

**MORPHOLOGICAL DIFFERENCES BETWEEN THREE SOUTH AFRICAN SPECIES OF
EVIDES DEJEAN, 1833 (COLEOPTERA: BUPRESTIDAE)**

D. N. MACFADYEN, B. K. REILLY
Department of Nature Conservation
Tshwane University of Technology
Private Bag X680
Pretoria, 0001, REPUBLIC OF SOUTH AFRICA
macfadyend@eason.co.za, reillybk@tut.ac.za

C. L. BELLAMY
Plant Pest Diagnostic Lab
California Department of Food & Agriculture
3294 Meadowview Road
Sacramento, CA 95832, U.S.A.
cbellamy@cdfa.ca.gov

AND

R. J. EISELEN
Statistical Consultation Service (STATKON)
University of Johannesburg (RAU)
P O Box 524
Auckland Park 2006, REPUBLIC OF SOUTH AFRICA

Abstract

The genus *Evides* Dejean, 1833 (Coleoptera: Buprestidae) belongs to the family of wood-boring beetles commonly known as jewel beetles. This comparative study was undertaken on the morphological characteristics of three species from field specimens, private collections and collections at the Transvaal Museum of Natural History. The genus *Evides* consists of eleven species and one subspecies in total worldwide. Nine species and one subspecies are endemic to Sub-Saharan Africa. One species is recorded from India and further species from Laos and Vietnam: Bellamy (World Catalogue, in prep.) The objective of the study was to quantify morphological differences between species representing the genus in South Africa. Specimens of *E. gambiensis* (Laporte & Gory, 1835), *E. interstitialis* (Obenberger, 1924) and *E. pubiventris* (Laporte & Gory, 1835) were collected in the Waterberg (Limpopo Province) and additional specimens of *E. pubiventris* were collected at Ezemvelo Nature Reserve (Gauteng Province). All three species are related, difficult to differentiate in the field and occur on the same host plants, marula (*Sclerocarya birrea* (A. Rich.) Hochst.) and false marula (*Lannea discolor* (Sonder) Engl.). Results indicate that there are morphological differences and species can be differentiated according to elytra length, total elytron width, eye size, frons length, frons width and abdomen length.

The large jewel beetle (Coleoptera: Buprestidae) fauna of southern Africa has received a number of recent revisionary works (Bellamy 2000; Bellamy & Holm 1986; Bily & Bellamy 2000; Gussmann 1995, 1997, 2000, 2002; Holm 1976, 1978, 1982; Holm & Bellamy 1985). These revisions highlighted the need for a detailed morphological study of the genus *Evides* Dejean 1833. Three species occur within South Africa: *E. gambiensis* (Laporte & Gory 1835), *E. interstitialis* Obenberger,



Fig. 1. *Evides pubiventris* (Laporte & Gory 1835), on foliage of *Lannea discolor* at Geelhoutbosch, Limpopo Province, January 1999. Photograph by C. L. Bellamy.

1924 and *E. pubiventris* (Laporte & Gory 1835) in connection with the distribution of their host plants, marula (*Sclerocarya birrea* (A. Rich.) Hochst.) and false marula (*Lannea discolor* (Sonder) Engl.) (family Anacardiaceae) (Bellamy *et al.* 1988, Picker *et al.* 2003). In this study, key morphological parameters were measured for each of these species to establish a frame of reference for their identification. Comparative notes on the taxonomy of each species are also provided.

Materials and Methods

Specimens were collected from Ezemvelo Nature Reserve and the Waterberg. Ezemvelo Nature Reserve is situated in the Rocky Highveld Grassland or Bankenveld veldtype, a transition between the monolithic fire climax grassland and savanna biomes (Acocks 1975). The site in the Waterberg, now part of Marakele National Park near Thabazimbi, represents the Mixed Bushveld (Acocks 1975). Areas with large numbers of *S. birrea* or *L. discolor* were selected in each site. Collection in the Waterberg was random as a result of greater host plant abundance. Collection at Ezemvelo Nature Reserve which was limited to where *L. discolor* occurred on the rocky hilltops.

Four field trips were conducted in the Waterberg during 2000, where accessible *S. birrea* and *L. discolor* were randomly checked. Twelve field trips to Ezemvelo Nature Reserve were conducted monthly during 2001. Specimens were collected in the early morning and late afternoon, utilizing the method of "beating" (Fourie 1993).



Fig. 2. *Evides gambiensis* (Laporte & Gory 1835), on foliage of *Lanena discolor* at Geelhoutbosch, Limpopo Province, January 1999. Photograph by C. L. Bellamy.

The three species collected *E. pubiventris* (Fig. 1); *E. interstitialis* and *E. gambiensis* (Fig. 2) were dislodged and fell onto the beating sheet, inactive as a result of the low ambient temperatures at that time of day. This method was unsuitable in the Waterberg, as the majority of host plants were of considerable height. A net extended on a pole (Fourie 1993) was used to collect specimens at this site. Specimens collected were labeled with information relating to capture (Fourie 1993). A total of 256 specimens was measured for comparative analysis. The number of specimens per species utilized in the analysis varied considerably due to abundance, *E. pubiventris* ($n = 203$), *E. interstitialis* ($n = 43$) and *E. gambiensis* ($n = 10$). These samples were statistically extrapolated to 256 specimens for this analysis.

Ten morphological parameters were measured for each species, including elytra length, right elytron width, total elytra width, head width, eye size, frons length, frons width, total body length, abdomen length, and abdomen width. Measurements were made using a standard electronic vernier caliper and standardized to two decimal places.

The lower confidence level (LCL) and upper confidence level (UCL) were determined for parameters analysed. The sample mean ($n = 256$) and 95% confidence limits were calculated for each parameter. Levene's test of homogeneity of variance was used to ensure equality of variance for each parameter ($P = 0.05$) and was followed by a one-way analysis of variance (ANOVA) for significance between and within parameters. Significant ANOVA's were followed by a *post hoc* Dunnett's T3 modified *t* test.

Table 1. Summary of mean body measurements inclusive of 95% confidence limits for the three species (in mm.).

Parameter	<i>E. pubiventris</i>	<i>E. interstitialis</i>	<i>E. gambiensis</i>	Combined
Elytron length	2.19	1.45	1.21	1.62
Elytron width	0.54	0.45	0.25	0.41
Total elytra width	1.08	0.90	0.50	0.83
Head width	0.63	0.31	0.29	0.41
Eye size	0.37	0.25	0.21	0.28
Frons length	0.42	0.26	0.25	0.31
Frons width	0.21	0.18	0.19	0.19
Total length	2.88	1.84	1.60	2.10
Abdomen length	6.10	2.25	0.80	3.05
Abdomen width	1.09	0.64	0.42	0.72

Results

Mean measurements and 95% confidence limits are shown for each morphological parameter in Table 1. Equivalency of variances ($P = 0.05$) indicate that elytra length, total elytra width, eye size, frons length, frons width, abdomen length were significant sources of variation and were subjected to ANOVA testing (Table 2). Right elytron width, head width, total length and abdomen width were not found to vary significantly and were excluded from further analysis. Elytra length ($F = 11,888.97$; $df = 2$; $P < 0.001$) and total elytra width ($F = 110,804.55$; $df = 2$; $P < 0.001$) were significantly greater for *E. pubiventris* than for *E. interstitialis*, each of which were in turn significantly greater than for *E. gambiensis* (Figures 3 and 4). Eye size ($F = 4,732.45$; $df = 2$; $P < 0.001$), frons length ($F = 5,999.47$; $df = 2$; $P < 0.001$), and frons width ($F = 165.27$; $df = 2$; $p < 0.001$) were also greater for *E. pubiventris* than for *E. interstitialis*; however, none of these parameters differed significantly between *E. interstitialis* and *E. gambiensis* (Figures 5–7). Abdomen length ($F = 318.15$; $df = 2$; $P < 0.001$) was significantly greater for *E. pubiventris* than for *E. gambiensis*; however, it did not differ significantly in either of these species from that of *E. interstitialis*, which exhibited a tremendous range of variation in this character (Figure 8).

Table 2. Levene's test of homogeneity of variances between morphological parameters measured in this study.

Morphological parameters	Levene Statistic	df1	df2	Significance
Elytra length	6.35	2	765	0.00
Elytron width	0.97	2	765	0.38
Total elytra width	7.69	2	765	0.00
Head width	0.77	2	765	0.46
Eye size	29.53	2	765	0.00
Frons length	13.21	2	765	0.00
Frons width	8.54	2	765	0.00
Total length	0.51	2	765	0.60
Abdomen length	12211.27	2	765	0.00
Abdomen width	1.45	2	765	0.24

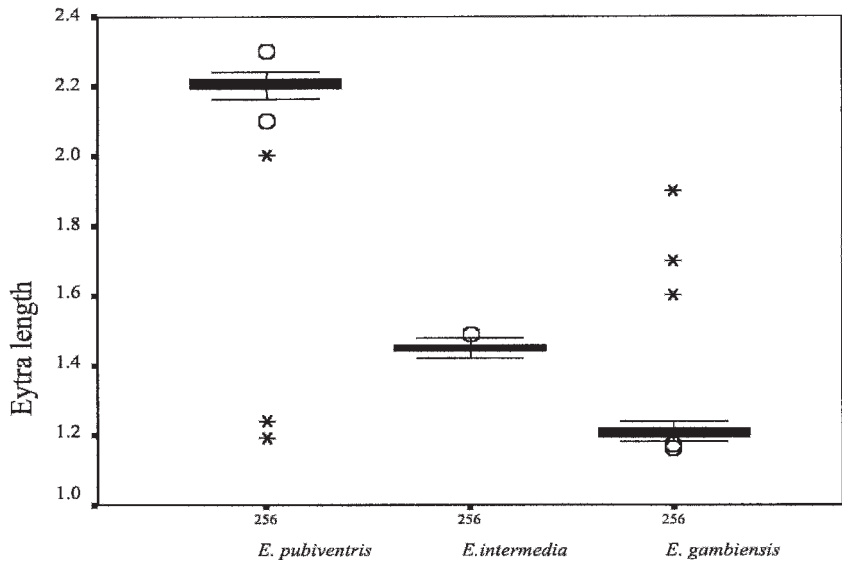


Fig. 3. Elytra length of three species of *Evides* (mean \pm S.E.)

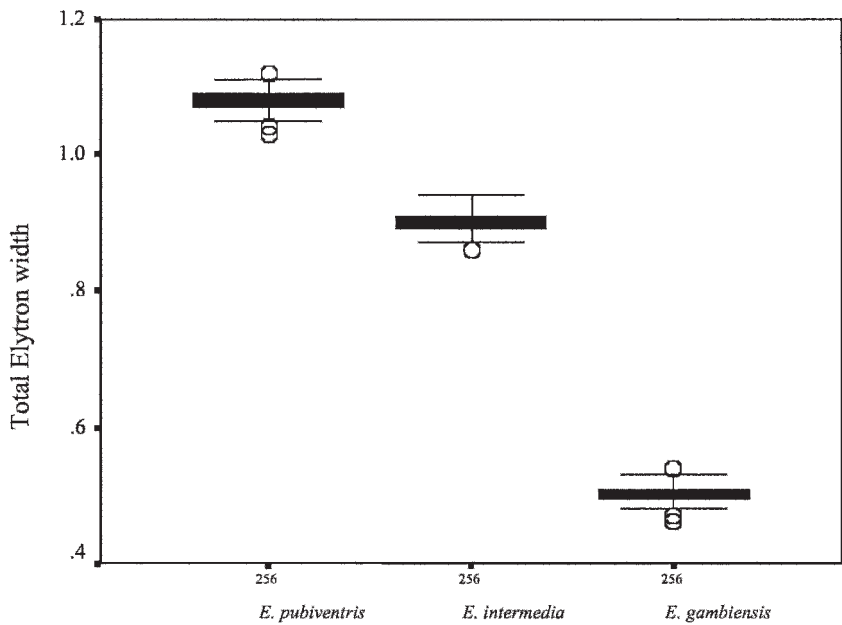


Fig. 4. Total elytra width of three species of *Evides* (mean \pm S.E.)

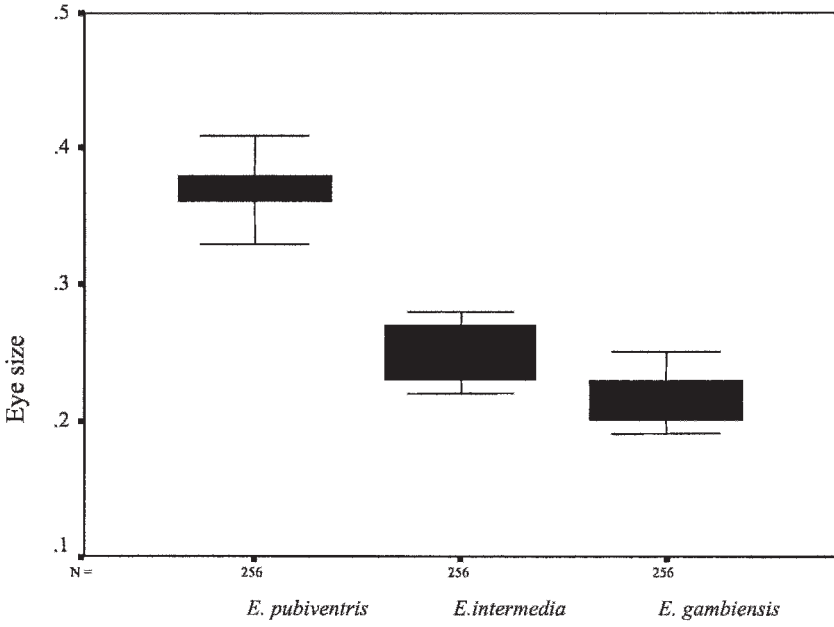


Fig. 5. Eye size of three species of *Evides* (mean \pm S.E.)

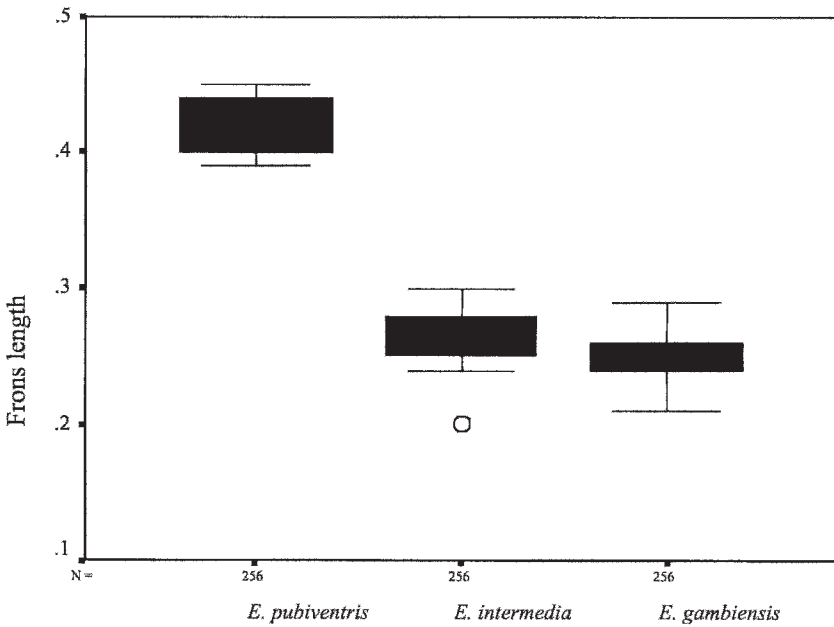


Fig. 6. Frons length of three species of *Evides* (mean \pm S.E.)

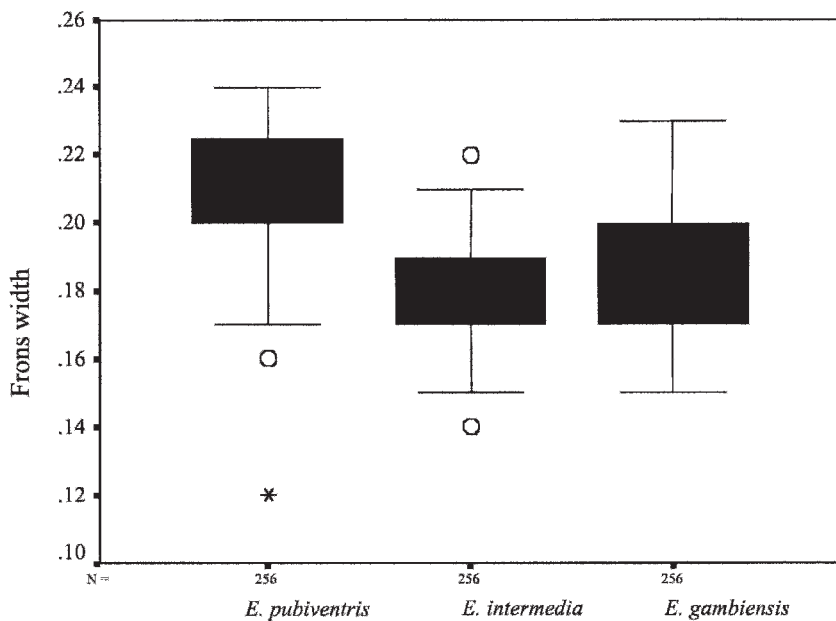


Fig. 7. Frons width of three species of *Evides* (mean ± S.E.)

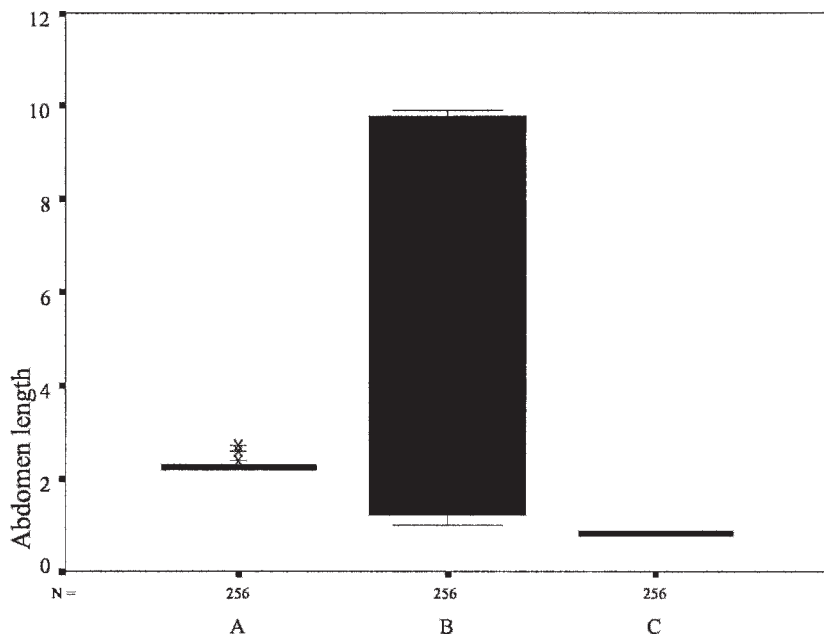


Fig. 8. Abdomen length of three species of *Evides* (mean ± S.E.)

Discussion

The taxonomy of *Evides* is complicated due to overlap in their distribution and similarities in size and coloration. The results of this study clearly show that *E. pubiventris* is the largest of the three South African species for nearly all morphological parameters measured. *Evides interstitialis* is by comparison smaller, while *E. gambiensis* is the smallest. The three species are very similar in appearance but exhibit diagnostic differences that allow them to be separated on the basis of size. Of the three species, *E. pubiventris* was the most abundant species encountered in the Waterberg during 2000, and it was the only species encountered at Ezemvelo Nature Reserve during 2001. *Evides interstitialis* was the second most abundant species during 2000, while *E. gambiensis* was the least. It is hoped that this study will provide a framework for future study on the behavior, life cycle and ecological importance of each species within this genus.

Acknowledgments

We would like to thank Neil MacFadyen, Morgan Hauptfleisch, Ruth Müller and Willem van der Merwe who assisted during the data collection period. A special thank you goes to Susan Strauss and Strilli Oppenheimer for free accommodation and access to the Waterberg and Ezemvelo Nature Reserve respectively. Financial support came from E. Oppenheimer & Son and Tshwane University of Technology.

Literature Cited

- Acocks, J. P. H. 1975.** Veld types of South Africa. *Memoirs of the Botanical Survey of South Africa* 40:128.
- Bellamy, C. L. 2000.** A revision of the African Coraebine genus *Alissoderus* Deyrolle, 1864 (Coleoptera: Buprestidae: Agrilinae). *Annals of the Transvaal Museum* 37(1):69–89.
- Bellamy, C. L., and E. Holm. 1986.** A revision of the African species of *Galbella* (Coleoptera Buprestidae). Department of Agriculture and Water Supply, Republic of South Africa, Entomology Memoirs, Number 63, 41 pp.
- Bellamy, C. L., R. L. Westcott, and D. S. Verity. 1988.** New synonymy, distributional and adult and larval host records for some southern African Buprestidae (Coleoptera). *The Coleopterists Bulletin* 42(1):73–83.
- Bily, S., and C. L. Bellamy. 2000.** A revision of the genus *Brachelytrium* Obenberger, 1923 (Coleoptera: Buprestidae: Anthaxiini). *Annals of the Transvaal Museum* 37(1):91–108.
- Fourie, I. 1993.** Collecting and preserving insects. Transvaal Museum, Pretoria. 1:1–30.
- Gussmann, S. V. M. 1995.** New species and subspecies of *Julodis* Eschscholtz (Coleoptera: Buprestidae) from southern Africa. *African Entomology* 3(2):111–129.
- Gussmann, S. V. M. 1997.** Systematic catalogue of *Julodis* Eschscholtz (Coleoptera: Buprestidae) from southern Africa. *African Entomology* 5(2):337–352.
- Gussmann, S. V. M. 2000.** Type designations and type determinations of southern African *Julodis* Eschscholtz (Coleoptera: Buprestidae). *Annals of the Transvaal Museum* 37:55–67.
- Gussmann, S. V. M. 2002.** Revision of the genus *Agelia* Laporte & Gory (Coleoptera: Buprestidae). *Annals of the Transvaal Museum* 39:23–55.
- Holm, E. 1976.** Revision of the genus *Nothomorpha* Thomson (Coleoptera: Buprestidae). *Journal of the Entomological Society of Southern Africa* 39(1):97–110.
- Holm, E. 1978.** Monograph of the genus *Acmaeodera* Eschscholtz (Coleoptera; Buprestidae) of Africa south of the Sahara. *Entomology Memoir* 47, 210 pp.
- Holm, E. 1982.** Revision of the Polycestini (Coleoptera: Buprestidae) of Africa. Department of Agricultural Technical Services Republic of South Africa, Entomology Memoir Number 47, 210 pp.

- Holm, E., and C. L. Bellamy. 1985.** Buprestoidea [pp. 224–228]. *In:* (C. H. Scholtz and E. Holm, editors). *The Insects of Southern Africa*, Butterworths, Durban.
- Laporte, F. L., and H. L. Gory. 1835.** *Histoire naturelle de iconographie des insectes coleopteres. Monographie des buprestides.* P. Dumenil, Paris. Volume 1, livraisons 1–7.
- Obenberger, J. 1924.** Kritische Studien über die Buprestiden (Col.). *Archiv für Naturgeschichte* 90(3):1–171.
- Picker, M., C. Griffiths, and A. Weaving. 2003.** *Field Guide to Insects of South Africa.* Struik, Cape Town. 440 pp.

(Received 18 October 2005; accepted 12 July 2007. Publication date 10 January 2008.)