii* Welwitsch (Flacourtiaceae). This paper is a contribution for the identification and description of cameroonian triozids.

2. Materials and Methods

The following abbreviations are used: LZUY= Laboratory of Zoology, University of Yaounde I; RMCA= Royal Museum of Central Africa; NHMB= Naturhistorisches Museum Basel, Switzerland; NHY= National Herbarium of Yaounde, Cameroon. The following abbreviations are used in the descriptions and measurement tables. Adult: BL, body length; BW, body width; HW, head width; AL, antenna length; F_1L, length of first antennal flagellomere; FCL, frontal cone length; WL, forewing length; WW, forewing width; wL, hindwing length; wW, hindwing width; MTL, metatibial length; MFL, metafemur length; MPL, male proctiger length; PL, paramere length; DAL, length of distal segment of aedeagus; FPL, female proctiger length; FSPL, female subgenital plate length. Fifth instar larva: BL, body length; BW, body width; AL, antenna length; WL, forewing-pad length; MTL, metatibial length.

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 on mount Kala (latitude: 03°50’121’’N, longitude: 11°26’004’’E, altitude: 1122 m) and Nkomilong (latitude: 03°49’954’’N, longitude: 11°20’504’’E, altitude: 1161 m), Mbankomo subdivision, in the Centre Region of Cameroon. The collection of specimens on the field was conducted during the period of January 2006 to December 2007 and the description and identification were done from 2015 to 2017. The specimens were preserved dry and slide-mounted or in 70 % ethanol and were deposited in LZUY, RMCA and NHMB. Morphological terminology follows [8, 9, 10]. The species was identified under stereomicroscope using Hollis [4]’s key for identification of afrotropical jumping plant lice of the family Triozidae. The host plants were identified in NHY. Drawings and measurements were made from slide-mounted material.

2.1 Statistical analysis

The SPSS statistical program 19.0 was used to analyse the morphometric parameters used in the species description.

3. Results

3.1 The fifth larval instar

Coloration: The overall body was dark brown, but the body margins were less dark brown, eyes have a reddish spot, the claws and spurs are dark.

Structure: The final larval instar (Plate 1) was flattened and slightly round, about 1.1 times longer than wide. It is not clearly divided into head, thorax and abdomen. The antenna was short and counts 10 segments; flagellum distinctly subdivided with a single subapical rhinarium on flagellomeres 1, 2, 3, and 4 (Plate 1). The legs bore few minute lanceolate setae while the margins of the body and wing pads were covered by truncate tubular sectasetae. The abdomen was composed of a submargin which bears truncate tubular sectasetae and a distal margin without setae. The posterior leg was elongated, and ended by a sessile and a globular tarsal arolium (Plate 1). The caudal region of the abdomen bore a circular circumanal with one ring of pores. The measurements and ratios are found in Table 1.

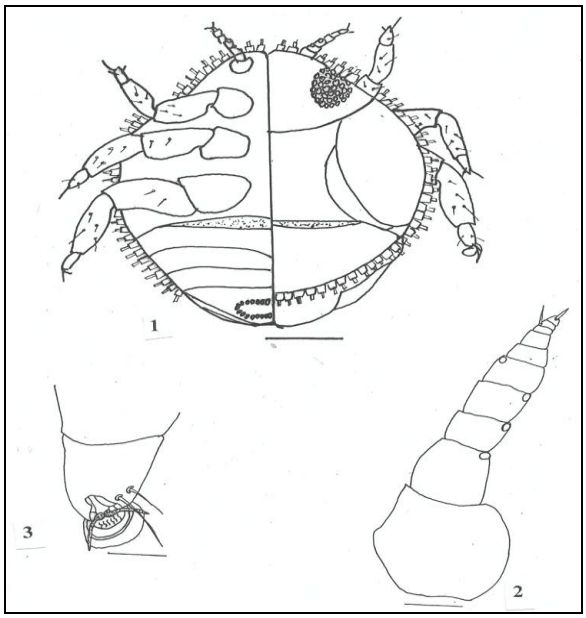

Plate 1: *Trioza kala*: 1, fifth larval instar, dorsal view (right), ventral view (left); 2, larval antenna; 3, tarsal apex with claws and arolium. Scale bars: 0.3 mm in 1; and 0.2 mm in 2, 3.

Table 1: Measurements (mm) of *Trioza kala* nymphs (N= number of measured specimens)

Parameters	N	Minimum	Maximum	Average
BL	6	1.91	2.03	1.97
BW	6	1.74	1.77	1.75
AL	6	0.34	0.34	0.34
TL	6	0.86	0.97	0.91
WL	6	1.08	1.20	1.14

3.2. Adult

Coloration: The overall body colour was brown but tergites of thorax were dark brown as well as sternites of abdomen. The male thorax and abdomen were darker brown than on the female. The eyes were translucent with a reddish spot inside. The forewings were slightly smoked while the hindwings were transparent. The spurs and claws were dark-brown.

Structure: The head (Plate 2) in profile view was almost at 90° to longitudinal axis of body; the occipital margin was round; the vertex was wider than longer with anterior margin deeply incised by median suture. The lateral ocelli were oval and placed posteriorly on vertex while the median ocellus was round and placed anteriorly on the vertex. Beside each lateral ocellus there was a tuft of lanceolate setae; the vertex bore a little number of setae. The genal cones were well developed but not elongated with rounded apices; the internal margin of the genal cones bears lanceolate setae. Antennal sockets enlarged; antennal flagellum in ♂ 1.27-1.83 in ♀ 1.30-2.19 times longer than the head width (Plate 2). The first flagellomere was wider and more elongated than the other flagellomeres; It bore a large number of rhinaria; the head was wider than the length of the first flagellomere in ♂ 2.28-3.71 in ♀ 2.48-2.78; a single rhinarium present subapically on flagellomeres 3, 4, 6; on flagellomere 5 the rhinarium was not subapical but median; two rhinaria were present subapically on flagellomeres 2 and 7; apical flagellomere with a long pointed seta subapically and a short truncate seta apically. The ultimate rostral segment bore nine setae (Plate 2). The thorax strongly arched; the pronotum was just visible from above, in profile view it was round down behind occiput. The mesopraescutum was about as wide as long, its anterior margin strongly arcuated in dorsal view; in profile view

strongly it was downcurved to pronotum. The forewing (Plate 2) hyaline, was elongated oval and a narrow subacute apex, it was in ♀ 2.1-2.6 in ♂ 2.1-2.9 times longer than wide. Costal break absent, pterostigma elongated with triangular form and longer than R_1 stem. M+Cu stem very short about 0.36 times as long as R stem and about 0.17 times as long as Cu stem; cu_1 cell wider than higher; radular spinules forming narrow stripes in cells m1, m2 and cu1; forewing 1.8 times longer than hindwing. The hindwing (Plate 2) with grouped costal setae: 3 setae before costal break, 5 setae plus 2 setae and hamelus after the costal break (3+5+2+1); hindwing 2.8 times longer than wide. Hind leg (Plate 3) long and slender; metacoxa was long with a short acute and pointed meracanthus; metatibia with a moderately developed 5 basal spines, apical spurs of hind tibia arranged as one outer and two inner spurs; arolium was globular; hind leg was covered with lanceolate setae. Male genitalia, as in (Plate 3), shown a subglobular subgenital plate with lanceolate setae. The proctiger was tubular weakly expanded along the posterior margin, the long lanceolate setae in apical half. Paramere (Plate 3), was irregularly narrowing from broad base to subacute apex the outer surface is curved in the subapical portion; apex strongly sclerotised; paramere was sparsed by long lanceolate setae. Aedeagus (Plate 3), two-segmented and the distal portion 1.5 times long than proximal portion; distal portion of aedeagus with sinusoidal internal margin and sclerotized short end tube. Female genitalia as in (Plate 3); in profile view was short, dorsal outline of proctiger beyond circumanal ring. Proctiger in half apical portion covered by long lanceolate setae; ventral outline of subgenital plate weakly curved, subgenital plate was moderately covered by a short setae subapically and long setae apically. Circumanal ring was elongated and slightly narrow on the middle portion, it consisted of a single row of pores on the dorsal line and two rows of pores on the ventral line. Dorsal and ventral valvulae were simple and covered by lateral valvula. Measurements and ratios are found in Table 2.

Host plant: *Beilschmiedia obscura* (Lauraceae).

Trioza kala caused a large gall formation on the leaves of *Beilschmiedia obscura*. The larvae were found inside the galls and produced white wax which indicated the presence of the pest on its host plant. Adults caused necrosis of leaves during highest proliferation of the pest. *Beilschmiedia obscura* is a plant species belonging in Lauraceae family with economic importance as its wood is used in manufacturing industries.

3.3 Material examined

Holotype ♂: Kala, 03°50’121”N, 11°21’004”E, 1122 m: 10 i 2009 (JL Tamesse) (RMCA),

Paratype: Kala, 03°50’121”N, 11°21’004”E, 1122 m: 10 i 2009; 20 ♂, 21♀, 8 larvae; Nkomilong, 03°49’954”E, 1161 m: 29 i 2007, 2♂, 3♀, 4 larvae; 19 ii 2007, 3♂, 2♀, 2 larvae.

Etymology: the species is named after the locality, Kala where it was collected for the first time.

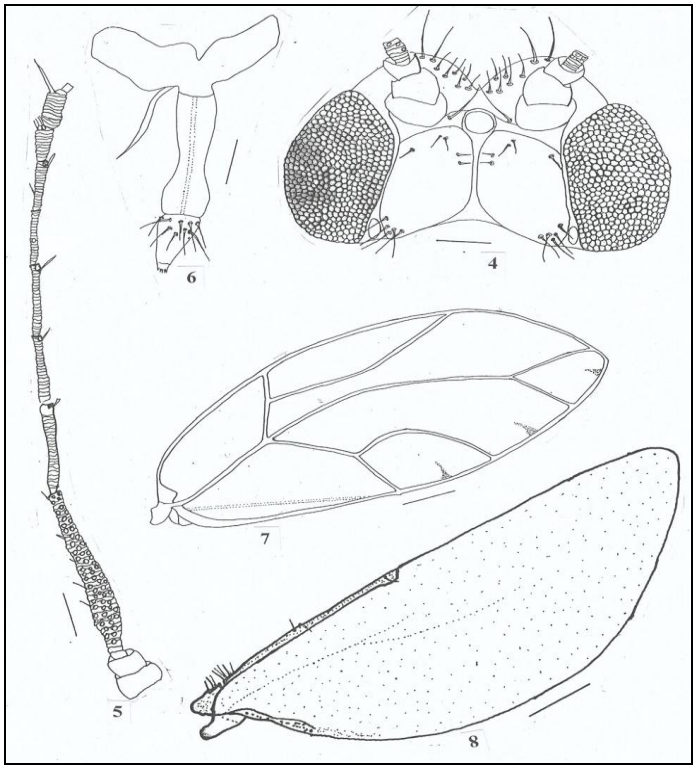

Plate 2: *Trioza kala*: 4, head in frontal face; 5, antenna; 6, rostral aspect; 7, forewing; 8, hindwing. Scale bars: 0.08 mm in 5; 0.05 mm in 4; 0.04 mm in 6; 0.3 mm in 8 and 0.2 mm in 7.

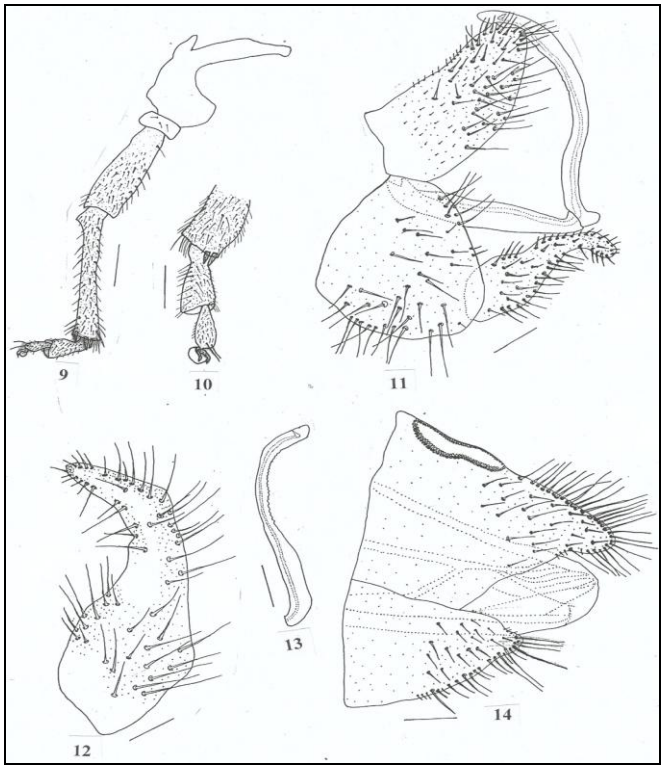

Plate 3: *Trioza kala*: 9, hind leg; 10, end part of hind leg; 11, male genitalia in profile; 12, paramere in lateral view; 13, distal portion of aedeagus; 14, female genitalia in profile. Scale bars: 0.06 mm in 10; 0.04 mm in 11, 13, 14; 0.02 mm in 12; and 0.1 mm in 9.

Table 2: Measurements (mm) and ratios of *Trioza kala* adults (N= number of measured specimens)

	Males				Females			
Parameters	**N**	**Min**	**Max**	**Average**	**N**	**Min**	**Max**	**Average**
BL	24	3.21	4.64	4.12	11	3.57	4.78	4.06
BW	24	1.07	1.43	1.17	11	1.00	1.50	1.21
HW	24	0.78	1.07	0.90	11	0.78	1.14	0.92
AL	24	1.21	1.71	1.48	11	1.36	1.57	1.46
F_1L	24	0.28	0.43	0.34	11	0.21	0.50	0.33
FCL	24	0.14	0.21	0.17	11	0.14	0.21	0.17
WL	24	5.21	6.28	5.68	11	5.07	6.42	5.68
WW	24	1.93	2.64	2.36	11	2.07	2.78	2.39
wL	24	2.71	3.64	3.17	11	2.86	3.71	3.11
wW	24	0.71	1.78	1.09	11	0.93	1.21	1.08
MTL	24	0.64	1.21	0.94	11	0.71	1.14	0.85
MFL	24	0.43	0.78	0.66	11	0.57	0.78	0.69
MPL	24	0.28	0.50	0.40	-	-	-	-
PL	24	0.28	0.43	0.31	-	-	-	-
FPL	-	-	-	-	11	0.28	0.64	0.44
FSPL	-	-	-	-	11	0.28	0.57	0.33
DAL	24	0.28	0.57	0.42	-	-	-	-
BL/HW	24	3.45	5.76	4.60	11	3.88	4.84	4.41
BL/BW	24	2.65	4.20	3.54	11	3.12	4.33	3.38
AL/HW	24	1.30	2.19	1.66	11	1.27	1.83	1.60
F1/HW	24	0.35	0.40	0.37	11	0.26	0.43	0.35
AL/F_1	24	3.48	5.60	4.42	11	3.14	7.14	4.54
WL/HW	24	5.27	7.51	6.35	11	5.20	6.83	6.18
WL/WW	24	2.14	2.92	2.41	11	2.11	2.61	2.38
WL/wL	24	1.92	1.72	1.79	11	1.77	1.73	1.82
MTL/HW	24	0.74	1.32	1.05	11	0.68	1.32	0.93
PL/HW	24	0.35	0.40	0.34	-	-	-	-
FPL/FSPL	-	-	-	-	11	1	1.1	1.3

4. Discussion

Trioza kala can be characterized by the fact that, the larvae induce large galls which resemble a « cocoon» in which they are found. The presence of white wax on the surface of these galls is an indicator sign of the presence of this pest on the host plant. Morphologically the nymphs bear a ring of truncate setae which is submarginal in the dorsal face of abdomen. Adult of *T. kala* has a first flagellomere similar to *Triozamia* spp. and *Trioza hargreavesi* [4] with several rhinaria. But *Triozamia* spp. bear a single subapical rhinarium on flagellomeres 4, 6 and 7; *T. hargreavesi* bears a single subapical rhinarium on flagellomeres 2, 4, 6 and 7 while *T. kala* bears a single subapical rhinarium on flagellomere 3, 4 and 6; the one on flagellomere 5 is median; flagellomeres 2 and 7 bear two subapical rhinaria. The ultimate rostral segment with at least four pairs of setae in species, *T. kala* and *T. hargreavesi* [4]. *Trioza kala* differs from *T. camerounensis* on the ultimate rostral segment with two pairs of setae instead of at least four pairs of setae [4]. The forewing is similar to *T. hargreavesi* except that the forewing veins in *T. kala* do not have short setae. Hindwing in *T. kala* bears 3 setae before the costal break, 5 plus 2 setae and humalus after the costal break while *T. hargreavesi* is bearing 0-2 setae before the costal break and setae after the costal break are divided into two groups. Hind tibia bears 5 moderately basal spines in *T. kala*, rather than 2-4 small spines in *T. hargreavesi* [4]. The paramere of the two species is very close but in *T. kala* the internal margin of paramere is more incurved than on *T. hargreavesi* [4]. The distal portion of aedeagus of the two species is very close but in *T. hargrevesi* the internal margin of the distal portion of aedeagus is not sinusoidal as *T. kala*. *Trioza kala* differs from *T. bamendae* [4] in paramere with cylindrical form, distal portion of aedeagus with incurved and pointed apex; the female genitalia is short, conoid, the anus bears a single ring of pores. *Trioza kala* differs from *T. perseae* [11] in hind coxa with a conical meracanthus, male proctiger has weak expanded lateral lobes. *Trioza kala* differs from *T. apicalis* [12] in distal portion of aedeagus apically widened and straight; the paramere has a small anterior lobe and a short dorsal projection. *Trioza kala* differs from *T. mica* [12] in distal portion of aedeagus apically hook-shaped, paramere with a large anterior lobe, the is forewing short and broad. *Trioza kala* differs from *T. stigma* [12] in distal portion of aedeagus apically gradually widened. *Trioza kala* differs from *T. centranthi* complex [13] on irregular triangular paramere and an apical dilatation of the distal portion of aedeagus. *Trioza kala* differs from *T. messii* [7] in frontal cones more developed, a first flagellomere without rhinarium.

5. Conclusion

Trioza kala and *T. hargreavesi* can be grouped together as sister species because they both share the extraordinary development of multiple supplementary rhinaria on the first antennal flagellum; an ultimate rostral segment with at least four pairs of setae. *T. kala* differs from *T. hargreavesi* in the absence of the setae on forewing veins, in the number of setae on costal margin of hindwing, in the number of basal spines on metatibia, and the sinusoidal form of the internal margin of the distal portion of aedeagus. The larva and host plant of *T. hargreavesi* being unknown, this limits comparative study between the two species.

6. Acknowledgements

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