
Seasonal abundance and sexual variation in morphometric traits of *Oxelytrum discicolle* (Brulle, 1840) (Coleoptera: Silphidae) in a Brazilian Atlantic Forest

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Abstract

Ferreira, P.S.F.; Pires, E.M.; Guedes, R;N.C.; Mendes, M. and Coelho, L.A. **Seasonal abundance and sexual variation in morphometric traits of *Oxelytrum discicolle* (Brulle, 1840) (Coleoptera: Silphidae) in a Brazilian Atlantic Forest.** *Biota Neotrop.* May/Aug 2006, vol. 6, no. 2, <http://www.biotaneotropica.org.br/v6n2/pt/abstract?article+bn02206022006>. ISSN 1676-0611

A total of 293 specimens of *Oxelytrum discicolle* were sampled weekly over a period of two years using a black light trap. The study took place in an Atlantic Forest reserve located near Viçosa city, Minas Gerais State, Brazil. The period of peak abundance of *O. discicolle* occurred during the wet season between the months of October and March. Statistical analysis showed that the abundance of individuals was significantly and positively correlated with temperature, but not with rainfall or relative humidity. Of 28 morphological measurements taken on each collected specimen, seven were found to be sexually dimorphic; however, neither morphology nor the degree of sexual dimorphism varied significantly among seasons.

Key words: *Oxelytrum discicolle*, population dynamic, sexual dimorphism, Minas Gerais

Resumo

Ferreira, P.S.F.; Pires, E.M.; Guedes, R;N.C.; Mendes, M. and Coelho, L.A. **Abundância sazonal e variação morfológica nos caracteres sexuais de *Oxelytrum discicolle* (Brulle, 1840) (Coleoptera: Silphidae) em uma floresta Atlântica brasileira.** *Biota Neotrop.* Mai/Ago 2006, vol. 6, no. 2, <http://www.biotaneotropica.org.br/v6n2/pt/abstract?article+bn02206022006>. ISSN 1676-0611

Um total de 293 espécimes de *Oxelytrum discicolle* foram amostrados semanalmente num período de dois anos usando uma armadilha tipo “black light”. O estudo foi feito em uma reserva de Mata Atlântica localizada próximo à cidade de Viçosa, Minas Gerais, Brasil. O período de pico de abundância de *O. discicolle* ocorreu durante a estação úmida, entre os meses de outubro e março. A análise estatística mostrou que a abundância dos indivíduos foi significativamente e positivamente correlacionada com a temperatura, mas não com a precipitação e umidade relativa. De 28 características morfológicas tomadas em cada espécime coletado, sete foram encontradas sexualmente dimórficas, entretanto, nem morfologia nem o grau de dimorfismo sexual variaram significativamente entre as estações.

Palavras-chave: *Oxelytrum discicolle*, dinâmica populacional, dimorfismo sexual, Minas Gerais

Introduction

The Silphidae (carrion beetles or burying beetles) are a distinct group living on dead vertebrate remains from the early decay to the late dry stage. There are conflicting descriptions of the food habits of silphids. Reed (1958) states that the immatures feed on the carrion and infrequently on maggots, while adults fed almost always on maggots. Payne and Crossley (1966) found adult silphids feeding only on maggots and did not mention immature food habits. Oliveira-Costa (2003) states silphids predators and Carvalho & Linhares (2001) assert the carrion beetles are both predators and saprophagous.

The biological, systematic and ecological studies of carrion beetles of Brazil are very few. In a majority of papers the species of burying beetles are cited in inventories of collected insects. Outside Brazil, there is more information about silphid ecology (Anderson 1982, Wilson et al. 1984), physiology (Ements & Zhulidov 1982, Wilson & Knollenberg 1984), biology (Ements & Zhulidov 1982, Peck & Anderson 1982, Prins 1984) and systematic (Kryzhanouskii & Sabiroba 1981, Schawaller 1977). According Costa (2000) the world fauna of carrion beetles is represented by 14 genera and 175 species. Neotropical Region has nine genera and 82 species. South America has six genera and 24 species, and one genus and three species in Brazil according Peck & Anderson, (1982), and two genera and five species according Costa (2000). The major ecological role of the silphids is their living intimately with the decomposition process of vertebrate carcasses. Jointly with the flies and other beetles they are of major importance in studies of Forensic entomology (Catt & Haskell 1990).

The objectives of this manuscript are to contribute to knowledge of Neotropical Silphidae in regard to the abundance of adults of *Oxytelus discicolle* under the influence of climate in dry and wet seasons; to evaluate if there are any morphological traits in different dry and wet seasons and between sex. Furthermore, the results will yield information for to researchers in Forensic entomology in Brazilian Atlantic Forest.

Material and Methods

The research took place on the natural reserve of Atlantic Forest set at municipality of Viçosa, State of Minas Gerais, Brazil, called Bacia do Córrego do Paraíso (coordinates: 20°45'16,5" S and 42°51'53,2" W). The sample method employed a black light trap (Ferreira & Martins 1982). The light trap was operated once a week during the period of 6:00 PM to 6:00 AM. The weather data were taken from Meteorological Station of Universidade Federal de Viçosa.

The sampling period was between August 1981 to July 1983. Specimens were identified at Identification Center for Fitophagous Insects (CIIF), Universidade Federal do Paraná (UFPR).

A total of 293 individuals of *Oxytelus discicolle* was used in this study (170 female and 123 males).

The quantitative characters are based on measurements of 28 morphological features. They were made using an ocular micrometer Wild (10X) in a Wild M 5 microscope at various objective magnifications. The measurements of morphological structures were taken in millimeters and the values were computed for use in the general analysis. Figure 2 show exactly how the quantitative measurements were made: body length (Figure 2-1) = \bar{O} head length, with length of the pronotum and elytron length, maximum body width (Figure 2-2), head length (Figure 2-3), head width (Figure 2-4) frons width (Figure 2-5), distance between antennal insertion (Figure 2-6), length of the antennae (Figure 2-7), length of the antennal club (Figure 2-8), length of scape (Figure 2-9), length of 2nd and 3rd antennal segments (Figure 2-10), length of compound eye (Figure 2-11), width of compound eye (Figure 2-12), width of the pronotum base (Figure 2-13), median pronotum length (Figure 2-14), maximum pronotum width (Figure 2-15), scutellum length (Figure 2-16), width of the scutellum base (Figure 2-17), elytron length (Figure 2-18), maximum elytron width (Figure 2-19), length of the anterior femur (Figure 2-20), length of the anterior tibia (Figure 2-21), length of the anterior tarsi (Figure 2-22), length of the median femur (Figure 2-23), length of the median tibia (Figure 2-24), length of the median tarsi (Figure 2-25), length of the posterior femur (Figure 2-26), length of the posterior tibia (Figure 2-27), and length of the posterior tarsi (Figure 2-28).

Two statistical analyses were employed: correlation analysis (PROC CORRE: SAS Institute, 2001) and two-way multivariate analysis of variance using the procedure PROC GLM with the MANOVA statement from SAS (SAS Institute 2001).

The influence of the weather parameters of rainfall, temperature and relative humidity on the abundance of *O. discicolle* was tested using correlation analysis (PROC CORR; SAS Institute 2001). The full set of morphometric data was subjected to a two-way multivariate analysis of variance with season and sex as independent variables using the procedure PROC GLM with the MANOVA statement from SAS (SAS Institute 2001). Subsequent two-way univariate analyses of variance (PROC GLM; SAS Institute 2001) were carried out for each individual morphological trait complementing the multivariate analysis to recognize the traits that were indeed different between sex and/or season.

Results

A total of 293 specimens (170 females and 123 males) of *Oxytelus discicolle* were collected throughout the sampling period (August 1981 to July 1983) and this species showed seasonal peaks of abundance during the wet season, between the months of October to March (Figure 1). However, there was no difference between the female/male rates ($\pm 1.4:1.0$, respectively). The abundance of this species was only significantly and positively correlated with

temperature ($p < 0.05$). This fact suggests the temperature as the main factor to the fly activities of *O. discicolle* (Table 1).

The two-way multivariate analysis of variance for the 28 morphometric traits assessed (Figure 2) indicated significant effect of sex ($p < 0.05$), while season showed only marginally significant effect ($p = 0.05$) (Table 2). The interaction between sex and season was not significant (Table 2) and therefore was not further considered. The two-way univariate analyses of variance carried out for each individual trait indicated significant differences for seven morphological traits between the 28 assessed (Table 3). Among these seven traits, there were significant differences only between sex (Table 3).

Body and elytron length, length of the antennae and of the 2nd and 3rd antennal segments, maximum pronotum width and length of the median tibia and posterior tarsi were the traits showing significant differences between sexes (Table 3). Body and elytron length as well as length of the median tibia were longer for females, while length of antenna and of the 2nd and 3rd antennal segments, pronotum width and length of the posterior tarsi were longer in males (Table 4).

Discussion

The analysis of the 28 morphometric traits between sexes and seasons (0.05 at 5%) showed no significance. On the other hand, among opposite sexes was significant and related to sexual dimorphism (0.007 to 5.0%). The females showed to be larger than males by their body and elytra length. In general the larger length of the females is associated with reproductive features (Renthal et al., 2003). The males present larger antenna which appear to support larger number of receptor sensilla that increases, among other functions, its capacity to locate the females for mating (Chapman, 1998). Other characteristics found in the males were the largest width of the pronotum and posterior tarsi as well as the smaller length of the medium tibia. The meaning of these differences is not clear, but represent expressions of sexual dimorphism. Temperature was the only influence in the distribution of adults seasonal activity. The analysis between individuals of the same sex in different seasons showed no significance. The few individuals that appeared in the dry season appear to have had a delay in their development. This probable problem was not reflected in the 28 morphometric traits. The abundance of *O. discicolle* in the time of higher temperature or the wet season means the reproductive period of the species in the Atlantic forest is between October to March.

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Table 1. Correlations between abundance of *Oxelytrum discicolle* and weather parameters.

Weather parameters	Total number of <i>O. discicolle</i> collected	
	r	p
Rainfall (mm)	0.33	0.12
Temperature (°C)	0.43	0.03*
Relative humidity (%)	- 0.20	0.25

* Significant at $p < 0.05$.Table 2. Multivariate analysis of variance (MANOVA) for seasonal and sex differences in 28 morphometric traits of *Oxelytrum discicolle*

Sources of variation	Wilks' lambda	F	df _{numerator}	df _{denominator}	p
- Season	0.8617	1.50	28	262.00	0.05*
- Sex	0.8092	2.21	28	262.00	0.007*
- Season x Sex	0.9387	0.61	28	262.00	0.94

* Significant at 5.0% probability.

Table 3. Univariate analysis of variance (ANOVA) for seasonal and sex differences in 28 morphometric traits of *Oxelytrum discicolle* ($df_{error} = 289$)

Morphometric trait	Model		Sources of Variation			
	F	p	Season		Sex	
			F	p	F	p
Body length	5.87	0.002*	0.11	0.73	11.65	0.003*
Body width	1.25	0.29	-	-	-	-
Head length	0.55	0.58	-	-	-	-
Head width	0.16	0.95	-	-	-	-
Vertex width	0.03	0.97	-	-	-	-
Distance between antennal base	2.04	0.13	-	-	-	-
Length of the antennae	8.54	0.001*	0.30	0.58	16.72	< 0.001*
Length of the antennal club	0.32	0.73	-	-	-	-
Length of 1 st antennal segment	1.92	0.15	-	-	-	-
Length of 2 nd and 3 rd antennal segments	4.56	0.011*	0.01	0.91	9.11	0.002*
Length of compound eye	1.71	0.18	-	-	-	-
Width of compound eye	1.53	0.21	-	-	-	-
Width of the pronotum base	1.46	0.23	-	-	-	-
Median pronotum length	1.24	0.29	-	-	-	-
Maximum pronotum width	5.27	0.005*	0.75	0.39	9.25	0.002*
Escutellum length	1.79	0.17	-	-	-	-
Width of the escutellum base	0.30	0.74	-	-	-	-
Elytron length	14.68	< 0.001*	0.05	0.82	29.34	< 0.001*
Maximum elytron width	1.31	0.27	-	-	-	-
Length of the anterior femur	2.10	0.12	-	-	-	-
Length of the anterior tibia	2.51	0.08	-	-	-	-
Length of the anterior tarsi	0.71	0.49	-	-	-	-
Length of the median femur	0.10	0.91	-	-	-	-
Length of the median tibia	2.82	0.05*	0.57	0.45	5.02	0.03*
Length of the median tarsi	1.08	0.34	-	-	-	-
Length of the posterior femur	0.47	0.63	-	-	-	-
Length of the posterior tibia	1.41	0.25	-	-	-	-
Length of the posterior tarsi	6.54	0.002*	0.28	0.59	12.13	0.001*

* Significant at 5.0% probability.

Table 4. Morphometric differences (mm) (\pm SE) between males and females of *Oxelytrum discicolle*. Means followed by the same letter in a row are not significantly different at $p < 0.05$ by the *F* test.

Morphometric trait	Sex	
	Female	Male
Body length	23.29 \pm 0.18 a	22.40 \pm 0.22 b
Length of the antennae	5.51 \pm 0.07 b	5.81 \pm 0.07 a
Length of 2 nd and 3 rd antennal segments	1.05 \pm 0.01 b	1.09 \pm 0.01 a
Maximum pronotum width	7.66 \pm 0.07 b	7.99 \pm 0.08 a
Elytron length	15.80 \pm 0.13 a	14.71 \pm 0.15 b
Length of the median tibia	5.32 \pm 0.05 a	5.16 \pm 0.06 b
Length of the posterior tarsi	5.05 \pm 0.04 b	5.31 \pm 0.05 a

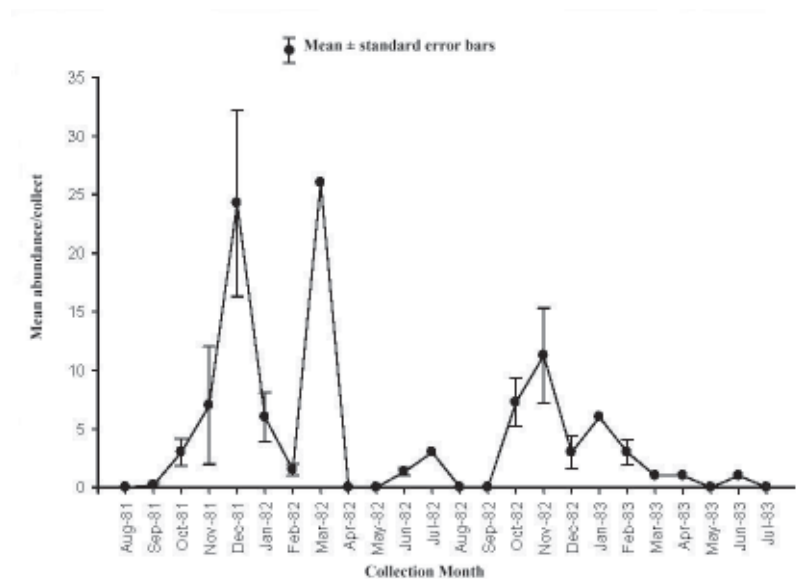


Figure 1 - The seasonal occurrence of 293 specimens of *Oxelytrum discicolle* throughout the sampling period (August 1981 to July 1983). The weekly samples results were combined to a monthly total as a single number.

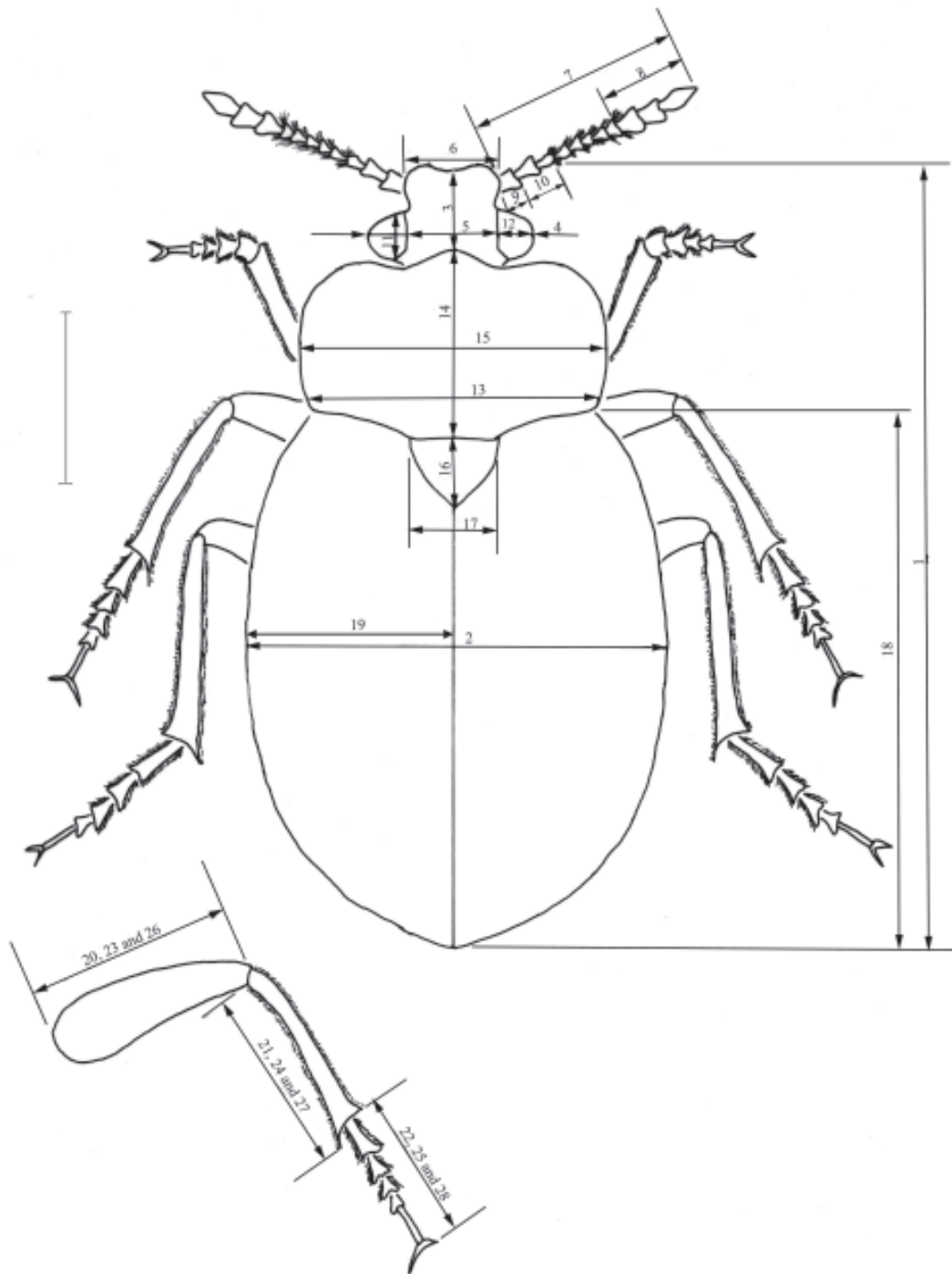


Figure 2 - Measurements of morphometric traits in *Oxelytrum discicolle* (Brulle, 1840). Scale (5 mm).

1 - body length (= \hat{O} head length, with length of the pronotum and elytron length); 2 - maximum body width; 3 - head length; 4 - head width; 5 - frons width; 6 - distance between antennal insertion; 7 - length of the antennae; 8 - length of the antennal club; 9 - length of scape; 10 - length of 2nd and 3rd antennal segments; 11 - length of compound eye; 12 - width of compound eye; 13 - width of the pronotum base; 14 - median pronotum length; 15 - maximum pronotum width; 16 - scutellum length; 17 - width of the scutellum base; 18 - elytron length; 19 - maximum elytron width; 20 - length of the anterior femur; 21 - length of the anterior tibia; 22 - length of the anterior tarsi; 23 - length of the median femur; 24 - length of the median tibia; 25 - length of the median tarsi; 26 - length of the posterior femur; 27 - length of the posterior tibia; 28 - length of the posterior tarsi.