







Research Article

Life cycle and morphometric analysis of nymphs of *Cynodonmiris corpoicanus* Ferreira & Barreto, 2013 (Hemiptera: Miridae)

Ciclo de vida y análisis morfométrico de las ninfas de *Cynodonmiris corpoicanus*
Ferreira y Barreto, 2013 (Hemiptera: Miridae)

Paulo Sergio F. Ferreira^{1*} , Nancy Barreto-Triana² , Pablo Andrés Osorio-Mejía² ,
Fagner de Souza³  and Luciano Santana Fiuza Ferreira⁴ 

^{1*}Universidade Federal de Viçosa (retired professor), Departamento de Entomologia, Viçosa, MG, Brasil.  *paulofiuza41@gmail.com. ²Corporación Colombiana de Investigación Agropecuaria, Agrosavia. C. I. Tibaitatá, Mosquera, Cundinamarca, Colombia. E-mail: nbarreto@agrosavia.co, posorio@agrosavia.co. ³Universidade Federal do Triângulo Mineiro, Laboratório de Ecologia Aquática, Avenida Guilherme Ferreira, 1940, Uberaba, Minas Gerais, Brasil. E-mail: gnaofagner@hotmail.com. ⁴Universidade Federal de Viçosa, Bacharelado em Cooperativismo, Departamento de Economia Rural, Edifício Edson Potsch Magalhães – R. Purdue, Campus Universitário, Viçosa, Minas Gerais, Brasil. E-mail: luciano.ferreira@ufv.br

ZooBank: urn:lsid:zoobank.org:pub:ED009D1A-BEBA-4720-8310-2AE52CFD6D66
<https://doi.org/10.35249/rche.47.4.21.04>

Abstract. The bug *Cynodonmiris corpoicanus* inhabit the Cundiboyacense High Plateau in Colombia feeding on grasses (Poaceae). The authors carry out their life cycle in greenhouse and characterize the damage on oat (*Avena sativa*) leaves. The duration egg – adult last 49.3 days and undergo five nymphal stages. The morphometric study was conducted by principal component analysis (PCA) and 2.03 PAST software. This method let to determine measures for nymphal stages separation, furthermore we consider coloration, morphology and morphometric description. A key for nymphal stages determination was developed by morphometric and morphology diagnostic characters. Also, we include illustrations of the *C. corpoicanus* nymphal stages.

Key words: Biology; bugs; damage; immature; morphology.

Resumen. La chinche *Cynodonmiris corpoicanus* habita en el Altiplano Cundiboyacense de Colombia donde se alimenta de pastos (Poaceae). Los autores realizaron su ciclo de vida en casa de malla y caracterizaron el daño ejercido sobre las hojas de avena (*Avena sativa*). La duración de huevo a adulto fue de 49,3 días y atraviesa por cinco estadios ninfales. El estudio morfométrico se condujo mediante el análisis de componentes principales (ACP) y el programa 2.03 PAST. Este método permitió la determinación de medidas para la separación de los estadios de las ninfas, además se consideró su coloración, morfología y descripción morfométrica. Se desarrolló una clave para la determinación de los estadios de ninfa a través de caracteres diagnósticos morfológicos y morfométricos. También se incluyen ilustraciones de los diferentes estadios de las ninfas de *C. corpoicanus*.

Palabras clave: Biología; chinches; daño; inmaduros; morfología.

Received 14 September 2021 / Accepted 13 October 2021 / Published online 29 October 2021 / Erratum 5 November 2021
Responsible Editor: José Mondaca E.

Introduction

In Colombia, specialized dairy production is mainly located at Andean zone above 2,000 meters, where 70% of milk national production is concentrated. Three areas located in the departments of Nariño, Antioquia, and Cundinamarca and Boyacá (Cundiboyacense High Plateau) stand out. There predominate Poaceae forage species such as kikuyo grass *Cenchrus clandestinus* (Hochst. ex Chiov.) Morrone, ryegrass *Lolium* spp. (L.), woolen grass *Holcus lanatus* L., fragrant grass *Anthoxanthum odoratum* L., blue grass *Dactylis glomerata* L., oat *Avena sativa* L. and some clover mixes (Fabaceae) *Trifolium repens* L. and *Trifolium pratense* L. (Carulla & Ortega 2016).

Research carried out by Corporación Colombiana de Investigación Agropecuaria -Agrosavia- on Cundiboyacense high plateau pastures resulted in the discovery of a new species of grass bug *Cynodonmiris corpoicanus* Ferreira & Barreto, 2013 (Heteroptera: Miridae) (Ferreira *et al.* 2013). The adults present general color yellowish brown. Antennae with reddish spots are more visible in antennal segments I and II; antennal segments III and IV darker; antennal segment I without bristles, and longer than the length of head and pronotum combined. Pronotum with dorsum and lateral margins yellowish; collar and disc darker with three wide stripes black. Hemelytra with swelling veins yellowish; apex of clavus and margins of claval commissure, black; membrane dark with prominent veins cells pale; cuneus reddish. Legs yellowish brown with reddish brown spots on femora and tibiae; spines of tibiae black. Abdomen reddish brown with pale spots (Ferreira *et al.* 2013). This mirid share habitat with another grass bugs belonging to the Stenodemini: *Collaria scenica* (Stål, 1859) (primary pests of pastures), *Collaria oleosa* (Distant, 1883) and *Stenodema andina* Carvalho, 1975 (secondary pests) which affect Poaceae pastures (Barreto Triana and Osorio Mejía 2015; Barreto-Triana *et al.* 2018).

The aim of this work was to study the life cycle, damage, morphology and morphometric of the nymphal stages of *C. corpoicanus*.

Materials and Methods

Life cycle was carried out at Tibaitatá Research Center of Agrosavia (Corporación Colombiana de Investigación Agropecuaria) (Mosquera, Cundinamarca, Colombia, 4°41'42" N, 74°12'14" W, 2,550 m). Observations were made in a greenhouse (22 °C ± 4 temperature and 54% ± 18 relative humidity). Adult bugs of *C. corpoicanus* were collected and confined in couples (one male, one female) in plots previously sown with forage oat (*Avena sativa*) and covered with plastic cylinder with muslin windows until to get postures. The insects and biological material analyzed for this study, were collected under the collection frame permission 1466 of 2014 issued by the Autoridad Nacional de Licencias Ambientales to the Corporación Colombiana de Investigación Agropecuaria. During the permanence of bugs on the plants, the damage caused to the leaves by their feeding activity was characterized. After retiring the adults, the presence of nymphs, exuviae and imagoes was monitored daily to determine stage duration (in days) and mortality (%). The illustrations were made by P.S.F. Ferreira using a camera lucida attached to a Leica stereoscope MZ 95. The measurements were taken with an ocular micrometer inserted into a 10X eyepiece and a calibration with a micrometer scale. The terminology used is based on Schuh & Slater (1995). For the evaluation and interpretation of the morphometric data, the principal component analysis (PCA) was performed using the PAST software version 2.03 (Hammer *et al.* 2001). The data were log-optimized to avoid the influence of size. This analysis identified appropriate measures in the separation of nymphs (Fig. 1). Measurements of nymphs were made on preserved specimens in 96% ethanol. These measures (Tab. 2) were used as proportions for all other measures, emphasizing new diagnostic characters. Therefore, measurements were presented as percentages of standard length. PCA evidenced the relevant measures in order to develop a higher efficiency of comparative analysis between the instars. For all ratios, a comparative

analysis was performed ($p = 95\%$ confidence data and parametric ANOVA for Kruskal-Wallis (KWp) for non-parametric) to confirm the statistical differences.

All entomological material was deposited in the laboratory of the Tibaitatá Research Center of Agrosavia, Colombia.

Results and Discussion

Life cycle. The assay shows that *C. corpoicanus* last 13.6 days in egg stage, 35.7 in nymph and 33.6 in adult, meanwhile, the egg - adult duration was 49.3 días (Tab. 1). This cycle is comparatively short respect to *C. scenica*, principal pasture pest, with 63 days egg – adult (Barreto Triana and Osorio Mejía 2015). In this way, *C. corpoicanus* could become a potential pest of the Cundiboyacense High Plateau pastures whose rotation period is 30 to 60 days.

Table 1. Life cycle of *Cynodonmirus corpoicanus* in greenhouse ($22\text{ }^{\circ}\text{C} \pm 4$ and $54\% \pm 18$ RH). / Ciclo de vida de *Cynodonmirus corpoicanus* en casa de malla ($22\text{ }^{\circ}\text{C} \pm 4$ y $54\% \pm 18$ HR).

stage	n	duration (days)	standar error	survival (%)
egg	88	13.6	0.05	60
nymph I	54	6.9	0.08	80
nymph II	44	6.7	0.17	100
nymph III	44	6.3	0.31	100
nymph IV	43	7.7	0.12	100
nymph V	43	8.1	0.19	100
total nymph		35.7		
egg - adult		49.3		
adult longevity	38	33.6	0.32	



Figure 1. Damage caused by *Cynodonmirus corpoicanus* in oat leaves / Daño causado por *Cynodonmirus corpoicanus* en hojas de avena.

Damage. The damage caused by *C. corpoicanus* on oat leaves initially shows with chlorotic points at apex which then continue towards the central axis of the leaf sheath. As the damage progresses, spots and stripes are observed that eventually reach both edges and cause wilting of the apical portion (Fig. 1). This type of damage is clearly different from that caused by *C. scenica* that mainly affects kikuyo grass (Barreto Triana and Osorio Mejía 2015).

Morphometric analysis

The Principal Component Analysis (PCA) showed differences between the nymphs of *C. corpoicanus*, the axis that best explained the differences between the orthogenetic states was the PCA 1 axis with 74.26% of explanation. The variables that most influenced this axis were antennomere IV length, labium length (positive values) and wing pads (negative value). The PCA axis 2, with 11.43% of explanation, had as main variables the length of antennomeres I, II and III, length of the hind femur, length of the hind tibia (positive values) and body length (value negative) (Tab. 2, Fig. 2).

Table 2. Measurements (in millimeters) of morphometric characters at different nymphal stages of *C. corpoicanus*. / Medidas (en milímetros) de los caracteres morfométricos en los diferentes estadios de las ninfas de *C. corpoicanus*.

	Nymph I			Nymph II			Nymph III			Nymph IV			Nymph V		
Characters	avg.	min.	max.	avg.	min.	max.	avg.	min.	max.	avg.	min.	max.	avg.	min.	max.
Body length	1.87	1.82	1.94	2.56	2.33	2.72	3.50	3.15	3.80	4.52	4.05	4.80	6.56	6.25	6.94
Body width	0.31	0.29	0.35	0.49	0.44	0.51	0.60	0.55	0.65	0.73	0.65	0.80	0.88	0.81	0.94
Dorsal head width	0.35	0.33	0.37	0.45	0.44	0.46	0.50	0.45	0.55	0.62	0.60	0.65	0.63	0.56	0.75
Head side length	0.36	0.5	0.39	0.49	0.46	0.51	0.61	0.55	0.65	0.68	0.65	0.70	0.89	0.81	1.00
Vertex width betw. eyes	0.26	0.24	0.29	0.33	0.31	0.36	0.37	0.35	0.45	0.45	0.45	0.45	0.39	0.31	0.44
Antennomere I length	0.26	0.24	0.31	0.45	0.44	0.49	0.65	0.60	0.70	0.90	0.85	1.00	1.24	1.16	1.31
Antennomere II length	0.46	0.45	0.47	0.77	0.69	0.90	1.07	1.00	1.15	1.58	1.50	1.70	2.05	1.98	2.14
Antennomere III length	0.69	0.65	0.73	1.12	1.08	1.15	1.42	1.35	1.50	1.88	1.80	1.95	2.10	1.98	2.16
Antennomere IV length	0.61	0.57	0.65	0.74	0.72	0.77	0.79	0.75	0.85	0.92	0.85	0.95	0.96	0.94	1.00
Labium length	0.90	0.86	0.98	1.18	1.15	1.21	1.28	1.20	1.35	1.58	1.50	1.75	2.05	1.94	2.22
Pronotum length	0.19	0.18	0.20	0.27	0.26	0.31	0.29	0.25	0.35	0.42	0.35	0.45	0.48	0.41	0.56
Pronotum width	0.33	0.29	0.37	0.42	0.41	0.44	0.51	0.50	0.55	0.63	0.60	0.65	0.80	0.75	0.84
Hind femur length	0.52	0.45	0.57	0.79	0.67	0.90	1.14	1.05	1.20	1.57	1.45	1.75	2.20	2.13	2.38
Hind tibia length	0.73	0.69	0.76	1.08	1.03	1.15	1.33	1.30	1.40	1.92	1.75	2.10	2.44	2.34	2.66
Hind tarsus length	0.30	0.27	0.33	0.35	0.33	0.36	0.41	0.35	0.45	0.55	0.50	0.60	0.77	0.75	0.81
Wing pad length	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.85	0.90	1.95	1.88	2.03

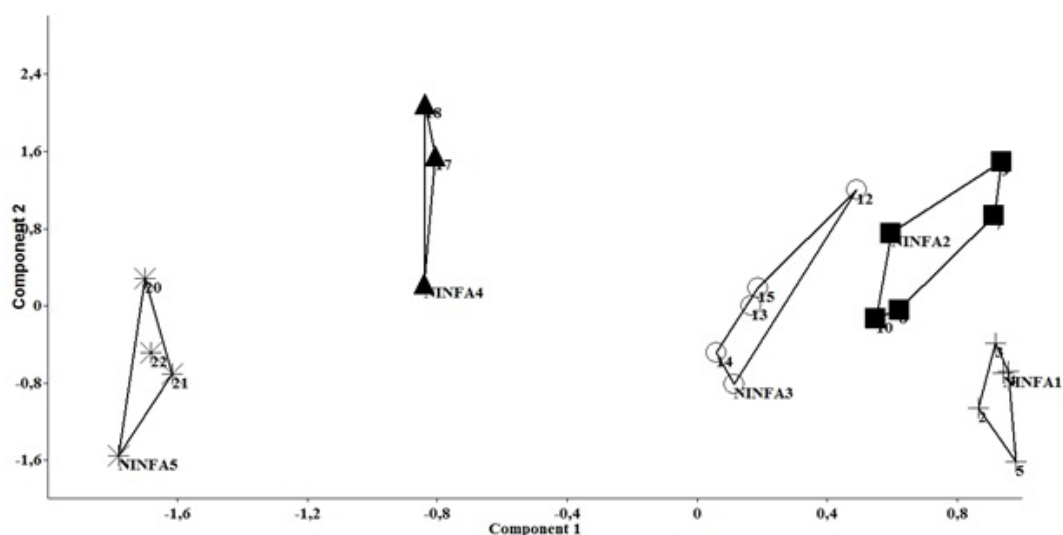


Figure 2. Principal component analysis (PCA) scores for the nymphae of *C. corpoicanus*. / Valores del análisis de componentes principales (ACP) de ninfas de *C. corpoicanus*.

Description of first stage nymph (Fig. 3)

Coloration. General coloration yellow-greenish with red stripes. Head with two lateral stripes extending from outer margin of the antennomere I to apex of abdomen. Two strips close to the inner margins of the eyes extending from antennal insertion to top of the abdomen. A median dorsal line is emerging from apex of frons to base of the head where it forks and joins in the region of metanotum and follows in a single strip to the top of the abdomen. Two longitudinal, lateral stripes on the outer margin of buccula to posterior coxae. Reddish eyes. Antennomeres I and II, reddish. Antennomeres III and IV, greenish. Legs greenish. The apex of tarsi and labium, dark.

Morphology. Body smooth with short and sparse pilosity. Body length is ranging from 1.82 to 1.94 mm, equal to or less than twice the width of the body. Head smooth with a width approximately equal to pronotum basal width. Front without or slightly striate. Vertex without a longitudinal groove. The apex of the front not extending acutely on the base of the clypeus. Clypeus convex with the base well delimited by a furrow and, longer than the mandibular plate. Eyes sessile, oval, its width greater than length, located in the posterior margin of the head not touching the anterior margin of the pronotum. The antenna is equal or longer than body length with pilosity shorter than the width of segments. The length of the antennomeres from highest to lowest: III > IV > II > I. Antennomere I cylindrical and thicker than the others with 2 to 4 setae long and erect near the apex. Antennomere I smaller than the width of head and vertex. The labium is reaching the top of posterior coxae. Pronotum quadrangular with 1.5 to twice its length. Pronotal collar, disc, and calli, obsolete. Scutellum absent. Legs with single hairs shorter than the width of segments. Pterothecae (wing pads) absent. Abdomen fusiform with short, sparse hairs. The central opening of dorsal abdominal gland between tergites III and IV, apparently absent. Proctiger inconspicuous.

Morphometric description. Nymph I of *C. corpoicanus* can be separated from all other nymphs by showing lower values in body width, with 46.87-56.66% of antennomere IV length (versus 60.71-99.86%) ($p = 0.0000002$). Higher values in the labium length 70.83-88.09%

of posterior tibial length (versus 88.88-126.66%) ($p = 0.0000$). It can also be distinguished by characters of the head, such as the dorsal width of the head and the interocular distance. Lower values in the dorsal head width, with 66.66-88.23% of the antennal length I (versus 94.44-201.85%) ($p = 0.00000002$). For other relevant morphometric data, see morphometry table 3.

Description of second stage nymph (Fig. 4)

Coloration. General color light yellow-green with red stripes. Head with seven red longitudinal stripes. Two lateral stripes at eye level extending through the outer margin of the antennomere I toward the apex of the abdomen. Two stripes near the inner margins of the eyes extending from antennal insertion to the apex of the abdomen. A median dorsal stripe is emerging from the top of the front extending to the base of the head where it bifurcates and joins in the region of the metanotum. After this point, it continues in a single line to the apex of the abdomen. Two longitudinal, lateral stripes on the outer margin of the buccula follow posteriorly to the hind coxae. Reddish eyes. Antennomere I and II reddish, III and IV, pale-green. Legs greenish with the tarsal apex and apex of the labium, dark.

Morphology. Body smooth with short and sparse hairs. Its length is ranging from 2.33 to 2.72 mm, between twice and four times the width of the body. Smooth head, nearly equal to pronotum width; front without or slightly striated, vertex without apparent longitudinal groove, and without lateral margins. The apex of the front not sharply extending on the base of the clypeus. The clypeus is distinctly convex with base delimited by a groove, longer than the mandibular plates. Eyes sessile, oval, wider than the length, situated on the posterior margin of the head, not touching the anterior margin of pronotum. The antenna is equal to or greater than body length. Antennal pilosity with short hairs shorter than the width of antennomeres. The length of the antennomeres from highest to lowest: III > II > IV > I. Antennomere I cylindric, thicker than the others, with 2 to 4 long and erect bristles, near the apex. Antennomere I shorter than the head width, and longer than the vertex width. The labium is surpassing the top of the hind coxae. Pronotum square with 1.5 to twice its length. Pronotal collar, disk, and callus, obsolete. Scutellum absent. Legs pilosity with short, and simple hairs, smaller than the width of the segments. Wings pads absent. Abdomen fusiform with short, sparse hairs. The central opening of the dorsal abdominal gland, apparent and transverse between the abdominal tergites III and IV. Proctiger not visible.

Morphometric description. Nymph II of *C. corpoicanus* can be distinguished from all other nymphs by the following characters: wider interocular distance, 130.76-141.66% of the antennomere length I, in relation to nymph I (versus 85.71-25%) and smaller than nymphs III, IV and V (144.44-417.95%) (KWp = 0.0005). Nymph II with the larger antennomere I length, 58.62-64.28% of antennomere IV length compared to nymph I (versus 40.00-46.87%) and lower value than nymphs III, IV and V (versus 76.47-139.13%) ($p = 0.0000$) (Tab. 3).

Description of third stage nymph (Fig. 5)

Coloration. The general color is yellow-green with red stripes. Head with seven red longitudinal stripes. Two lateral stripes at eye level (not advancing from the outer margin of the antennomere I) following in the posterior direction to the apex of the abdomen. Two stripes near the inner margins of the eyes extending from antennal insertion to the apex of the abdomen. A median dorsal stripe extending from the top of the front to the base of the head. From this point, the stripe branches and meets in the region of the metanotum and follows to the apex of the abdomen. Two longitudinal, lateral stripes on the outer margin

of the buccula followed later to the posterior coxae. Reddish eyes. Antennomeres I and II pale-reddish, and III and IV pale-greenish. Segment I with red spots on the surface. Legs pale-greenish with the apex of the tarsi and labium, dark.

Morphology. Body smooth with short and sparse pilosity. Body length ranges from 3.15 to 3.80 mm and more than twice and shorter than four times the width of the body. Head smooth, near equal to pronotum width. Front without or slightly striate. Vertex without longitudinal groove, and marginate at the base. The apex of the front acute and extending over the base of clypeus. Clypeus strongly convex, cuneiform, with the base well delimited by a furrow, and longer than the mandibular plates. Eyes sessile, oval and broader than its length. Eyes located on the posterior margin of the head not touching the anterior margin of the pronotum. The antenna is equal to or greater than the length of the body with hairs shorter than the width of the antennomeres. The length of the antennomeres from highest to lowest: III > II > IV > I. Antennomere I cylindrical thicker than the others, without long and erect bristles near its apex with a row of short hairs. Antennomere I equal or longer than the head width, and longer than the vertex width. The labium is going beyond the apex of the hind coxa. Pronotum square with width 1,5 to twice its length. Pronotum collar, disc, and callus, obsolete. Scutellum absent. Legs with short, simple hairs, smaller than the width of the segments. Tibiae with hairs mixed with setae in a longitudinal row. Length of the tarsomere II 1,5 times the length of tarsomere I. Wing pads inconspicuous. Abdomen fusiform with short, sparse pilosity. The central opening of the dorsal abdominal gland, between the abdominal tergites III and IV evident and transverse. Proctiger present, cylindrical, with dorsal surface showing microtrichia that extends to the abdomen dorsally. Wing pads unicolored and greenish.

Morphometric description. Nymph III can be distinguished from nymphs I and II by wider dorsal head 118.18-140% of antennomere I length, (versus 66.66-105.88%), and smaller than in nymphs IV and V (versus 141.66-232.19%) ($p = 0.00000002$). The greater antennomere I, 76.47-87.5% of the antennomere IV length, concerning nymphs I and II (versus 40-64.28%) and smaller than in IV and V nymphs (versus 89.47-139.13%) ($p = 0.0000$) (Tab. 3).

Description of fourth stage nymph (Fig. 6)

Coloration. General color light brown, greenish with red stripes. Head with seven longitudinal red stripes. Two lateral stripes at eye level are running to the apex of the abdomen, and not extending along the outer margin of the antennomere I. Two stripes near the inner margins of the eyes extending from the antennal insertion to the apex of the abdomen. A dorsal median stripe, emerging from the top of the front to the base of the head where it forks and meets in the metanotum where it follows in a single stripe to the apex of the abdomen. Two longitudinal, lateral stripes on the outer margin of the buccula extending to the posterior coxae. Reddish eyes. Antennomeres I and II reddish, and III and IV greenish. Antennomere I with red spots on the surface. Legs greenish brown with the apexes of the tarsi and labium, dark. Wing pads unicolored, greenish.

Morphology. Smooth body with short and sparse pilosity. Body length is ranging from 4.05 to 4.80 mm, longer than four times and less than five times, the width of the body. Head smooth, smaller than pronotum width. Front without or slightly striated, vertex without apparent longitudinal groove, no marginated behind. The apex of the front extending acutely over the base of clypeus. Clypeus strongly convex, cuneiform, longer than the mandibular plates, with the base well delimited by a groove. Eyes sessile, oval and broader than the length. Eyes located in the posterior margin of the head not touching the anterior margin

of pronotum. Antenna greater or equal to body length with short pilosity shorter than the width of antennomeres. The length of the antennomeres from highest to lowest: III > II > I > IV. Antennomere I cylinder, thicker than the others, without long and upright bristles near the apex, and showing a row of short bristles. Antennomere I broader than or equal to the width of the head and longer than the width of the vertex. The labium is reaching the apex of the hind coxae. Pronotum quadrangular with its width 1.5 to twice its length. Pronotum collar, disk, and callus, obsolete. Scutellum absent. Legs with short, simple hairs, smaller than the width of the segments, mixed with semi-erect bristles in longitudinal rows, more evident in the tibiae. Wing pads triangular, extending to the apex of the abdominal tergite IV. Anterior wing pad near the size of posterior ones. Abdomen fusiform with short, and sparse pilosity. The central opening of the dorsal abdominal gland, in the intercession of the abdominal tergites III and IV, evident and transverse. Proctiger present, cylindrical, dorsal surface with microtrichia that extends to the abdomen dorsally.

Morphometric description. Nymph IV of *C. corpoicanus* can be distinguished from other nymph instars by displaying differences in its wing pads. From nymphs I, II, and III by the presence of wing pads (versus absence of wing pads or inconspicuous in nymph III). From nymph V by having smaller length of wing pads over body length, 17.70-22.22% (versus 28.30-32.5%) (KWp = 0.0004). Nymph IV of *C. corpoicanus* can also be differentiated from all other nymphs by presence of the following additional characters: greater dorsal head width, 141.66-153.84% of antennomere I length, in relation to nymphs I, II and III (versus 66.66-140%) and lower than Nymph V (versus 160.54-232.19%) ($p = 0.00000002$); and smaller dorsal head width, 38.23-40% of the antennomere II length, in relation to nymphs I, II and III (versus 42.85-81.81%) and higher than Nymph V (versus 27.28-35%) ($p = 0.0000$) (Tab. 2).

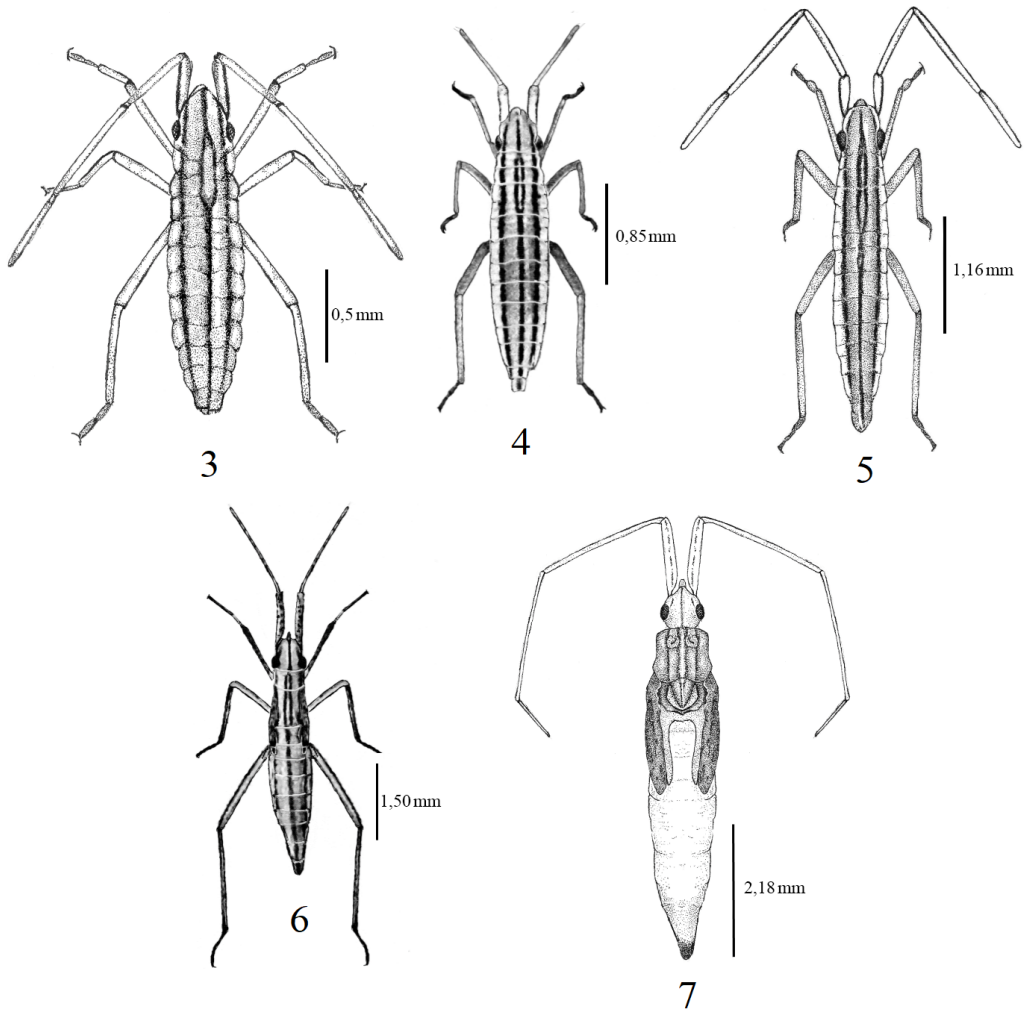
Description of fifth stage nymph (Fig. 7)

Coloration. General color, light greenish brown with red spots and stripes. Head with a single dark red, dorsal, median stripe emerging from the apex of the front and extending to the base of the head. If there is a stripe on the inner margin of the eye, only reaching the base of the head. Central pale stripe is emerging from the apex of the pronotum to the apex of scutellum. Black eyes. Antennomeres I and II reddish. Antennomeres III and IV greenish. Antennomere I with red spots on the surface. Legs greenish brown. The apex of the tarsi and labium, dark. Dark colored wing pads with outer margins of anterior wing pads pale.

Morphology. Body smooth with short and sparse pilosity. Length is longer than 6.0 mm, more than five times the width of the body. Head smooth, narrower than pronotum width. Frons striated, vertex with a longitudinal groove, not marginated at the base. The apex of the front extending acutely over the base of the clypeus. Clypeous strongly convex, cuneiform, with the base well delimited by a groove, and longer than the mandibular plates. Eyes sessile, oval, broader than the length, located in the posterior margin of the head, and not touching the anterior margin of pronotum. Antenna shorter than the length of the body, with hairs smaller than the width of antennomeres. The range of the antennomeres from highest to lowest: III > II > I > IV. Antennomere I cylindric, thicker than others, with rows of short bristles and microtrichia. Antennomere I higher than or equal to the width of the head and longer than the width of the vertex. The labium is reaching the apex of the middle coxae. Pronotum trapezoid with a width less than 1.5 times its length. Pronotum collar, disk, and callus, present. Scutellum present. Legs with short, simple hairs, smaller than the width of the segments, mixed with semi-erect bristles in longitudinal rows, more evident in the tibiae. Length of tarsomere II near the same as tarsomere I. Wing pads narrow and elongated, reaching abdominal tergite IV. Anterior wing pads are more extended than

posterior ones. The abdomen fusiform with short, and sparse hairs. The central opening of the dorsal abdominal gland evident and transverse. Proctiger present, cylindrical, dorsal surface with microtrichia that extend to the abdomen dorsally.

Morphometric description. Nymph V of *C. corpoicanus* can be distinguished from the other nymphal instars by showing differences in its wing pads of nymphs I, II and III by the presence of wing pads (or absence of wing pads or these inconspicuous ones). From the Nymph IV, the length of the wing pads over the length of the body 28.30-32.5% (versus 17.70-22.22%) ($p = 0.0004$), on the length of the antennomere I ($p = 0.0004$), on antennomere II length, 87.5-100% (versus 52.94-60%) ($p = 0.0004$), on the antennomere III length, 88.11-111.03% (versus 44.73-50%) ($p = 0.0004$), on the antennomere IV length, 198.73-213.04% (versus 89.47-105.88%) ($p = 0.0004$). Smaller values of interocular distance over body length, 4.50-7% (versus 9.21-14.73%) ($p = 0.000001$) support the separation of the nymph V from other nymphal instars (Tab. 2).



Figures 3-7. Nymphal stages of *C. corpoicanus*. 3. Instar I. Scale: 0.5 mm. 4. Instar II. Scale: 0.85 mm. 5. Instar III. Scale: 1.16 mm. 6. Instar IV. Scale: 1.50 mm. 7. Instar V. Scale: 2.18 mm. / 3. Estadio I. Escala: 0,5 mm. 4. Estadio II. Escala: 0,85 mm. 5. Estadio III. Escala: 1,16 mm. 6. Estadio IV. Escala: 1,50 mm. 7. Estadio V. Escala: 2,18 mm.

Table 3. Results of principal component analysis (PCA) for nymphae of *C. corpoicanus*. Bold values are the ones that most influence the divergences. / Resultados del análisis de componentes principales (ACP) para ninfas de *C. corpoicanus*. Los valores en negrita son los más influyentes en las divergencias.

Jolliffe cut-off= 0.0020557		
Axis	1	2
Eigenvalues	0.034893	0.005373
% Variance	74.262	11.435
Body length	-0.03939	-0.0743
Body width	0.09417	0.1116
Dorsal head width	0.1932	0.07204
Head side length	0.1338	0.0516
Vertex width between eyes	0.1682	0.08935
Antennomere I length	-0.09137	0.2666
Antennomere II length	-0.1407	0.4339
Antennomere III length	0.1403	0.6221
Antennomere iv length	0.3686	-0.00579
Labium length	0.3756	0.08566
Pronotum length	0.05625	0.05953
Pronotum width	0.1168	0.002504
Hind femur length	-0.1335	0.3328
Hind tibia length	0.03879	0.4359
Hind tarsus length	0.07407	-0.05388
Wing pads length	-0.7346	0.07257

An identification key for the five nymphal stages of *Cynodonmiris corpoicanus*

- 1. (N1. N2) Wing pads absent; acute projection of the apex of front absent or vestigial; clypeus is not heavily swollen; pilosity of antennomere I with 2 to 4 setae long erect and close to the apex; antennomere I without red spots; proctiger not evident 2
- 1'. (NIII. NIV. NV) wing pads present or inconspicuous; acute projection of the apex of front visible; clypeus strongly convex and cuneiform; antennomere I without long setae near the apex; antennomere I with red spots; proctiger present cylindrical-conical shape and with dorsal surface showing many microtrichias that extend to the abdomen dorsally 3
- 2. (NI) Relationship among the length of antennomeres from highest to lowest: III>IV>II>I; length of labium reaching the apex of hind coxae; lower values in body width with 46.87-56.66% of the length of antennomere IV; higher values in the posterior length of the tarsus 37.14-44.44% of the hind tibiae length (Nymphal instar I)
- 2'. (NII) Relationship among antennomeres length from highest to lowest: III>II>IV>I. Labium extending beyond the apex of hind coxae; greater interocular distance 130.76-

- 141.66% of the length of antennomere I; smaller length of antennomere I. 58.62-64.28% of length of antennomere IV; higher values in body width with 60.71-86.67% of the length of antennomere IV; lower values in the posterior length of the tarsus 25.00-34.62% of the hind tibiae length (Nymphal instar II)
3. (NV) - Body length greater than 6 mm. Antennomere I with black microtrichias. The apex of the labium reaching the median coxae. Pronotum with collar calluses and disc well visible; lateral wing pads narrow elongated and dark color; the anterior ones with pale margins reaching the tergite abdominal IV; the anterior wing pads longer than the next ones. The greater length of wing pads 28.30-32.5% of body length (Nymphal instar V)
- 3'. (NIII. NIV) - body length less than 6 mm; antennomere I without black microtrichias; apex of labium reaching or beyond apex of hind coxae; pronotum with collar. calluses and disc obsolete; lateral wing pads. triangular. uniform color. extending to apex of abdominal tergite IV; anterior wing pads near size of posterior ones or shorter 4
4. (NIII) Relationship among antennomeres length from highest to lowest: III>II>IV>I. Labium length beyond the apex of hind coxae; head width approximately equal to pronotum width; smaller interocular distance 144.44-200.00% of length antennomere I. Higher length antennomere I 76.47-87.50% of antennal IV length; higher values in the body width with 60.71-86.67% of the antennal IV length; lower values in the posterior length of the tarsus 25.00-34.62% of the hind tibiae length (Nymphal instar III)
- 4'. (NIV) The relationship among antennomere length from highest to lowest: III>II>I>IV; length of labium reaching the apex of posterior coxae; head width shorter than pronotum width; smaller length of wing pads. 17.70-22.22% of body length (Nymphal instar IV)

Conclusions

Considering the duration of *C. corpoicanus* life cycle their host plants and damage caused, it could become a potential pest of Cundiboyacense High Plateau pastures although it still occurs in low populations with respect to *Collaria scenica* (Stål, 1859) and *C. oleosa* (Distant, 1883) incidence. *C. corpoicanus* should be also considered a potential pest by the insect-host plant relationships (Poaceae); life cycle length 49.3 days shorter than the main pest *C. scenica* 63 days; the period of rotation of pastures of 30 to 60 days in the Cundiboyacense Plateau, and the damage presented by chlorotic spots that produce wilt in the apical region of the hosts (Barreto and Osório 2015).

The morphometric analysis allowed to group useful characteristics to establish a key that allows the identification of *C. corpoicanus* nymphal stages. In addition, the key will contribute to add new nymph stage characteristics of other species of mirids pasture pests. As there are no publications with descriptions and diagnoses of nymphal stages of the main pests *Collaria scenica* and *C. oleosa*, further research should be carried out. The results will provide important data for the identification of pests in the field, their different stages of development, and establish the monitoring and integrated management of mirid pests.

Acknowledgments

We are grateful to Colciencias/ CNPq International Agreement (490149/2009-0) and Corpoica/Colciencias-Sena (240-2010) for financial support through the institutions Agrosavia—Corporación Colombiana de Investigación Agropecuaria and the Universidade Federal de Viçosa. Departamento de Entomologia. The authors especially thank to Jesús Gómez for his support in carry out the bug rearing and registration the specimen data, and to John Gallo for the plant maintenance, both from the Entomology Laboratory.

Literature Cited

- Barreto Triana, N. and Osorio Mejía, P. (2015)** El complejo de las chinches de los pastos. *Infortambo Andina*, 78: 16-20.
- Barreto-Triana, N., Ferreira, P.S.F., Osorio-Mejía, P.A. and Ferreira, L.S.F. (2018)** Plant bugs (Hemiptera: Miridae) associated with pastures in Colombia. *Zootaxa*, 4441(2): 390-400.
- Carulla, J. and Ortega, E. (2016)** Sistemas de producción lechera en Colombia: retos y oportunidades. *Archivos Latinoamericanos de Producción Animal*, 24(2): 83-87.
- Ferreira, P.S.F., Barreto-Triana, N. and Osorio-Mejía, P.A. (2013)** New species of plant bug associated with pastures in Colombia. and notes on the genera *Dolichomiris*. *Cynodonmiris*. and *Megaloceroea* (Hemiptera: Heteroptera: Miridae). *Zootaxa*, 3709(5): 473-482.
- Hammer, O., Harper, D.A.T. and Ryan, P.D.P. (2001)** Paleontological statistic software package for education and data analysis. *Palaeontologia Electronica*, 40(1): 1-9.
- Schuh, R.T. and Slater, J.A. (1995)** *True bugs of the world (Hemiptera: Heteroptera): Classification and natural history*. Cornell University Press. Ithaca. USA. 336 pp.
-

Erratum. The following amendment was included on page 678, first paragraph of Materials and Methods, lines 6-7:

It said: [...] plastic cylinder with muslin windows until to get postures. During the permanence of bugs [...].

Now it says: [...] plastic cylinder with muslin windows until to get postures. The insects and biological material analyzed for this study, were collected under the collection frame permission 1466 of 2014 issued by the Autoridad Nacional de Licencias Ambientales to the Corporación Colombiana de Investigación Agropecuaria. During the permanence of bugs [...].

3 November 2021