

Research Article

Two News Species of Psyllids Genus *Syntomoza* (Hemiptera: Liviidae) Pest Insects Associated with *Flacourtia Indica* (Flacourtiaceae) in Cameroon

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Abstract

Background: Psyllids mainly through their larvae which suck sap from their host plants can be harmful by causing the transmission of diseases through their saliva. Objective: The aim of this study was to describe the news species of psyllids genus *Syntomoza* pest insects associated with *Flacourtia indica* (Flacourtiaceae). Methods: Psyllids specimens were collected using an entomological net and a mouth aspirator. The specimens were preserved in 70% ethanol, mounted on slides. Identifications, measurements and illustrations were made using a Microscope. Results: *Syntomoza biniae* sp. nov., have vertex sub-rectangular without foveae; male proctiger in profile, with lateral lobe large, broadly rounded in the middle, narrowed apically, obliquely truncate at apex; paramere with apical region narrow curved forward bearing two short black thick spine oriented inwards; inner face with a conspicuous fold anteriorly extending obliquely toward apex; distal segment of aedeagus almost curved in basal half, dorsal margin weakly sinuate; female subgenital plate in lateral view subtriangular, very enlarged at the base with distinct hump; dorsal and ventral valvulae slightly curved dorsally. Fifth instar larvae, with antennal segments with following numbers of pointed setae: 1(0), 2(0), 3(2), 4(0), 5(1), 6(0), 7(2); dorsum of caudal plate bearing scarcely arranged small sharp cuticular teeth; anus ventral, surrounded by only outer circumanal pore ring. *Syntomoza flacourtae* sp. nov., with male proctiger in profile medially with well-developed, broadly rounded posterior expansions, rather with two pits, one at base and other at apex, narrowed apically, apical margin rounded; paramere is rather with bulging posterior margin on one-third basally, anterior margin incurved, inner face covered with two row of eight stouter setae situated along anterior margin medially; circumanal ring oval to pear shaped. In fifth instar larvae: antenna segments 3 and 5 without numbers of pointed setae; forewing pad with a row of seven marginal long lanceolate; abdomen on all dorsum surface bearing lanceolate setae and additional like-scaly setae; anus terminal, without additional pore fields. Damage caused by *Syntomoza* spp. includes distortion and winding of the lateral edges of young leaves. Conclusion: Taxonomic studies indicated that, *Syntomoza biniae* sp. nov. and *Syntomoza flacourtae* sp. nov. are the news species of Liviidae family described from Adamawa Region of Cameroon.

Keywords

Syntomoza Biniae sp. nov., *Syntomoza Flacourtae* sp. nov., Psyllid Pest, *Flacourtia Indica*, Flacourtiaceae, Adamawa-Cameroon

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1. Introduction

Psyllids (Hemiptera: Psylloidea) are phloem-feeding insects, they are generally highly host specific on woody dicotyledonous plants and display their largest species diversity in the tropics [1, 2]. Most of the known psyllids species in the world are oligophagous being restricted to one or a few closely related hosts plants, particularly in their immature stages [3, 4]. Psyllids can be harmful to their plant hosts mainly through their larvae which take sap mainly from the flower buds causing the transmission of diseases through their saliva [5]. The intake of food leads to the alteration of photosynthetic activity, with consequent disturbed growth and the weakening of the plant which becomes sensitive to attacks by secondary organisms [6].

Syntomoza Crawford [7] genus belonging to the Liviinae (Paurocephalinae) subfamily and to Liviidae family [8]. The Liviidae family included Euphyllaurinae Crawford, 1914, Liviinae Löw, 1879 and Neophyllurinae subfam. nov. The Liviinae subfamily included six genera: *Aphorma* Hodkinson, *Camarotoscena* Haupt, *Diclidophlebia* Crawford, *Livia* Latreille, *Paurocephala* Crawford and *Syntomoza* Enderlein. Keys for the identification of adults and fifth instar larvae are provided by Burckhardt & Mifsud [9]. From Cameroon, some species belonging of Liviidae family have been described: *Diclidophlebia leptonychia* and *D. irvingiae* [10]; *D. eastopi xuani* [11]; *D. xuani* Messi et al. [12]; *D. andjigae* [13]; *Paurocephala sinuate* and *P. nkomekui* [14] and *P. famendon-goeis* [15].

Seven species belonging to *Syntomoza* genus have been described worldwide, one of them in Africa, *Syntomoza africana* collected on *Dovyalis abyssinica* (Flacourtiaceae) in Ethiopia, Kenya and Uganda [9]. The host plants of *Syntomoza* species belonging to the Flacourtiaceae family, except for *S. unicolor* which is associated with *Populus* spp. belonging to Salicaceae family.

The knowledge on the diversity of psyllids fauna and their distribution in Cameroon is still incomplete and it general poorly investigated. During surveys in the Adamawa region of Cameroon, two psyllids species of *Syntomoza* genus was collected on *Flacourtia indica* Willd. (Flacourtiaceae); this plant family is also quite represented in the Adamawa region of Cameroon. This paper report for the first time from Cameroon, on the description of the news species of psyllids genus *Syntomoza* (Hemiptera: Liviidae) pest insects associated with *Flacourtia indica* (Flacourtiaceae).

2. Materials and Methods

Type locality: University Campus of Ngaoundere, 7°25'09, 8''N; 13°32'42, 4''E; 1085 m. Type material: Holotype: ♂, University Campus of Ngaoundere, 28 June 2011. Paratype: Beka-Hossere: 2♂, 4♀, 7°20'19, 9''N; 13°33'31, 4''E; 1111 m, 10 July 2015. Bini: 16♂, 16♀, 1larva, 14-24 May 2011; 51♂, 42♀, 1larva, 2-11-23 June 2011; 19♂, 11♀, 12-21-30

July 2011; 1♀, 2 January 2012; 3♂, 5♀, 23 March 2012; 2♂, 3♀, 1 larva, 3 April 2012; 6♂, 8♀, 16-25 August 2012; 1♂, 1♀, 3 September 2012; 4♂, 7♀, 29 March 2013; 9♂, 4♀, 3larvae, 3 April 2013; 10♂, 7♀, 26 July 2015. University Campus of Ngaoundere: 26♂, 20♀, 21-31 May 2011; 32♂, 22♀, 9-28 June 2011; 21♂, 16♀, 7-24 July 2011; 48♂, 24♀, 4-13-20 August 2011; 6♂, 2♀, 14-23 August 2012; 3♀, 26 December 2012; 4 larvae, 14 September 2024. Dang: 15♂, 12♀, 1larva, 17-26 v 2011; 31♂, 41♀, 1larva, 4-14-25 vi 2011; 7♂, 7♀, 5 July 2011; 3♂, 4♀, 2-11 August 2011; 4♂, 5♀, 4larvae, 31 March 2012; 12♂, 20♀, 4larvae, 5 April 2012; 1♂, 2♀, 11-30 August 2012; 2 larvae, 30 March 2013; 8♂, 10♀, 1 larva, 4 April 2013, 7°24'42, 4''N; 13°32'42, 4''E; 1077 m.

Type series deposit: The type series of *Syntomoza* spp. (Figures 1a-d) were deposited in the collections of the Laboratory of Zoology, Higher Teachers' Training College, University of Yaounde I, Cameroon (LZUY).

Field survey: The observations and survey took place in various localities of the Adamawa Region, Cameroon, from May 2011 to September 2024. During each survey, host plants were inspected. Adults of psyllids were captured with a mouth aspirator. Nymphs were sampled directly from buds and leaves of the host plant. The host plant was identified at the National Herbarium in Yaounde (Cameroon) and is deposited in LZUY.

Observations and illustrations: The specimens are preserved dry and slide-mounted or in 70% ethanol and are deposited in Laboratory of Zoology, University of Yaounde I. The morphology was illustrated using transmission Leica microscope and measurements were made from slide-mounted using Leica stereomicroscope.

Terminologies: The terminologies used for the description follow the identification keys of Mifsud & Burckhardt [16] and Burckhardt & Mifsud [9].

Head: Vertex, median suture, genal cones, ocellus, compound eyes; Antenna: Rhinaria, flagellomere; Wing: costal break, pterostigma, vein, spinules, cells; Leg: metacoxa, meracanthus, metatibia, spurs, arolium; Male genitalia: proctiger, paramere, aedeagus, ductus ejaculatorius; Female genitalia: proctiger, subgenital plate, dorsal and ventral valvulae, circumanal ring.

3. Results

3.1. Description of *Syntomoza Biniae* sp. nov.

Adult Coloration: (Figures 1a and 1b), head and the thorax light brown; the rest of the body dark yellow; the last two segments of the antenna are dark. The compound eyes are dark red.

Structure: Head (Figure 2) less broad than body width, slightly less than body width 0.8-1.12 mm in males and 0.8-

1.0 mm in females. Head is curved perpendicularly with respect to the longitudinal axis of the body; the vertex is almost rectangular, flat, uniformly rounded forward and downward, it bears small dense simple setae in its middle on either side of the median suture; genal cones conspicuously separated from vertex, emerging in same plane without basal suture, very short and anteriorly broadly rounded, divergent apically outwards, obtusely rounded at apex; the anterior margin each bearing a long simple setae. The posterior ocelli at the extreme lateral base of vertex; anterior ocellus larger than posterior pair, visible in front; eyes moderately large, hemispherical and somewhat recessive.

Antenna (Figure 4) is longer than the width of the head; ten segmented, basal two segments robust, cylindrical, the third segment is the longest; fourth to eighth segments are subequal to each other, the two terminal segments equal in length but wider than the preceding, terminal segment with two almost equal long simple setae at apex, two small simple setae present near each rhinaria on segment 4, 6 and 9.

Thorax dorsally convex and curving forward into head, without pubescence, pronotum flat, viewed dorsally, longer in middle and narrowed laterally, convexly rounded.

Forewings (Figure 6) is membranous and covered with dense spinule surfaces occupying all the surfaces of the wing cells, long and broadest medially, 2.0-2.17 times as long as wide in males, 2.04-2.33 times as long as wide in females, narrowly rounded at apex, narrow at base; pterostigma very large and long, distinct with conspicuous setae on external margin; R vein and M+Cu₁ vein with equal length; R_s vein subparallel with M vein and straight, apex portion of R_s flexed downward near apex; M₁₊₂ and M₃₊₄ veins are also straight and oblique, M₁₊₂ vein longer than M₃₊₄ vein; cu₁ cell very large and longer than the pterostigma. All veins armed with a double row of small setae.

Hindwing (Figure 8) long and narrowed, slightly less long than forewing, 2.5-2.69 times as long as wide in males, 2.66-3.0 times as long as wide in females, narrowly rounded and upturned apically, the membrane beset numerous punctations, only R+M+Cu₁ vein conspicuous, costal margin armed with 2+7 ungrouped setae basally, two setae before costal break and seven other after costal break and 1 hooked seta apically (hamulus).

Legs (Figure 10) moderate size, coarsely pubescent, metacoxa with very developed meracanthus, laterally straight, horn shaped. Posterior tibia without basal spur, metatibia (Figure 11) enlarged at its apical end and bearing an open crown of 10 sclerotized black apical spurs and a group of 6 thick unsclerotized setae (small teeth) at the apex. Metabasitarsus without black spurs.

The male genitalia smaller than abdomen. Male proctiger (Figure 14) simple, broad and short; in profile parallel-margined, broad basally, anterior margin straight, lateral lobe large, broadly rounded in the middle, narrowed apically, obliquely truncate at apex bearing a row of long simple setae.

Male proctiger bears on apical two-thirds surface, dense moderately long setae. Proctiger measurements are 0.2-0.4 mm long, it is 0.33 times longer than head width.

Paramere (Figures 16-17) is almost lamellar, posterior margin slightly curved, broad at base, apical region narrow curved forward bearing two short black thick spine oriented inwards; inner face with a conspicuous fold anteriorly extending obliquely toward apex; mesal surface bears about twenty short and stout setae. Paramere on anterior margin bears a row of short simple scattered setae. Paramere on inner face (Figure 17), with a cluster of stout setae pointing outward in its basal half. Paramere measurements are 0.2-0.28 mm; it is 0.33 times longer than head width.

Aedeagus long, distal segment of aedeagus (Figure 20) almost curved in basal half, with dorsal margin weakly sinuate, without expansion basally, with a simple, ovate (spoon-like structure) apical dilation, ductus ejaculatorius relatively long and straight. Distal segment of aedeagus measurements are 0.2-0.28 mm long, it is 0.32 times longer than head width.

Female genitalia (Figure 22) conical shaped. Female proctiger (Figure 24) distinctly longer than subgenital plate in lateral view, dorsal margin descending, almost straight, weakly incurved distal to circumanal ring, apical portion narrow, less attenuate and rounded at apex; bearing two transverse rows of 4 long simple setae in its middle and a tuft of long simple setae not densified in its middle; bearing small very dense simple setae and some long simple setae on the posterior margin of apex. Female proctiger measurements are 0.68-1.0 mm; it is 0.97 times longer than head width and 1.68 times longer than the subgenital plate.

Subgenital plate (Figure 22) in lateral view subtriangular, very enlarged at the base with distinct hump, strongly narrowed at the apex, with posterior half bent upward and acutely pointed at apex, ventral margin straight upwards, with an acute apex, bearing a row of long simple setae on posterior half and dense setae on the apical surface. Circumanal ring elongated oval shape consisting of two rows of pores surrounded by small setae, the outer row circular and the inner one oblongate pores. Dorsal and ventral valvulae slightly curved dorsally, inner valve is shorter than the ventral one, ovipositor acutely pointed. Measurements and ratios are found in Table 1.

3.2. Fifth Instar Larvae of *Syntomoza Biniae* sp. nov.

Coloration: is generally yellow with tibia, tarsus and the tip of last antennal article light brown; the rest of the antenna and the legs are yellow. The compound eyes are dark yellow.

Structure: Body (Figure 26) broadly oval with rounded margins; 2.12-2.62 times longer than wide. Margin of head with five very long simple setae. Antenna (Figure 28) short 7-segmented, with rhinaria formula as 3577: each a subapical rhinarium present on segments 3 and 5, and two rhinaria on segment 7. Antennal segments with following numbers of

pointed setae: 1(0), 2(0), 3(2), 4(0), 5(1), 6(0), 7(2), seventh segment longest, not differentiated into segments, bearing two equal and slender terminal spines. The wing pads well developed, with humeral lobe projecting from the side of the body, reaching below the anterior margin of the eyes. Forewing pad (Figure 30) with a row of 21 marginal very long lanceolate setae; hindwing pad with four marginal long lanceolate setae; both wing pads bearing long lanceolate setae scarcely dorsally. Hindlegs bearing massive spurs on the apex of the metatibia. Tarsal arolium (Figure 32) short, fan-shaped with well-developed unguitractor, strongly longer than claws. Abdominal

margin with eight lanceolate setae and one pointed sectasetae on either side anterior to caudal plate. Caudal plate margin with several pointed sectasetae and lanceolate simple long setae on either side laterally, dorsum of caudal plate with strong micro sculpture consisting of scarcely arranged small sharp cuticular teeth (Figure 34). Anal opening (Figure 35) situated well inside from the apex of the body, outer circumanal pore ring consisting of a single row of elongated pores; extra pore fields forming continuous inner band, consisting of elongate patches. Fifth larval stage measurements are 1.63-1.81 mm long and 0.81 mm width. Measurements are found in Table 2.

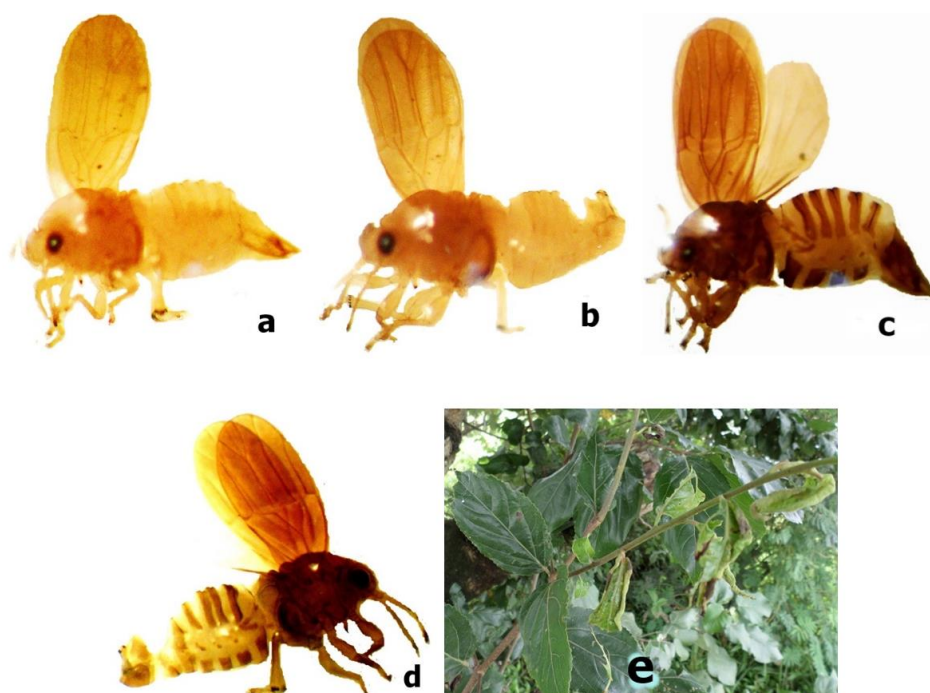


Figure 1. Species of *Syntomoza* spp. and host plant, a: female adult of *Syntomoza biniae* sp. nov. (x25), b: male adult of *Syntomoza biniae* sp. nov. (x25), c: female adult of *Syntomoza flacoutiae* sp. nov. (x25), d: male adult of *Syntomoza flacourtiae* sp. nov. (x25), e: *Flacourtia indica* (Flacourtiaceae).

3.3. Description of *Syntomoza Flacourtiae* sp. nov.

Adult Coloration: (Figures 1c and 1d) are dark brown; head and thorax dark brown; antennae yellowish with two apical segments dark brown; spaces between the dorsal and ventral sclerites and the rest of the antenna are yellow. Forewings subhyaline, brown, veins dark brown; hindwing hyaline, light brown, C+Sc, R+M+Cu₁, A₁ and A₂ veins entirely dark brown; compound eyes dark brown.

Structure: Head (Figure 3) less broad than body width, 0.77-0.83 as broad as body width in males and 0.71-0.72 as broad as body width in females. Head is inclined with respect to the longitudinal axis of the body; the vertex is almost rectangular, posterior margin with a depression in middle, flat, uniformly rounded forward and downward, it bears small

dense simple setae circumscribed in its middle on either side of the median suture; genal cones non separated from vertex, emerging in same plane without basal suture, short and anteriorly broadly rounded, divergent apically outwards, obtusely rounded at apex; the anterior margin without setae. The lateral ocelli at the extreme lateral base of vertex; median ocellus larger than lateral pair, visible in front; eyes prominent, hemispherical.

Antenna (Figure 5) 1.11-1.13 times as long as head width in males and 0.85-1.0 times as long as head width in females; slender, 10-segmented, basal two segments robust, cylindrical, segment 3 longest; fourth to eighth segments are subequal to each other, the two terminal segments equal in length but wider than the preceding, terminal segment with two subequal long simple setae at apex, two small simple setae present near each rhinaria on segment 4, 6, 8 and 9.

Thorax is convex dorsoventrally at the level of the

mesoscutum, metascutellum and metapostnotum bear kinds of tubercles.

Forewings (Figure 7) is membranous and covered with dense spinule surfaces occupying all the surfaces of the wing cells, and darker in the pterostigma and the wing cell cu_1a ; long and broadest medially, 2.2-2.5 times as long as wide in males, 2.18-2.4 times as long as wide in females, narrowly rounded at apex, narrow at base; pterostigma very large and long, distinct with conspicuous setae on external margin; R vein and $M+Cu_1$ vein with unequal length, R vein 1.33-1.5 times longer than $M+Cu_1$ in males, R vein 1.08-1.33 times longer than $M+Cu_1$ in females; R_s vein subparallel with M vein and straight, apex portion of R_s flexed downward near apex; M_{1+2} and M_{3+4} veins are also straight and oblique, M_{1+2} vein longer than M_{3+4} vein; cu_1 cell large and less longer than the pterostigma. All veins armed with a double row of small setae.

Hindwing (Figure 9) long and narrowed, slightly less long than forewing, 2.5-2.66 times as long as wide in males, 2.5 times average as long as wide in females, narrowly rounded and upturned apically, with a depression on posterior margin in one-third apically, the membrane beset numerous punctations, all veins conspicuous, costal margin armed with 2+6 ungrouped setae basally, two setae before costal break and six other after costal break and 1 hooked seta apically (hamulus).

Legs (Figure 12) moderate size, coarsely pubescent, metacoxa with robust meracanthus, laterally straight, horn shaped and directed upwards. Posterior tibia without basal spur, metatibia (Figure 13) enlarged at its apical end and bearing an open crown of 10 sclerotized black apical spurs and a group of 4 thick unsclerotized setae (small teeth) at the apex. Metabasisarsus without black spurs.

The male genitalia smaller than abdomen. Male proctiger (Figure 15) simple, broad and short; in profile parallel-margined, broad basally, anterior margin straight without setae, medially with well-developed, broadly rounded posterior expansions, narrowed apically, apical margin rounded bearing a row of longest simple setae. Male proctiger bears on apical two-thirds surface, dense moderately long setae. Male proctiger measurements are 0.32-0.40 mm long, it is 0.45 times longer than head width.

Paramere (Figures 18-19) is almost lamellar, in lateral view, with bulging posterior margin on one-third basally, anterior margin incurved, convex medially and gradually narrowing in apical third, with a row of long simple scattered setae, apical region narrow curved forward, well-sclerotised, bearing two short black thick spine oriented inwards; inner face (Figure 19) with a conspicuous fold anteriorly extending obliquely toward apex; inner face covered with scattered long simple setae pointing downward on half apically and scattered long simple setae pointing upward on half basally, two row of eight stouter setae situated along anterior margin medially. Paramere measurements are 0.24-0.32 mm; it is 0.37 times longer than head width.

Aedeagus long, distal segment of aedeagus (Figure 21) almost straight in basal half, with dorsal margin straight, without expansion basally, with a simple, subovate (broadly axe-shaped) apical dilation, ventral margin slightly curved, ductus ejaculatorius relatively long and sinuate. Distal segment of aedeagus measurements are 0.2-0.24 mm long, it is 0.26 times longer than head width.

Female genitalia (Figure 23) conical shaped. Female proctiger (Figure 25) distinctly longer than subgenital plate in lateral view, dorsal margin descending, almost straight, weakly incurved distal to circumanal ring, apical portion narrow, attenuate and rounded at apex; bearing two transverse rows of 4 long simple setae in its middle and a tuft of long simple scattered setae in its middle; bearing numerous small simple setae as well as a row of long simple setae on the posterior margin of apex. Female proctiger measurements are 0.68-0.8 mm; it is 0.88 times longer than head width and 1.59 times longer than the subgenital plate.

Subgenital plate (Figure 23) in lateral view subtriangular, very enlarged at the base with margin rounded, strongly narrowed at the apex, with posterior half bent upward and bluntly pointed at apex, ventral margin straight upwards, with a blunt apex, bearing a row of long simple setae on posterior half and dense setae on the apical surface.

Circumanal ring oval to pear shaped with two contiguous rows of pores surrounded by small setae, the outer row circular and the inner one oblongate pores. Dorsal and ventral valvulae almost straight dorsally, inner valve is shorter than the ventral one, ovipositor acutely pointed. Measurements and ratios are found in Table 1.

3.4. Description of Fifth Instar Larvae of *Syntomoza Flacourtiae* sp. nov.

Coloration: is generally light brown with the caudal plate and the last two antennal articles dark brown; the rest of the antenna and the legs are yellow. The compound eyes are dark yellow.

Structure: Body (Figure 27) elongated with rounded margins; 2.58-2.62 times longer than wide. Anterior margin of head bearing five long simple setae. Antenna (Figure 29) short 7-segmented, with rhinaria formula as 3577: each a subapical rhinarium present on segments 3 and 5, and two rhinaria on segment 7. Antennal segments with following numbers of pointed setae: 1(0), 2(0), 3(0), 4(0), 5(0), 6(0), 7(6), seventh segment longest, not differentiated into segments, bearing two unequal and slender terminal spines. The wing pads well developed, without humeral lobe. Forewing pad (Figure 31) with a row of seven marginal long lanceolate setae; hindwing pad with three marginal long lanceolate setae; only forewing pad bearing two long lanceolate setae dorsally.

Hindlegs bearing massive spurs on the apex of the metatibia. Tarsal arolium (Figure 33) relatively large, fan-shaped apically with well-developed unguitractor, strongly longer than

claws. Abdominal margin with seven lanceolate setae on either side anterior to caudal plate. Caudal plate margin with several pointed sectasetae, lanceolate simple long setae and like-scaly setae on either side laterally, dorsum of caudal plate and abdomen with several rows of strong micro sculpture consisting of density arranged small sharp cuticular teeth (like-scaly setae) (Figure 36). Anal opening (Figure 37) terminal, outer circumanal pore ring consisting of a single row of elongated pores; absence of additional pore fields. Fifth larval stage measurements are 2.09-2.36 mm long and 0.81-0.90 mm width. Measurements are found in Table 2.

Etymology: *Syntomoza biniae* sp. nov., derived from Bini, the name of the locality in which this species of psyllids has been the most collected; *Syntomoza flacourtiae* sp. nov., derived from the genus name of the host plant *Flacourtia*, collected in the Adamawa region of Cameroon.

Host plant: *Flacourtia indica* named “Governor plum” in English, has some uses according to Bonnet *et al.*, [17]: food with the pulp of edible ripe fruits; agricultural with the twigs used for fences; in traditional pharmacopoeia with the roots used against anaemia, childhood gastritis and dermatosis, with the leaves as purgatives and cholagogues; the twigs are used against colic and diarrhoea [18, 19].

Distribution: The plant is distributed in the forest galleries and rocky hills of the Sudano-Guinean and Guinean savannas from Senegal to Cameroon, up to the Central African Republic and Angola.

Biology: The damage caused by *Syntomoza* spp. on *Flacourtia indica* (Figure 1e) is the distortion and the winding of the lateral edges of the young leaves. The larvae as well as the adults live and feed on the underside of the young leaves.

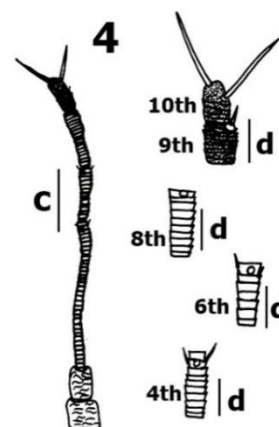


Figure 4. Antenna of *S. biniae*.

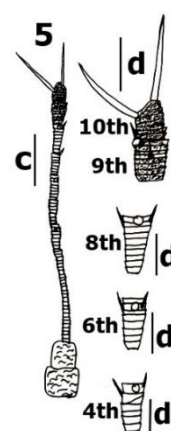


Figure 5. Antenna of *S. flacourtiae*.

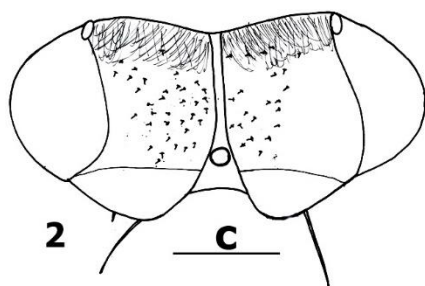


Figure 2. Head of *S. biniae*.

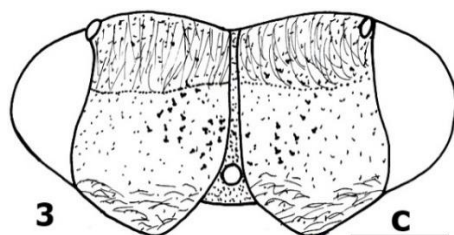


Figure 3. Head of *S. flacourtiae*.

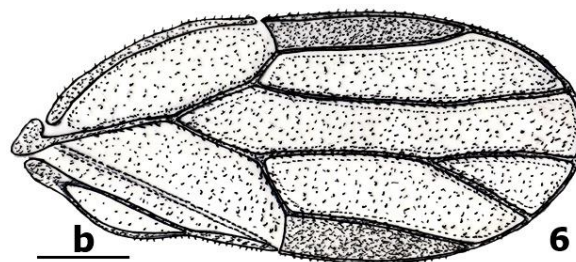


Figure 6. Forewing of *S. biniae*.

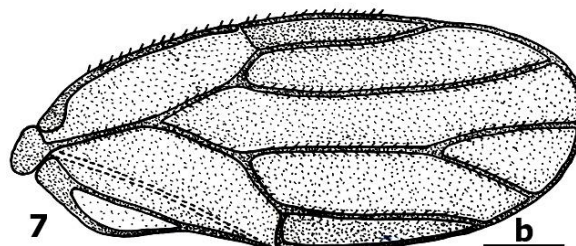


Figure 7. Forewing of *S. flacourtiae*.

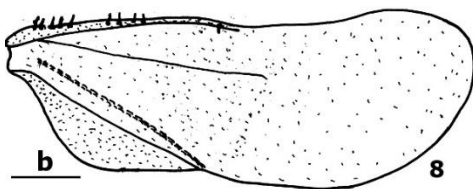


Figure 8. Hindwing of *S. biniae*.

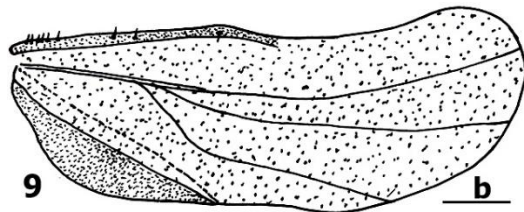


Figure 9. Hindwing of *S. flacourtiae*.

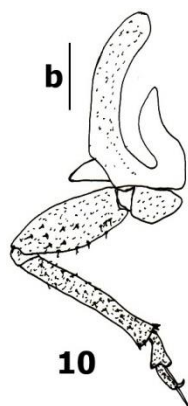


Figure 10. Metathoracic leg of *S. biniae*.

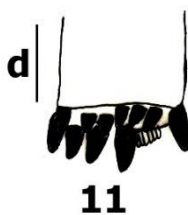


Figure 11. metatibial apical end of *S. biniae*.

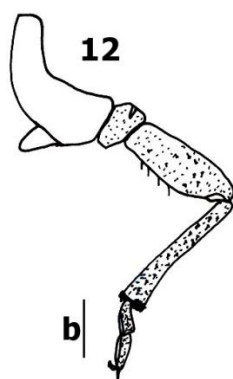


Figure 12. Metathoracic leg of *S. flacourtiae*.

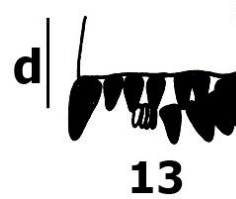


Figure 13. metatibial apical end of *S. flacourtiae*.



Figure 14. Male proctiger of *S. biniae*.

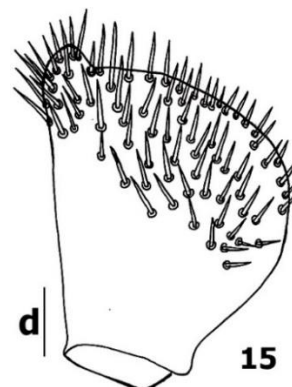


Figure 15. Male proctiger of *S. flacourtiae*.

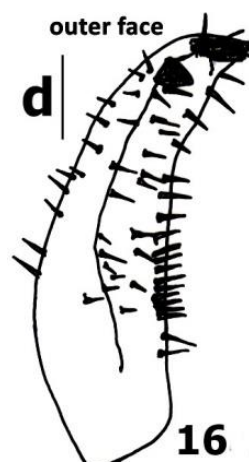


Figure 16. Paramere outer face of *S. biniae*.



Figure 17. Paramere inner face of *S. biniae*.

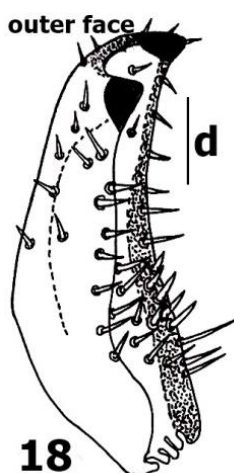


Figure 18. Paramere outer face of *S. flacourtiae*.

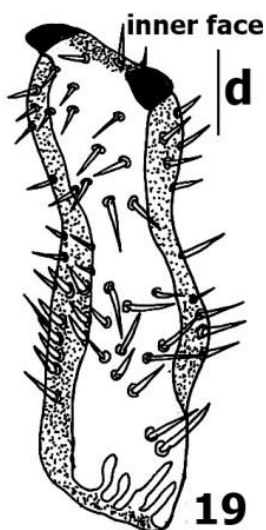


Figure 19. Paramere inner face of *S. flacourtiae*.



Figure 20. Aedeagus of *S. biniae*.

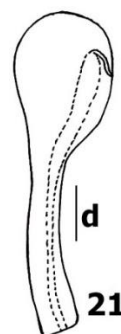


Figure 21. Aedeagus of *S. flacourtiae*.

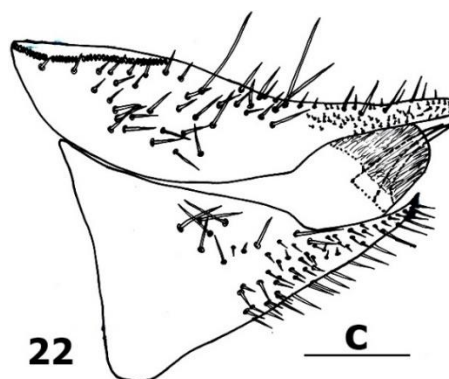


Figure 22. Female genitalia of *S. biniae*.

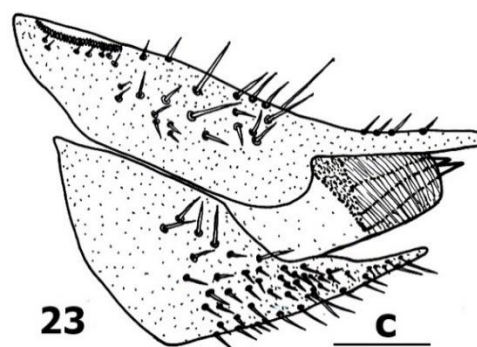


Figure 23. Female genitalia of *S. flacourtiae*.

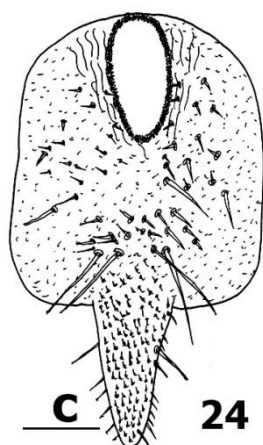


Figure 24. Female proctiger of *S. biniae*.

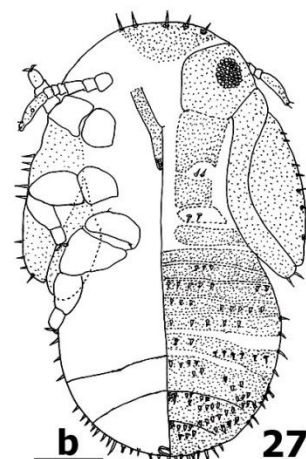
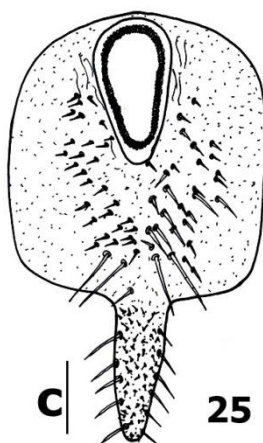


Figure 27. Fifth larval stage, left dorsal view and right ventral view of *S. flacourtiae*.



Scales: a: 2 mm; b: 0.8 mm; c: 0.4 mm; d: 0.2 mm.

Figure 25. Female proctiger of *S. flacourtiae*.

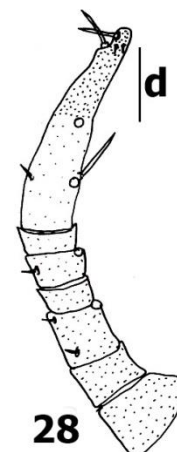


Figure 28. Antenna of *S. biniae*.

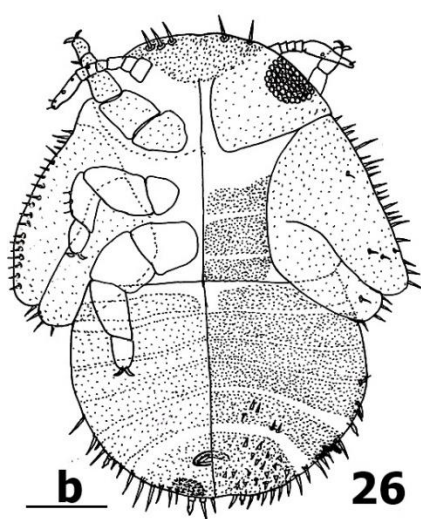


Figure 26. Fifth larval stage, left dorsal view and right ventral view of *S. biniae*.



Figure 29. Antenna of *S. flacourtiae*.

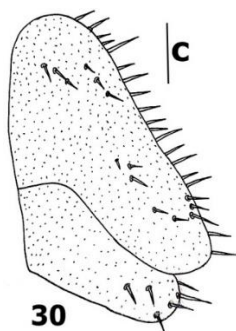


Figure 30. Forewing pad of *S. biniae*.

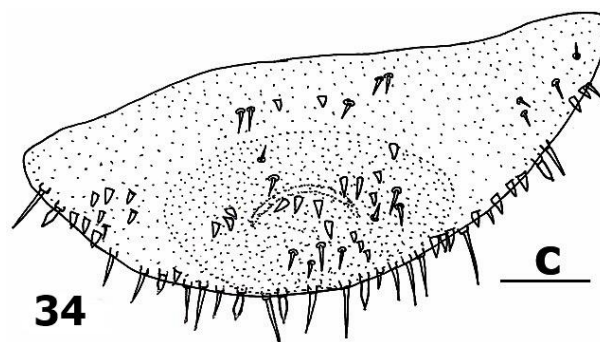


Figure 34. Caudal plate in dorsal view of *S. biniae*.

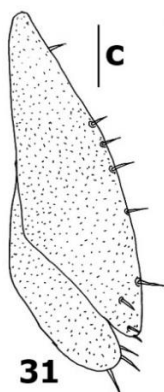


Figure 31. Forewing pad of *S. flacourtae*.

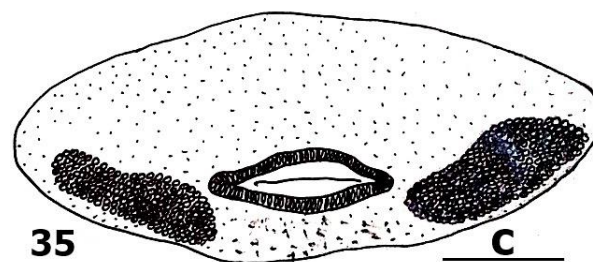


Figure 35. Caudal plate in ventral view of *S. biniae*.

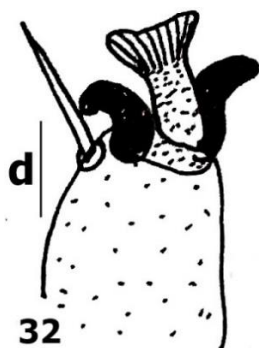


Figure 32. Tarsal arolium of *S. biniae*.

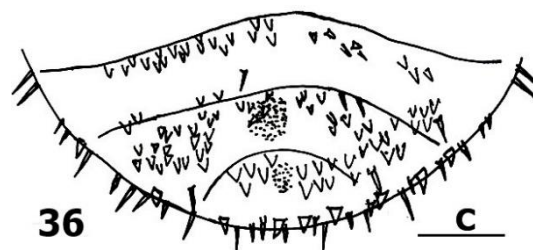


Figure 36. Caudal plate in dorsal view of *S. flacourtae*.

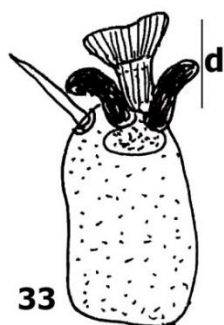
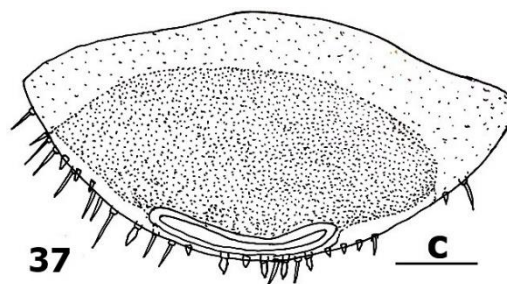


Figure 33. Tarsal arolium of *S. flacourtae*.



Scales: b: 0.8 mm; c: 0.4; d: 0.2 mm.

Figure 37. Caudal plate in ventral view of *S. flacourtae*.

Table 1. Measurements (mm) and ratios of *Syntomoza* spp. adults species (N= number of measured specimens).

Parameters	<i>Syntomoza biniae</i> sp. nov. Males				<i>Syntomoza biniae</i> sp. nov. Females				<i>Syntomoza flacourtiae</i> sp. nov. Males				<i>Syntomoza flacourtiae</i> sp. nov. Females			
	N	Min	Max	Average	N	Min	Max	Average	N	Min	Max	Average	N	Min	Max	Average
BL	40	2.0	3.0	2.34	40	2.0	3.0	2.7	40	2.4	3.0	2.8	40	2.8	3.8	3.35
BW	40	0.80	1.12	0.90	40	0.92	1.2	1.03	40	0.88	1.2	1.04	40	1.12	1.28	1.18
HW	40	0.72	0.88	0.77	40	0.8	1.0	0.86	40	0.68	1.0	0.8	40	0.8	0.92	0.85
AL	40	0.68	1.0	0.83	40	0.68	1.0	0.86	40	1.0	1.12	1.07	40	1.0	1.12	1.08
F ₁ L	40	0.2	0.24	0.22	40	0.2	0.24	0.22	40	0.2	0.2	0.2	40	0.2	0.24	0.22
WL	40	1.6	2.0	1.82	40	1.8	2.8	2.25	40	2.2	2.2	2.2	40	2.4	2.8	2.6
WW	40	0.8	0.92	0.84	40	0.88	1.2	1.04	40	0.88	1.0	0.96	40	1.0	1.28	1.17
wL	40	1.4	2.0	1.60	40	1.6	2.4	1.92	40	1.6	2.0	1.8	40	2.0	2.2	2.18
wW	40	0.52	0.8	0.60	40	0.6	0.8	0.71	40	0.6	0.8	0.69	40	0.8	0.88	0.82
MTL	40	0.4	0.6	0.53	40	0.4	0.68	0.59	40	0.48	0.6	0.54	40	0.52	0.6	0.59
MFL	40	0.36	0.48	0.40	40	0.4	0.52	0.42	40	0.4	0.52	0.48	40	0.4	0.6	0.49
MPL	40	0.2	0.4	0.26	/	/	/	/	40	0.32	0.40	0.36	/	/	/	/
PL	40	0.2	0.28	0.20	/	/	/	/	40	0.24	0.32	0.30	/	/	/	/
FPL	/	/	/	/	40	0.68	1.0	0.79	/	/	/	/	40	0.68	0.8	0.75
PSPL	/	/	/	/	40	0.4	0.6	0.47	/	/	/	/	40	0.4	0.6	0.47
DAL	40	0.2	0.28	0.25	/	/	/	/	40	0.2	0.24	0.21	/	/	/	/
BL/HW	40	2.78	3.40	3.03	40	2.5	3.0	3.13	40	3.52	3.0	3.5	40	3.5	4.13	3.94
BL/BW	40	2.5	2.67	3.78	40	2.17	2.5	2.62	40	2.72	2.5	2.69	40	2.5	2.96	2.83
AL/HW	40	1.11	1.13	1.07	40	0.85	1.0	1.0	40	1.47	1.12	1.33	40	1.25	1.21	1.27
F ₁ /HW	40	0.28	0.27	0.28	40	0.25	0.24	0.25	40	0.29	0.20	0.25	40	0.25	0.26	0.25
AL/F ₁	40	4.0	4.16	3.77	40	3.4	4.16	3.90	40	5.0	5.6	5.35	40	5.0	4.66	4.90
WL/HW	40	2.22	2.27	2.36	40	2.25	2.8	2.61	40	3.23	2.2	2.75	40	3.0	3.04	3.05
WL/WW	40	2.0	2.17	2.16	40	2.04	2.33	2.16	40	2.5	2.2	2.29	40	2.4	2.18	2.22
WL/wL	40	1.14	1.00	1.13	40	1.12	1.16	1.17	40	1.37	1.1	1.22	40	1.2	1.27	1.19
MTL/HW	40	0.55	0.68	0.68	40	0.55	0.68	0.68	40	0.70	0.60	0.67	40	0.65	0.65	0.69
PL/HW	40	0.27	0.45	0.33	/	/	/	/	40	0.47	0.40	0.45	/	/	/	/
FPL/FSPL	/	/	/	/	40	1.7	1.66	1.68	/	/	/	/	40	1.7	1.33	1.59
LR	40	0.6	0.8	0.60	40	0.6	0.8	0.74	40	0.6	0.8	0.67	40	0.8	1.0	0.86
LM+Cu ₁	40	0.6	0.8	0.60	40	0.6	0.8	0.74	40	0.4	0.6	0.51	40	0.6	0.92	0.71
LM ₁₊₂	40	0.8	1.0	0.86	40	1.0	1.4	1.21	40	1.0	1.2	1.03	40	1.0	1.4	1.18
LM ₃₊₄	40	0.6	0.8	0.66	40	0.8	1.2	0.93	40	0.8	0.8	0.8	40	0.8	1.2	0.94
LPt	40	1.2	1.6	1.25	40	1.2	2.0	1.8	40	1.2	1.6	1.36	40	1.2	2.0	1.63
m ₁	40	0.4	0.6	0.44	40	0.4	0.6	0.44	40	0.6	0.8	0.65	40	0.8	0.88	0.80

Adult legend: BL, body length; BW, body width; HW, head width; AL, antenna length; F₁L, length of first antennal flagellomere; 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; LR, R vein length of forewing; LM₁₊₂, M₁₊₂ vein length of forewing; LM₃₊₄, M₃₊₄ vein length of forewing; LPt, pterostigma length; m₁, m₁ cell length of forewing.

Table 2. Measurements (mm) and ratio of *Syntomoza* spp. fifth instar larva (N= number of measured specimens).

Parameters	<i>Syntomoza biniae</i> sp. nov.				<i>Syntomoza flacourtiae</i> sp. nov.			
	N	Minimum	Maximum	Average	N	Minimum	Maximum	Average
BL	05	1.63	1.81	1.70	04	2.09	2.36	2.22
BW	05	0.81	0.81	0.81	04	0.81	0.90	0.86
AL	05	0.4	0.45	0.42	04	0.58	0.63	0.62
MTL	05	0.67	0.69	0.68	04	0.72	0.72	0.72
WL	05	0.11	0.11	0.11	04	0.11	0.14	0.13
BL/BW	05	2.12	2.62	2.40	04	2.58	2.62	2.58

Fifth instar larva legend: BL, body length; BW, body width; AL, antenna length; WL, forewing-pad length; MTL, metatibial length.

4. Discussion

Syntomoza biniae sp. nov. differs from others *Syntomoza* species in the general colour and wing pattern. In *S. magna* [20], membrane of forewings pale yellowish brown to dirty yellowish brown, scattered with numerous irregular dark brown spots, and sometimes dark patches; body colouring in general dirty yellowish brown to ochreous, scattered with numerous dark brown to black spots and several dark patches on head and thorax. In *Anomoterga tatuata* / *Syntomoza tatuata* [21, 22], general colour dark brown to black with lighter brown markings and stripes on the thorax and abdomen. In *S. unicolor* [23], dorsal surface of head and body evenly brown, ventral surface ochreous; wings transparent, whitish, veins light ochreous.

Head in *Syntomoza biniae* sp. nov., with width 0.8-1.12 mm in males and 0.8-1.0 mm in females, vertex sub-rectangular without foveae. It differs from *Anomoterga tatuata* [21] and *Syntomoza tatuata* [22] with width of head, less broad, 0.6-0.7 mm, vertex with two foveae on each side of the median suture and situated toward the upper part. It also differs from *S. unicolor* [23] with width of head, less broad, 0.59-0.67 mm, vertex with fine microsculpture.

Antenna in *Syntomoza biniae* sp. nov., longer than the width of the head; basal two segments robust, cylindrical, the third segment is the longest, terminal segment with two almost equal long simple setae at apex, two small simple setae present near each rhinaria on segment 4, 6 and 9. It differs from *S.*

magna [20] with antenna shorter than width of head and it also differs from *A. tahuata* [21] with first and second antennal segments small and slender. It is close to *S. unicolor* [23] with antenna bears a pair of short setae on segments 4, 6 and 9, with subequal terminal setae, both longer than segment 10.

Forewing in *Syntomoza biniae* sp. nov. membranous and covered with dense spinule surfaces occupying all the surfaces of the wing cells, long and broadest medially; R_s vein subparallel with M vein and straight, apex portion of R_s flexed downward near apex; cu₁ cell very large and longer than the pterostigma. It is close to *S. africana* [9] and *S. unicolor* [23] in forewings shape, however, surface spinules cover just the half posterior in C+Sc cell in *S. africana* [9]. It differs from *S. magna* [20], with forewing somewhat parallelogram shaped, broad, cell m₂ apparently smaller than cu₁.

Hindwing in *Syntomoza biniae* sp. nov. long and narrowed, narrowly rounded and upturned apically, the membrane beset numerous punctations, only R+M+Cu₁ vein conspicuous, costal margin armed with 2+7 ungrouped setae basally, two setae before costal break and seven other after costal break and 1 hooked seta apically (hamulus). It differs from *A. tatuata* [21], with the obscure venation developed in the form of fine ridges along which the punctations are arranged in more or less definite single, double, and irregular rows. It also differs from *S. magna* [20] with all vein conspicuous, costal margin armed with 3+3 ungrouped setae basally, membrane subopaque.

Metacoxa in *Syntomoza biniae* sp. nov., with very developed meracanthus, laterally straight, horn shaped; metatibia enlarged at its apical end and bearing an open crown of 10 sclerotized black apical spurs and a group of 6 small teeth at

the apex. It differs from *A. tatuata* [21], with 8-10 sclerotized black apical spurs and 2-4 small teeth at the apex; 10 spurs and 3 small stout setae in *S. africana* [9].

Male proctiger in *Syntomoza biniae* sp. nov. simple, broad and short; in profile parallel-margined, broad basally, anterior margin straight, lateral lobe large, broadly rounded in the middle, narrowed apically, obliquely truncate at apex bearing a row of long simple setae; bearing on apical two-thirds surface, dense moderately long setae. It differs from *A. tatuata* [21] with apical part longest, narrowed, incurved on anterior margin apically, horizontally truncate at apex without a row of long setae. It differs from *S. africana* [9] and *S. unicolor* [23] with anterior margin slightly sinuate, lateral lobe large, broadly truncated in the middle narrowed apically, incurved on posterior margin apically, obliquely truncate at apex. It also differs from *S. magna* [20] with anterior margin straight in half basally, slightly incurved in half apically, lateral lobe large, prominent subtriangular broadly rounded posteriorly in the middle, horizontally truncate at apex.

Paramere in *Syntomoza biniae* sp. nov. is almost lamellar, posterior margin slightly curved, broad at base, apical region narrow curved forward bearing two short black thick spine oriented inwards; inner face with a conspicuous fold anteriorly extending obliquely toward apex; mesal surface bears about twenty short and stout setae. It differs from *A. tatuata* [21] lamellar with a forward directed single claw-like process on the mesal side of the apex. It differs from *S. africana* [9] with paramere in lateral view, lamellar, narrowed in the middle; apical margin sclerotized, with a forward directed single claw-like process on the mesal side of the apex, inner face with a cluster of seventeen stout setae pointing upward in its basal half. It also differs from *S. unicolor* [23] with paramere obliquely truncate with each an anterior and posterior sclerotised tooth apically, anterior and posterior margins incurved medially and equally differs from *S. magna* [20] with paramere long, narrowed to apices, tips pointed and directed cephalad.

Distal segment of aedeagus in *Syntomoza biniae* sp. nov. almost curved in basal half, dorsal margin weakly sinuate, without expansion basally, with a simple, ovate (spoon-like structure) apical dilation, ductus ejaculatorius relatively long and straight. It differs from *S. africana* [9] with distal portion of aedeagus relatively short with rounded apical dilatation, ductus ejaculatorius relatively long and sinuate. It differs from *A. tatuata* [21], distal segment of aedeagus, with long lateral lobe, apex strongly dilated; it also differs from *S. unicolor* [23], with basal portion of aedeagus with transverse folds apically on the inner side; and it equally differs from *S. magna* [20] with apex enlarged on upper side, dorsal margin strongly curved.

Female subgenital plate in *Syntomoza biniae* sp. nov. in lateral view subtriangular, very enlarged at the base with distinct hump, strongly narrowed at the apex, with posterior half bent upward and acutely pointed at apex, ventral margin straight upwards. It differs from *S. unicolor* [23] and *S. magna* [20]

with female subgenital plate in lateral view enlarged at the base, rounded at base, ventral margin truncated upwards.

In *Syntomoza biniae* sp. nov., circumanal ring elongated oval shape consisting of two rows of pores surrounded by small setae, the outer row circular and the inner one oblongate pores. Dorsal and ventral valvulae slightly curved dorsally, inner valve is shorter than the ventral one, ovipositor acutely pointed. It differs from *A. tatuata* [21] with the circumanal ring developed as a single row of simple, elongate pores; it also differs from *S. unicolor* [23] and *S. magna* [20], with dorsal and ventral valvulae strongly curved ventrally, ovipositor very long acutely pointed.

For the fifth instar larvae. In *Syntomoza biniae* sp.n, antenna with a rhinaria formula of 3577 like in *S. unicolor* [19].

In *Syntomoza biniae* sp.n., antennal segments with following numbers of pointed setae: 1(0), 2(0), 3(2), 4(0), 5(1), 6(0), 7(2), seventh segment longest, not differentiated into segments, bearing two equal and slender terminal spines. It differs from *S. unicolor* [23] with following numbers of pointed setae: 1(3), 2(1), 3(2), 4(0), 5(2), 6(0), 7(1), seventh segment bearing two unequal and slender terminal spines.

Forewing pad in *Syntomoza biniae* sp.n., with a row of 21 marginal very long lanceolate setae like in *S. unicolor* [23]; hindwing pad with four marginal long lanceolate setae similar to *S. unicolor* [23].

In *Syntomoza biniae* sp.n., dorsum of caudal plate with strong micro sculpture consisting of scarcely arranged small sharp cuticular teeth. It differs from *S. unicolor* [23] with dorsum of caudal plate, with several rows of cuticular teeth mixed to small simple setae.

Anal opening ventral in *Syntomoza biniae* sp.n., surrounded by only outer circumanal pore ring consisting of a single row of elongated pores; extra pore fields forming continuous inner band, consisting of elongate patches. It differs from *S. unicolor* [23] with additional inner circumanal pore ring consisting of row of circular pores.

In adults, *Syntomoza flacourtiae* sp. nov., is close to *Syntomoza biniae* sp. nov. which is sheltered by the same host plant, nevertheless we note some differences: dark yellow coloration in *Syntomoza biniae* sp. nov. and dark brown in *Syntomoza flacourtiae* sp. nov.; specimens relatively larger than one; genal cones non separated from vertex, with fine microsculpture, the anterior margin without setae; the type of venation on the hindwing with all veins conspicuous is different as well as the number of spiny setae on costal margin armed with 2+6 ungrouped instead of 2+7 ungrouped setae basally; metatibia bearing an open crown of 10 sclerotized black apical spurs and a group of 4 small teeth at the apex instead of 10 sclerotized black apical spurs and a group of 6 small teeth; male proctiger in profile medially with well-developed, broadly rounded posterior expansions, rather with two pits, one at base and other at apex, narrowed apically, apical margin rounded; paramere is rather with bulging posterior margin on one-third basally, anterior margin incurved, inner face covered with two row of eight stouter setae situated along anterior margin medially; the

shape of subgenital plate in lateral view subtriangular, rounded at the base, ventral margin straight upwards, with an blunt apex, without distinct hump; circumanal ring oval to pear shaped; arrangement of setae on the female proctiger, especially in their middle is denser with a transverse row of very long simple setae instead of two rows as in *Syntomoza biniae* sp. nov.

In fifth instar larvae: *Syntomoza flacourtae* sp. nov. differs from *Syntomoza biniae* sp. nov. in the form; antenna segments 3 and 5 without numbers of pointed setae, seventh segment bearing two unequal and slender terminal spines; forewing pad with a row of seven marginal long lanceolate setae instead of 21; abdomen on all dorsum surface bearing lanceolate setae and additional like-scaly setae; anus is rather terminal, without additional pore fields.

5. Conclusion

Host plant, *Flacourtia indica* belonging to Flacourtiaceae family, shelters two news species belonging to *Syntomoza* genus (Hemiptera: Liviidae). *Syntomoza biniae* sp. nov., is morphologically different from others species of *Syntomoza* genus. Adults, has vertex sub-rectangular without foveae; hindwing with membrane beset numerous punctations and only R+M+Cu₁ vein conspicuous; male proctiger in profile broad basally, anterior margin straight, lateral lobe large, broadly rounded in the middle, narrowed apically, obliquely truncate at apex bearing a row of long simple setae; paramere with posterior margin slightly curved, broad at base, apical region narrow curved forward bearing two short black thick spine oriented inwards; inner face with a conspicuous fold anteriorly extending obliquely toward apex; mesal surface bears about twenty short and stout setae; distal segment of aedeagus almost curved in basal half, dorsal margin weakly sinuate, without expansion basally, ductus ejaculatorius relatively long and straight; female subgenital plate in lateral view subtriangular, very enlarged at the base with distinct hump, posterior half bent upward and acutely pointed at apex, ventral margin straight upwards; circumanal ring elongated oval shape consisting of two rows of pores, dorsal and ventral valvulae slightly curved dorsally. Fifth instar larvae, with antennal segments with following numbers of pointed setae: 1(0), 2(0), 3(2), 4(0), 5(1), 6(0), 7(2), seventh segment bearing two equal and slender terminal spines; dorsum of caudal plate bearing scarcely arranged small sharp cuticular teeth; anus ventral, surrounded by only outer circumanal pore ring.

Syntomoza flacourtae sp. nov., is morphologically different from others species of *Syntomoza* genus and *Syntomoza biniae* sp. nov. with specific characters: male proctiger in profile medially with well-developed, broadly rounded posterior expansions, rather with two pits, one at base and other at apex, narrowed apically, apical margin rounded; paramere is rather with bulging posterior margin on one-third basally, anterior margin incurved, inner face covered with two row of eight

stouter setae situated along anterior margin medially; circumanal ring oval to pear shaped; arrangement of setae on the female proctiger, especially in their middle is denser with a transverse row of very long simple setae. In fifth instar larvae: antenna segments 3 and 5 without numbers of pointed setae; forewing pad with a row of seven marginal long lanceolate; abdomen on all dorsum surface bearing lanceolate setae and additional like-scaly setae; anus terminal, without additional pore fields.

This study enriched the biodiversity of jumping plant louse of *Syntomoza* genus and also the pests of African medicinal plants to survey.

Abbreviations

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Author Contributions

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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