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# Description of *Hilda cameroonensis* sp.n. (Hemiptera: Tettigometridae) new species of Hildinae associated with *Vernonia amygdalina* Delile (Asteraceae) from Cameroon

**Joseph Lebel Tamesse*, Lidy Flore Dongmo**

*University of Yaoundé I, Higher Teacher Training College, Laboratory of Zoology, Yaoundé, Cameroon*

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**Key words:** *Vernonia amygdalina, Tettigometridae, Hilda* kirkaldy*, Cameroon*

**Abstract**

*Vernonia amygdalina* Del., commonly called bitter leaf, is a perennial schrub that belongs to the family Asteraceae and grows throughout tropical Africa. It is probably the most used medicinal plant in the genus *Vernonia*. Extracts of the plant have been used in various folk medicines' as remedies against helminthic, protozoal and bacterial infections with scientific support for these claims. The leaves suffered serious damages caused by insect pests. In Cameroon, a new species of the genus *Hilda,* is reported for the first time on *Vernonia amygdalina* and cause the leaves shrivelled. All instars nymphs and adults of this new species are described: eggs have a peduncle in one extremity and their median portion is convex; for the fifth instar larval, metatibia of metathoracic leg bearing nine spines in their ventral view; For the adult, antenna are type IV, head and tegmina structure are similar as the same structure described for all *Hildiniens* species*,* metathoracic leg have eight spurs in distal end of tibiae, seven spurs in first segment of tarsus, two spurs in second and, third segments has two claws and arolium; male genitalia so complex, with anal tube short, edeagus long tubulous and devided into two parts, and pygophor wear silks in their apical ends. These characters permit us to identify this new specie in the genus *Hilda*, species *Hilda cameroonensis* sp.n.

***Corresponding Author:** Joseph Lebel Tamesse ✉ jltamesse@yahoo.fr

**Introduction**

*Vernonia amygdalina* Del (Asteraceae) is a multipurpose and rapid regenerating soft wooded shrub of 2 to 10 m high with petiolate leaves of around 6 mm in diameter. This plant has been named differently by different ethnics group around the world (Yeap *et al.* 2010). In Africa, it is called muop or ndolé (Cameroun), tuntwano (Tanzanie), onugbu (Igbo in Nigeria), and muduluza (Uganda) (Sani *et al.* 2012). The plant belongs to the order Asterales, Asteraceae family, *Vernonia* genus and the species *Vernonia amygdalina* (Farombi and Owoeye, 2011). More than 500 species of *Vernonia* genus are distributed in Africa and Asia, approximately 300 in Mexico, Central and South America and around 16 can be found in the United States (Yeap *et al.* 2010). Apparently, *V. amygdalina* is a plant with diverse potentials uses. Its chemical composition makes it ideal for nutritional and medicinal uses (Ijeh and Ejike, 2010). The leaves are used for human consumption; these leaves are washed before cooking to get rid of the bitter taste (Sani *et al.* 2012). The processed *V. amygdalina* are consumed locally and even exported to Europe and North America restaurants for the preparation of African dishes (Fontem *et al. 2003). V. amygdalina* can be classified as healthy food. It contains some active drug molecules and other substances that are necessary for maintaining good health and safe physiological functions of the body without any toxicity (Iwu, 2002). *V. amygdalina* has medicinal virtue according to Bigendako *et al. (*1995) and Kahane *et al.* (2005). It is probably the most used medicinal plant in the genus *Vernonia* (Ijeh and ejike, 2011). Fan Cheng *et al.* (2013) was shows that this plant has much therapeutic effect and can be consider as an antibacterial, antidiuretic, antipaludeen, antifungal, anticanceral. These results seem to confirm that *V. amygdalina* is important in traditional medicine. The dried leaves of *Vernonia amygdalina* were also found to have insecticidal potency against the larvae of *Callosobruchus maculates* and *Sitophilus zeamais*; these insects caused heavy losses of stored cow pea and maize respectively (Kabeh and Jalingo, 2007).

Several insects, including Hemiptera (Sternorrhyncha, Cicadomorpha, Fulgoromorpha and Heteroptera), Coleoptera (Coccinellidae and Curculionidae), Lepidoptera and Orthoptera are reported feeding on leaves of this important crop (Banjo *et al.* 2006). Some of these family insects caused serious damages to their host plants, *Diaphorina enderleini* according to Alènè *et al.* (2011). Among the major pests of *V. amygdalina* plants, we collected for the first time one species of Tettigometridae family feeding on the plant tissue. Tettigometridae is the most interesting and important family of Fulgoroidea super family, although it is one of smallest group within this super family (Muir, 1922). The planthoppers were bring together for the first time under a unique taxa "Fulgorellae" by Latreille in 1807 (Hamilton, 2011). The family of Tettigometridae was established by Germar in 1821, to receive a unique genus *Tettigometra* Latreille 1804 with the former holotype species of *Fulgora obliqua* Panzer and *Fulgora virescens* Panzer 1799 (known as *Tettigometra virescens* Panzer and *Tettigometra obliqua* Panzer respectively); all these species was distinguished by the structure of the head and general form of body (Fennah, 1952). Walker in 1851 described a new genus *Isthmia* Walker from Sierra Leone, which was redescribed and assigned as *Hilda* Kirkaldy in 1900 (Fennah, 1952). Lindberg (1948) re-defines the subgenera *Tettigometra* Latreille, *Mitricephalus* Signoret, *Eurychila* signoret and *Brachyceps* Kirkaldy; and add two more *Micrometrina* Lindberg and *Macrometrina* Lindberg (Fennah, 1952). In 1912, Schmidt described two new genera *Megaloplastinx* and *Euphyonarthex*, and places them in a new tribe Megaloplanstinini which was separate from the typical tribe Tettigometrini by the longer, and relatively more slender, legs. The first comprehensive attempt to classify the family of Tettigometridae was that of Baker (1924), who divided it into three subfamilies, Tettigometrinae, Egropinae and Megaloplastinxinae, separated principally by the structure of the fronts and vertex. The first sub-family included *Tettigometra* Latreille, together with Signoret's subgenera *Mitricephalus* Signoret, *Eurychila* signoret and *Brachyceps* Kirkaldy.

The second subfamilies include *Egropa* Melichar, *Hilda* Kirkaldy, *Mesogropa* Baker and *Nototettigometra* Muir; and the third *Megaloplanstinx* Schmidt, *Euphyonarthex* Schmidt, *Tembandumba* Distant and Raatzbrockmannia Schmidt. In 1987, Bourgoin described a new genus, *Cyranometra* from Africa. Planthoppers are recorded as pests of economic plants. Some works have focused on the impacts of particular planthoppers on specific crop plants, especially rice, surgarcane, maize, oats, wheat, barley and coconut palm. Planthopper of the family of Tettigometridae are pathogen vectors in some family like Fabaceae, Anacardiaceae, Rutaceae, Solanceae, Poaceae, Annonaceae and Asteraceae (O'Brien and Wilson, 1985). *Hilda spp* is reported as a minor pest on cashew nuts, pigeonpea, citrus, soybean, maize, potato, okra, sunflower, cowpea, phaseolus bean and mung bean. The extent of damage to groundnut can often be of economic importance; the infested plants by groundnut hopper *Hilda patruelis*, turn yellow, wilt and die due to sap sucking by the hoppers; the vascular system of the plants turns brown, probably as a result of toxins in the saliva of *H. patruelis* (Minja *et al.* 1999). The knowledge on the family of Tettigometridae is very limited (Weaving, 1980). No record have been published concerning the impact of this insects on *Vernonia*

The aim of the study was to report the presence of the insect of the Tettigometridae family as pest of *Vernonia amygdalina* in Yaoundé (Cameroon). Developmental stages of the insect are described compared to the previous species described in the same genus and the new species is named. The damages caused by the new pest are also described.

## Materials and methods

*Type series deposit*

The type series of *Hilda cameroonensis* sp.n. (Fig. 1A) were deposited in the collections of the Laboratory of Zoology, University of Yaoundé I, Cameroon (LZUY).

*Field survey*

The observations and survey took place at *Vernonia* plantations once a week, from November 2014 to October 2015 in the locality of Nkolfoulou nearest Yaoundé city, Yaoundé, Cameroon (altitude 680m, 03°55'0"N, 11°34'60"E, division of Soa, Center Region). During each week of our survey 30 trees of *Vernonia amygdalina* were inspected. Adults of Tettigometridae 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 at Yaoundé (Cameroon) and is deposited in LZUY.

*Observations and illustrations*

The specimens were slide mounted. The specimens are preserved dry and slide-mounted or in 70% ethanol and are deposited in Laboratory of Zoology. 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 Fennah (1952).

## Results and discussion

*Description of eggs and larval stages of Hilda cameroonensis* sp.n

*Eggs*

Eggs are yellowish and spherical in form. Peduncle is in the one extremity of egg while the terminal opposite portion of egg is so dark. One of the median portions is convex (**Fig.1A**). Egg measurements are 0.74-0.91mm long without peduncle, and 0.31-0.42 mm width.

*Larval stages*

Larvae are dark brown in general; head with genal cone and thorax with 3 pairs of legs. Legs divided into 4 segments with several lanceolated setae, tarsus with 2 claws and an arolium at their extremity.

*First larval stage* (Fig. 1B)

Antennae divided into 3 segments like legs. There is no wind pad and abdomen is segmented. Abdomen and labium is yellow. First larval stage measurements are as follows: 0.77-1.6 mm long and 0.28-0.71 mm width, then 2.75 times longer than wide.

*Second larval stage* (Fig. 1C)

Antennae with several setae, divided into 3 segments; long setae at their distal end. Wing pad present but less developed. Head, abdomen and genitalia with lanceolated setae. Second larval stage measurements are as follows: 1.57-2.25 mm long and 0.63-1.23 mm width, then 2.49 times longer than wide.

*Third larval stage* (Fig. 2A)

Wind pad more developed than that of the previous larval stage, with setae. Head, abdomen and genitalia with lanceolated setae. Third larval stage measurements are as follows: 2.14-2.8mm long and 0.86-1.14mm width, then 2.48 times longer than wide.

*Fourth larval stage* (Fig. 2B)

Wind pad more developed than that of larval stage 3 with setae. Abdomen and genitalia with lanceolated setae. Fourth larval stage measurements are as follow: 2.76- 3.4 mm long and 1- 1.34 mm width, then 2.76 times longer than wide.

*Fifth larval stage* (Fig. 2C)

The fifth instar larval has much coloration, but the mature stage is dark brown. Antennae with setae, divided into 2 segments with long setae at their distal end. Tarsus of prothoracic leg and mesothoracic leg divided into 2 segments. Metatibia of metathoracic leg bearing 9 spines in their ventral view. Tarsus of metathoracic leg divided into 3 segments; the first and second segment have every one 2 spurs in lateral view; the third segment have two claws and an arolium. Abdomen, legs and genitalia with lanceolated setae. Wind pad more developed than that of the larval stage 4, with setae. Fifth larval stage measurements are as follow 3.42-4.43 mm long and 1.31-1.48 mm width, then 2.99 times longer than wide.

*Description of adults of Hilda cameroonensis* sp.n.

*Colour*

After the last moult adult is green; they become dark brown when mature. Females are darker than male. Head is yellowish with dark point; eyes purplish; antennae brown with the long setae dark; legs are yellowish with dark point from femoral to tarsus.

*Structure*

Male and female are different from each other by their sizes and the structure of their genitalia. Female measurements are as follow: 5.41-6.47 mm long and 1.82-2.7 mm width; male measurements are as follows: 5.41-1.88 mm long and 1.76-1.88 mm width then females are 3 times as long as wide and males are 3.1 times as long as wide. Females are longer and larger than males. Tegument covered with short lanceolated setae in both males and females. Distal end of the genitalia is pointed in females and conical in males.

*Head* (Fig. 3A)

Vertex is parabolic, front more elongated than vertex; setae present; no median ocellus but lateral ocellus on the level of anterior cheek. Eye observed is red with globular compounds, there is little white perforations between ommatidia; the antennae are inserted laterally under the compound eyes. Head width measurements are as follows 0.43- 0.51 mm in female and 0.43-0.45 mm in male.

*Antennae* (Fig. 3B)

Antennae is short and robust with long lanceolated setae at their extremity. They are short and sturdy dark brown. Presence of two antennal having at its end a whip similar to a silk. The sensory organ plate includes cuticules crowns without laces and porous areas without plates. This sensory organ plate is type IV.

*Legs*

Legs are yellow clear with darks marking. Legs are covered with several setae. Prothoracic (Fig.4A) and mesothoracic leg (Fig. 4B) without tarsus spines; but metathoracic leg (Fig. 4C, 4D) have 8 spurs in distal end of tibiae,

7 spines in first segment of tarsus, 2 spines in second segment of tarsus and the third segment with 2 claws and arolium. Metafemur measurements are as follows: 0.94- 1.17 mm long in male and 1.17- 1.47 mm long in female. Female metafemur is 1.24 times longer than male metafemur. Female metatibia is 1.25 times longer than male metatibia.

*Wings*

Forewings (Fig.5A) are coriaceous and recover their body. Forewing venation is reduced and concentred in a restricted zone. Costal, radial and medial veins are not bifurcate. Cubital vein fused with medial vein in their middle. Forewings measurements are as follows: 3.82- 4.70 mm long and 1.41-1.82 mm width in female; 3.94-4.11mm long and 1.29-1.41mm width in male. Forewing is 2.7 times longer than wide in female and 3 times longer than wide in male.

Hindwings (Fig.5B) are hyaline. Hindwings have two lobes. Venation of the first lobe: costal vein (C) bifurcated as subcostal (Sc 1+Sc2); radial vein (R) bifurcated as R1 and R2. Radial vein (R2) joint subcostal vein (Sc2) and formed transversal vein and form a cell. Medial vein (M) bifurcated in M1 and M2. Cubital and post cubital vein do not bifurcated. The second lobe has a short anal vein (An). The two lobes are separated by a fold called plicavanalis. Hindwing measurements are as follows 3.47- 4.41 mm long and 1.76-2.05 mm width in female; 3.35- 3.41 mm long and 1.76-2.05 mm width in male. Hindwing are 1.7 times longer than wide in female and 1.8 times longer than wide in male. Forewings and hindwings are without setae.

*Genitalia*

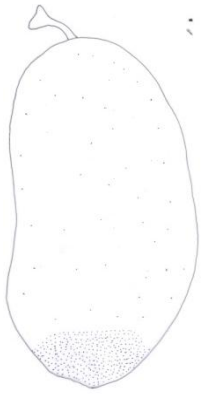
*Female genitalia*

Female genitalia is reduce and not important in the taxonomy.

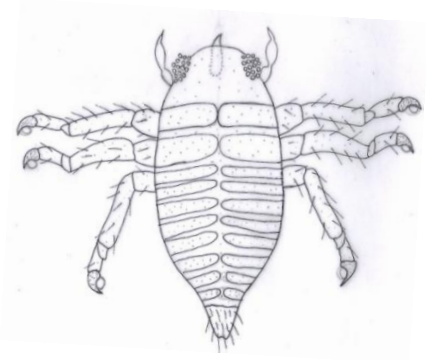
*Male genitalia*

A male genitalia (Fig.5C) is so complex and permit to classified species of *Hilda* genus. Periandrium is semibulbous not short not large and is connected to anal tube at their base. Anal segment is short and subcylindric.

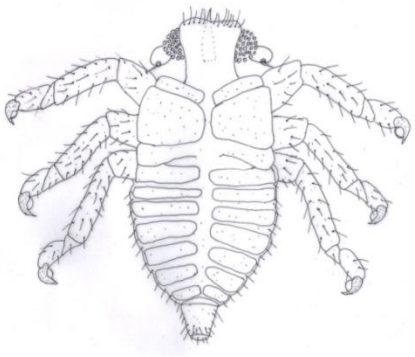
The apical marge of anal segment is prolonged dorsally as an incurved spine. Aedegus is elongated tube in two parts, one part connect to genital style, is sclerosed and possess some setae in their dorsal part, distal end do not have setae but at their distal end in the inferior part was a small membranous zone. Genital styles long are even and symmetrically arranged. They included pigmented shaped depressions wide lobes on either side inside styles and at the base thereof : pyrophore. These two lobes of pygophore long and no convex, wear silks in their apical ends.



A

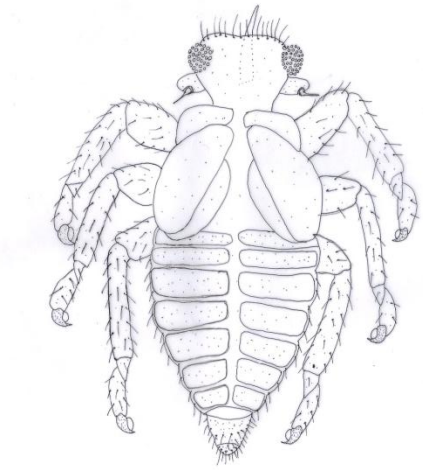


B

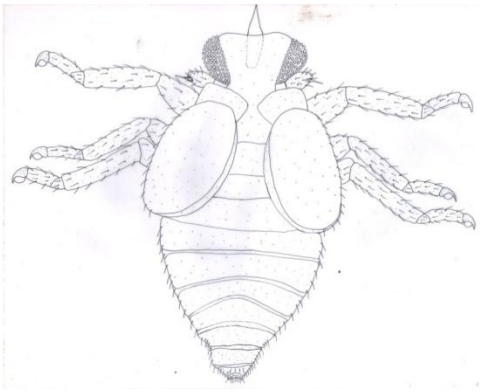


C

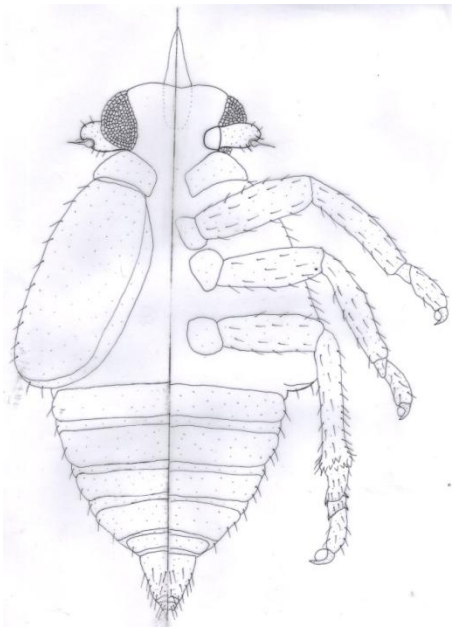
**Fig. 1**. *Hilda cameroonensis* sp.n. A- egg ; B- first stage larval ; C- second stage larval.



A



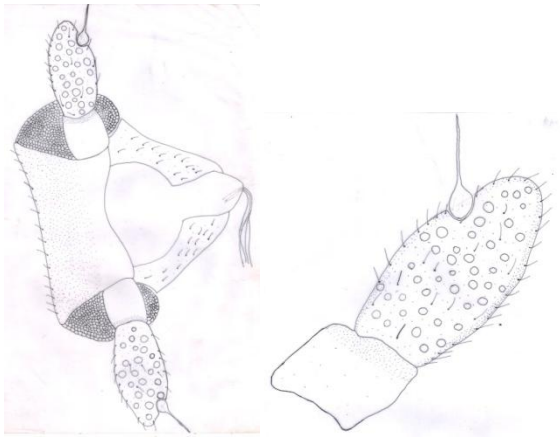
B



C

**Fig. 2**. *Hilda cameroonensis* sp.n. A- third stage larval ; B- fourth stage larval ; C-fifth stage larval.

A B



C D

**Fig. 3**. *Hilda cameroonensis* sp.n. A- male (dorsal view); B- female (dorsal view); C- head (ventral view); D- antenna.

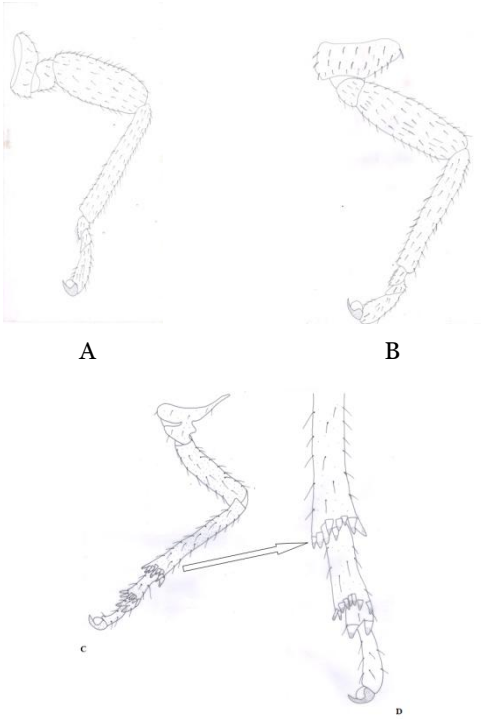



**Fig. 4**. *Hilda cameroonensis* sp.n. A- prothoracic leg ; B- mesothoracic leg ; C- metathoracic leg.

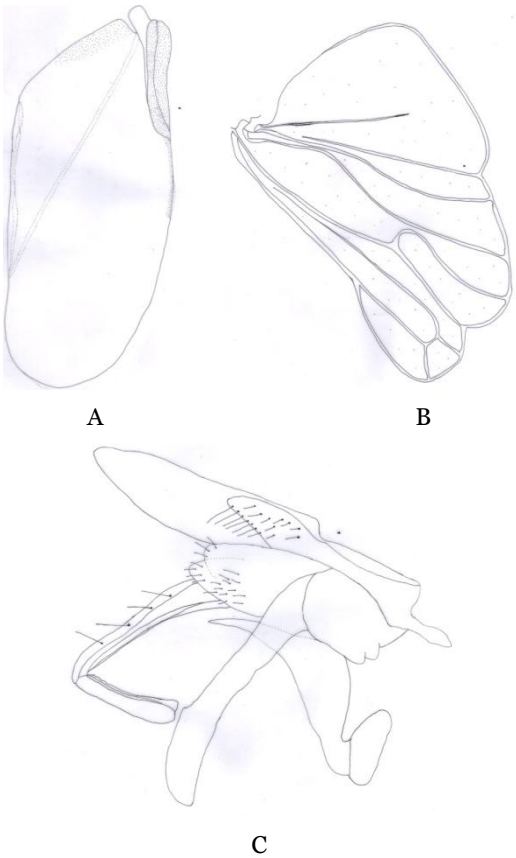


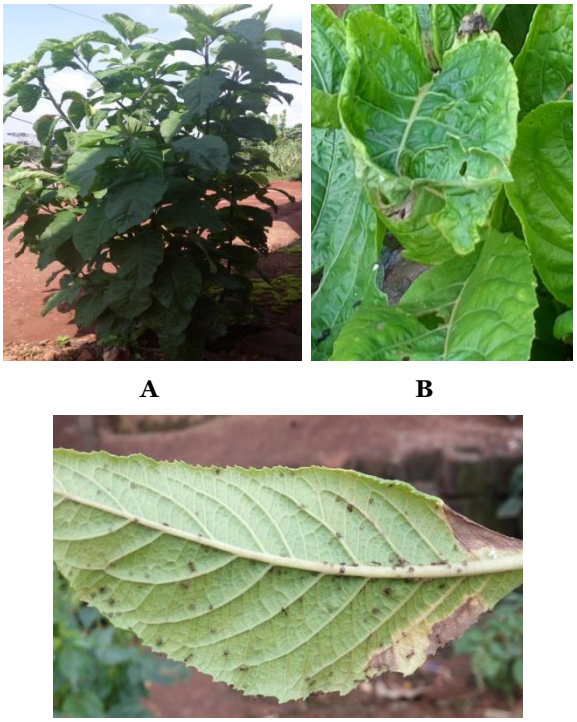

**Fig. 5**. *Hilda cameroonensis* sp.n. A- forewing ; B- Hindwing ; C- male genitalia.

**Discussion**

*Hilda cameroonensis* sp.n described here is compared to the previously described *Hilda* species mostly from afrotropical region. Ten *Hilda* species are known within genus *Hilda* Kirkaldy (Bourgoin, 1988); the common character to separate different species are slight differences in the level of the genital structure (Bourgoin, 1988). The adult of *H. cameroonensis* sp.n. share a series of morphological character with other *Hilda spp*., such as the colour. For this specie, the antennae structure is short with sensory organ of type IV; head structure with parabolic vertex, and tegmina structure with dark blotches at the costal groove of the forewing. Head and tegmina are as similar to the ones of *Hilda hodeberti* (Bourgoin, 1988), *Hilda patruelis (*Minja *et al*. 1999) from South Africa and *Hilda breviceps* (Muir, 1922).

*H. cameroonensis* sp.n is different from *H. hodeberti* describe by Bourgoin (1988); the male of H cameroonensis is 1.13 times longer than the male of *H. hodeberti* and the female of *H. cameroonensis* seems to have the same length (1.02 times) as the female of *H. hodeberti*. The wings of *H. cameroonensis* sp.n are similar to those of *Apohildajuno* Linnavuori (Bourgoin, 1988). For the groups we noted the absence of dark and erected setae at the distal end of the wings. The Adult genitalia apparatus of *H. cameroonensis* sp.n is similar to the genitalia apparatus of *H. breviceps*; periandrium is semibulbous, longer and large; it is connected at anal tube which is short; edeagus long and tubulous with two portions.

The newly described species encounter characters previously described on various species. This description is important to recognize the new species amount the ten previous species knew in this group. The damages caused by this pest on its host plants included the gradual loss of green colour to yellow, crumpled leaf shape, wilting and winding of leaves that eventually falls. (Fig. 6).



**A** **B**

**C**

**Fig. 6.** Damages causes by *H. cameroonensis* sp.n. A- *Vernonia amygdalina* plant. B- Crumpled and winding leaves, C- Wilting and yellowing leaves.

This species is reported for the first time in Cameroon on *V. amygdalina* where it causes damages. It is therefore important to take into account the presence of this pest in the cultivation process of *V. amygdalina*. Given the importance of the host plant it is necessary, integrated pest management again this pest could be necessary. More studies are required mostly for the biology and population dynamic of the newly described *Hilda* species from Cameroon.

## Conclusion

Morphological studies of individuals from different stages of development of this new species enable the identification of this pest *Hilda cameroonensis* sp.n. It belongs to the superfamily Fulgoroidea, family Tettigometridae, subfamily Hildinae, and genus *Hilda*. The damage induced by this pest to *Vernonia* plants is important. It is therefore important to pursue this study for the purposes of integrated pest management in Cameroon.

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