


A remarkable teratological case for *Eucymatodera parva* Schenkling, 1908 (Cleridae: Tillinae) from Namibia

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Teratology can be defined as the study of the causes producing abnormalities, malformations or defects of the physical development (Ujházy *et al.* 2012). Teratological examples have been described in almost all animal groups, including insects (Ferrer *et al.* 2014). The importance of reporting teratological events in insects has been discussed by Glasgow (1925), Cockayne (1937) and Savini & Furth (2004). Glasgow (1925) stated that insect malformations should be documented to make these cases available to investigators who may have a special interest in such events. Cockayne (1937) mentioned that, even if the observed teratologies do not represent something novel, it seems desirable to publish these descriptions accompanied by plates illustrating the nature of the abnormality. Savini & Furth (2004) in their discussion of malformations in Coleoptera, stressed the importance of recording insect abnormalities, indicating that, in some cases, these abnormalities offer valuable information about the influence of environmental conditions during insect development.

Balazuc (1948) was the first to describe and classify various teratological cases within Coleoptera and provided a standard nomenclature for these abnormalities. Since the publication of his teratological glossary, numerous forms of teratomorphs in beetles (Carabidae, Cerambycidae, Chrysomelidae, Meloidae, Staphylinidae, Scarabaeidae and Tenebrionidae) have been reported and discussed by various authors, including Balazuc (1948, 1968), Haget (1949), Green (1952), Winkler (1958), Strand (1959), Delkeskamp (1969), Frank (1981), Gamarra & Outerelo (1986), Osuna (1992), Ortuño & Hernández (1993), Navarrete-Heredia *et al.* (2002), Lays (2003), Savini & Furth (2004), Asiain & Marquez (2009), Clark & Belo Nieto (2010), and Ferrer *et al.* (2014).

Here, we report a remarkable teratological case in a clerid male of the species *Eucymatodera parva*

Schenkling, 1908 with an anomaly in the right antenna (Figs 1A–B). The specimen was captured in the Sossusvlei Dune area, south of Sesriem, Namibia, and is deposited in the insect collection of the Ditsong National Museum of Natural History, Pretoria, South Africa (TMSA). The specimen label has the following information:

MATERIAL EXAMINED. South West Africa, Namib Sossus vlei, 24.40S 15.24E, 15-1-1975, E-Y: 546 at light, Endrödy-Younga col.

Eucymatodera Schenkling is a clerid genus in the subfamily Tillinae which is currently composed of eight species (Corporaal 1950). The group is relatively common in sub-Saharan Africa, and it predominantly inhabits thorny forests, savannas and scrublands. The affected specimen displays a polymely (presence of supernumerary appendages) with a trifurcate right antenna emerging from a single scape (Fig. 1A–B). It appears that the right scape in this specimen is, in reality, three scapes fused together. Each antenna emerging from the fused scape is composed of 10 antennomeres and has the proportional size and shape of a normal antenna (Fig. 1B). The teratomorphic and left antennae are normally situated, just below the antennal emargination (Fig. 1B–C). The left antenna appears to be normal (Fig. 1C). The head, including mouthparts, and the thorax, abdomen, and legs also appear normal.

The existence of teratomorphic specimens in various groups of insects is probably caused by changes in embryonic or postembryonic development (Balazuc 1948). On the other hand, certain malformations have no genetic background, but are triggered by chemical elements (Walton 1989; Martinez & van Emden 2001; Harrison *et al.* 2012), parasites (Marcangeli *et al.* 1992; Csosz 2012) or environmental factors (Clark & Belo Neto 2010). Irrespective of the cause, teratomorphs are scientifically important as they can provide insightful information about certain traits that, through



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Fig. 1. **A.** Habitus of affected specimen of *Cymatodera parva*; **B.** Close-up of right antenna showing trifurcate appendage emerging from fused scape; **C.** Close-up of normal left antenna.

time, can become fixed in the population. Teratological malformations can also function as bioindicators of certain pollutants present in the environment (Vermeulen 1995; Schulz & Martins-Junior 2001; Dziengo-Czaja *et al.* 2008).

Asiain & Márquez (2009) indicated that teratomorphs affecting elytra and legs are among the most common malformations reported in Coleoptera, followed by antennal abnormalities. Antennal defects have been regularly recorded for the order Coleoptera, especially in the families Cerambycidae, Carabidae and Staphylinidae (Balazuc 1948; Osuna 1992; Ortuño & Hernández 1993; Asiain & Márquez 2009). According to Ferrer *et al.* (2014), teratomorphs are more frequent in Carabidae, Cerambycidae and Staphylinidae; however, the authors argue that these groups are among the most studied families of Coleoptera, and this bias in reports may be affecting the ratio of published teratological cases.

A plethora of studies have documented the structural malformations in *Drosophila* caused by mutations in the homeotic gene *Antennapedia* (e.g. Struhl 1981; Carroll *et al.* 1986; Kaufman *et al.* 1990; Hooper *et al.* 1992; Yao *et al.* 1999). These mutations may lead to striking homeotic transformations of the *Drosophila* head structure called atavistic malformations, which means the return of a specialised segment into a more primitive condition (Stuhl 1981). Shockley & Ulyshen (2009) have mentioned that reduplicated legs are the result of genetic mutation(s) of one or more genes involved in ventral appendage formation and elongation during normal development. Shockley & Ulyshen (2009) further indicate that mutant expression of these genes sometimes produces malformations on non-locomotory appendages, such as antennae. We argue that, in a number of instances, antennal malformations are caused by mutations of the gene *Antennapedia*, a HOM-C gene highly

conserved among various groups of arthropods (Gauchat *et al.* 2000), and suspect that the triplication of the right antenna reported herein has very likely been triggered by such mutation(s).

Previous teratologies in the beetle family Cleridae have been documented (*e.g.* Winkler 1958; Verdugo & Coello 2012; Castro-Tovar *et al.* 2014); however, we were unable to verify cases of antennal bifurcation in other clerid beetles. Undoubtedly, there must be various clerid teratomorphs among entomological collections, but perhaps there is little interest on reporting them. On the other hand, these abnormalities may be so mild that entomologists believe there is no necessity to make these cases publicly available. We believe that teratomorphs should receive more attention among taxonomists and non-taxono-

mists alike since, on many occasions, antennal malformations, such as the existence of extra or fused antennomeres, may lead to the misidentification of entomological material at various taxonomic levels.

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