Morphological Variation Of The Tanzanian Tailed Net-Winged Beetle *Lycus Trabeatus* Guérin-Méneville (Coleoptera: Lycidae) Connotes Subspecific Delimitation

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Abstract: Two morphotypes of the Tailed Net-winged Beetle Lycus trabeatus Guérin-Méneville, 1835 (Lycidae; Coleoptera), currently listed as a monotypic form, were identified and collected from the field in the southern highlands of Tanzania, where they were uncommon. One category was identified as a holotype female and the other one appeared to be a less described paratype female. Their morphological analysis reveals significant variation that connotes subspecific delimitation. The landmarks here reported as the basis for sub-categorization of L. trabeatus are mainly associated with the elytra upon which two new subspecies namely Lycus t. trabeatus and Lycus t. matojoi are proposed. The findings also expand the biogeographic docket of this insect.

Index Terms: Coleoptera, holotype, Lycidae, Lycus trabeatus, monotypic, paratype, species, subspecies

1 INTRODUCTION

THE Tailed Net-winged Beetle, Lycus trabeatus (scientific synonym Chlamydolycus trabeatus), belongs to the family Lycidae of the order Coleoptera (Bocak and Bocakova, 1998; Miller, 2000; Kazantsev, 2004; Dvorak and Bocak, 2007). The species reaches a length of about 22–31 mm (0.87-1.2 in); its pronotum is black with orange edges; elytra vary – some widely expanded with a three-quarter constriction along the length, some slender and others intermediate, black at base and tip but not on expanded portion; antennae black and mildly serrate; femora orange and the reminder of legs black (Lawrence et al., 2000; Weaving et al., 2004; Triplehorn and Johnson, 2005; BioLib.cz., 2012). Feeds on flowers; inhabits subtropical forests, savannas and grasslands; occurs in Ethiopia, Eritrea, Congo and South Africa with only scanty data from Tanzania (BioLib.cz., 2012; Atkins and Webb, 2012; Weaving et al., 2004). Herein, the morphological variation between two morphotypes of L. trabeatus is unravelled and their systematics reassessed for taxonomic review.

2 MATERIALS AND METHODS

2.1 Species Sampling

Two morphotypes here proposed as Lycus t. trabeatus (n = 2) and Lycus t. matojoi (n = 3) were captured at Mkwawa University College of Education (MUCE) campus, some 2 km north of Iringa Municipal headquarters in the southern highlands of Tanzania (7° 46' 0" South, 35° 42' 0" East), and preserved in 100% ethanol for morphological analysis. Species identification was guided by BioLib.cz. (2012) and Weaving et al. (2004).

2.2 Morphometry

Morphological analysis of this study adopted the descriptions of Bocacova (2001), Kazantsev (2010), Herrmann and Háva (2010) and Lamb et al. (2013), with necessary modifications. Parameters analysed are summarized in Table 1. Total length (TL) comprises linear distance from anterior margin of pronotum to apex of elytra. Antennal length (AL) comprises linear distance of antenna from base to apex. Prothoracic dimensions include pronotal length (PL) – maximum length of pronotum measured from anterior margin to posterior margin, and the pronotal width (PW) – maximum linear width of pronotum. Elytral dimensions include elytral length (EL) – maximum linear distance from shoulder to apex of elytron, elytral width (EW) – maximum linear width of elytron, and the humeral width (HW) measured between the most anteriorly positioned points, i.e., the humeral angles. Other elytral dimensions analysed are elytral lobe length (ELL) – linear distance of elytron apical lobe, elytral lobe width (ELW) – maximum linear width of elytron apical lobe, elytral fold width (EFW) – maximum linear width of inward elytron fold, as well as the elytral texture and rugosity.

2.3 Variation analysis

Intraspecific variation of L. trabeatus was mainly analyzed based on the homogenized ratios of the elytron morphological datasets. Similarity significance was assessed using Chi-square (χ^2) test based on the following Null Hypothesis, H0: $\chi^2A = \chi^2B$ (i.e., there is no difference between elytral ratios of both morphotypes), where χ^2A = mean ratios of Lycus t. trabeatus, and χ^2B = mean ratios of Lycus t. matojoi. Ratios analysed are EW/EL, EW/HW and EFW/EW, coupled by nonparametric diagnosis of the elytral texture and rugosity.

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Table 1: Morphological parameters analysed and their definitions

Parameters	Definitions
Total length (TL)	Linear distance from anterior margin of pronotum to apex of elytra
Antennal length (AL)	Linear distance of antenna from base to apex
Pronotal length (PL)	Maximum length of pronotum measured from anterior margin to posterior margin
Pronotal width (PW)	Maximum linear width of pronotum
Elytral length (EL)	Linear distance of elytron from shoulder to apex of elytron
Elytral width (EW)	Maximum linear width of elytron
Humeral width (HW)	Maximum linear width of humerus measured between the most anteriorly positioned points i.e. the humeral angles
Elytral lobe length (ELL)	Linear distance of elytron apical lobe from base to apex
Elytral lobe width (ELW)	Maximum linear width of elytron apical lobe
Elytral fold width (EFW)	Maximum linear width of elytron fold
Elytral texture and rugosity	Physical smoothness and constriction of elytron

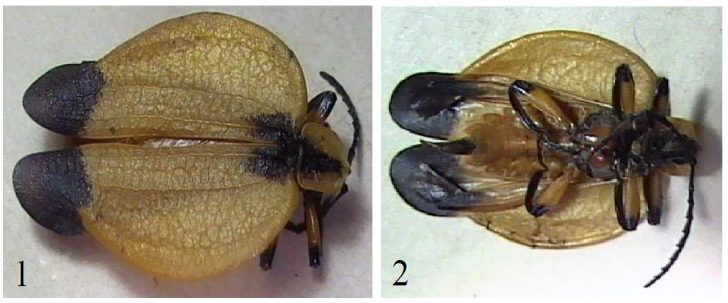
3 RESULTS AND DISCUSSION

3.1 Lycus trabeatus trabeatus (Fig. 1-4)

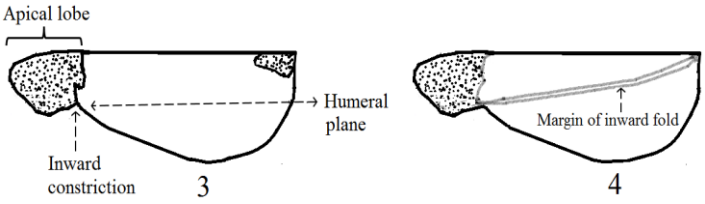
Material: Holotype ♀♀, Tanzania (southern highlands), 7.46.0°S, 35.42.0°E, 14-15 April 2014, Lycus t. trabeatus (here designated).

Etymology: The subspecies name is adopted from the existing species epithet.

Description: Female. Relatively larger with 22 mm total length and 8 mm humeral width. Antennal length of 10 mm hence almost half the TL. Prothorax almost as broad as long, measuring 4 mm in length and in width. Elytron measuring 18 mm in length, i.e. three-quarters the TL, and bow-shaped (widely broadened) with 8 mm elytral width, which is comparable with HW and one-third the TL. Elytron has a distinct constriction at 16 mm (three-quarters) level down the length. This constriction is emerged into a black, cordate (heart-shaped) apical lobe whose length (5 mm) roughly equals the width. Elytron has a distinct inward fold of 6 mm width (i.e. three-quarters the EW or HW) running longitudinally from the elytral base to posterior margin of the apical lobe. Elytra have complex leathery texture indicating substantial rigidity.



Figures 1-2: Lycus t. trabeatus, female: 1 - dorsal view; 2 - ventral view.



Figures 3-4: Details of female elytron of Lycus t. trabeatus: 3 - dorsal view; 4 - ventral view.

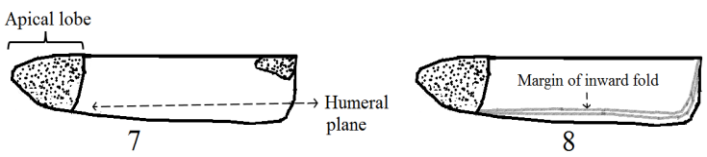
3.2 Lycus trabeatus matojoi (Fig. 5-8)

Material: Paratype**,** ♀♀♀, Tanzania (southern highlands), 7.46.0°S, 35.42.0°E, 14-15 April 2014, Lycus t. matojoi (here designated).

Etymology: The subspecies is named after Dr. Nicodemus D. Matojo, the collector and novelist of the type series.

Description: Female. Relatively smaller, averagely measuring 18 mm in total length and 8 mm in humeral width. Antennal length of 10 mm, i.e., almost half the TL. Pronotal length equals the width, measuring 3 mm each. Elytra slightly smaller, measuring 15 mm in length (three-quarters the TL) and 4 mm in width (half the HW and almost a quarter the TL). Elytral margins are linear with no extended portion, neither any constriction. Elytron inward fold of 1 mm width, i.e. a quarter the EW.

Figures 5-6: Lycus t. matojoi, female: 5 - dorsal view; 6 - ventral view.



Figures 7-8: Details of female elytron of Lycus t. matojoi: 7 - dorsal view; 8 - ventral view.

Table 2 summarizes the homogenized morphological ratios of the two morphotypes of L. trabeatus.

Table 2: Morphometric ratios of Lycus t. trabeatus (Ltt) and Lycus t. matojoi (Ltm)

Morphological dimensions	Measures (mm)		Ratio computations		
	Ltt	*Ltm*	Denominators	*Ltt* Ratios	*Ltm* Ratios
Total length (TL)	22	18	-	-	-
Antennal length (AL)	10	10	TL	1.0	1.0
Pronotal length (PL)	4	3	TL	0.2	0.2
Pronotal width (PW)	4	3	PL	1.0	1.0
Elytral lobe length (ELL)	5	4	TL	0.2	0.2
Elytral lobe width (ELW)	5	4	ELL	1.0	1.0
Elytral length (EL)	18	15	TL	0.8	0.8
Elytral width (EW)	8	4	HW	1.0	0.5
Elytral width (EW)	8	4	EL	0.4	0.3
Elytral fold width (EFW)	6	1	EW	0.8	0.3

3.3 Intraspecific variation

Parametric results of the elytral datasets have generated significant difference between Lycus t. trabeatus and Lycus t. matojoi, with minimal overlap for each character. χ^2 (Chi-square) value for elytral ratios is 0.51 indicating that the ratios differ significantly ($p = 0.78$ hence > 0.05) between the two morphotypes (Fig. 9). Additionally, a number of other characters are unique to either of the two morphotypes, including the inward elytral constriction, laterally protracted (bow shaped) elytra, and highly leathery texture (i.e., high rigidity), exclusively in Lycus t. trabeatus.

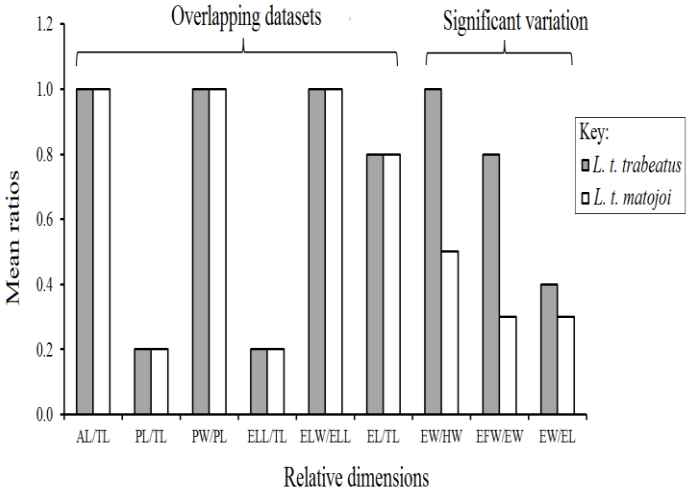


Figure 9: Comparative datasets of morphometric ratios between Lycus t. trabeatus and Lycus t. matojoi.

4 CONCLUSIONS

Despite broad overlap of a wide range of antennal, pronotal and elytral morphometrics, significant ($p > 0.05$) variation exists between the two morphotypes of L. trabeatus with distinct subspecific delimitation of taxonomic importance, including differential elytral protraction, constriction, folding and texture. In light of the findings, the two morphotypes do not appear as monotypic form of the existing species. To accommodate the notable taxonomic variation, L. trabeatus should be re-categorized into two new subspecies here named as Lycus t. trabeatus which is a well-known holotype material of the species, and Lycus t. matojoi which appears to be its paratype.

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