

Teratology in a century-old museum specimen of *Kheper cupreus* (Laporte de Castelnau, 1840) (Coleoptera: Scarabaeidae: Scarabaeinae) from Zimbabwe

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Running title: TERATOLOGY IN A *KHEPER CUPREUS* SPECIMEN

Teratology is the scientific study of, patterns, causes, and mechanisms of abnormalities that are present in a specimen from before birth, but also includes other abnormal formations (Ujházy *et al.* 2012). Teratological deformations can be hereditary (Hawkins 1938) or have environmental (chemical or mechanical) origins (Ujházy *et al.* 2012), but the true cause is often unknown (Jelínek 2005). In their report of a clerid beetle with a teratomorphic antenna, Burke *et al.* 2018 stresses the importance of reporting on teratological cases to alert specialists about them and potentially then investigate how environmental conditions influence insect development. These abnormalities may indicate that specific contaminants are present in the environment (Vermeulen 1995; Dziengo-Czaja *et al.* 2008). Additionally, as it has happened in Scarabaeidae on at least one previous occasion (Cherman *et al.* 2021), that a new species (*Liogenys ophthalmica* Frey, 1973) was described on the bases of a teratology, it is thus vitally important that these abnormalities are formally documented. The two type specimens of *L. ophthalmica* that were described by Frey, 1973 each have a different teratology in the head area (shape of the head and large eyes) and thus somewhat similar to the teratology described in the specimen here. The following are additional examples of different types of described teratologies of the head area in Coleoptera and include a specimen each of: *Pentodon idiota* Herbst, 1789 (as *Pentodon monodon* Fabricius, 1792) (Mocquerys 1880) and *Melanophila acuminata* (DeGeer, 1774) (Balazuc 1948) showing an enlarged head (macrocephaly) and *Phyllophaga dasypoda* (Bates, 1888) (Guzmán-Vásquez *et al.* 2020) showing an enlarged clypeus (clypeal hypertrophy), or the clypeus may be bifurcated (schistocephaly), as in *Prosopocoilus occipitalis* (Hope & Westwood, 1845) as

(*Metopodontus occipitalis* Hope, 1845) (Balazuc 1948). There are other known cases not mentioned here, but it is clear from the sparse amount of published records that finding similar cases of deformation of the clypeus or even the whole head in nature is extremely rare (F. Krell, personal communication), making the described case here extraordinary.

Here we report the discovery of a peculiar and exceptional male specimen of *Kheper cupreus* (Laporte de Castelnau, 1840) (Figures 1 and 2) found by Vaughan Jessnitz in a private collection. The specimen was collected 95 years before the time of publication. The specimen was originally collected at Mazoe (an area north northwest of Harare, Zimbabwe, currently spelt Mazowe [-17.52° 31.01°]) on 9.xii.[19]28. It exhibits symmetrical teratomorphy in the vertex, frons, genae and clypeus.

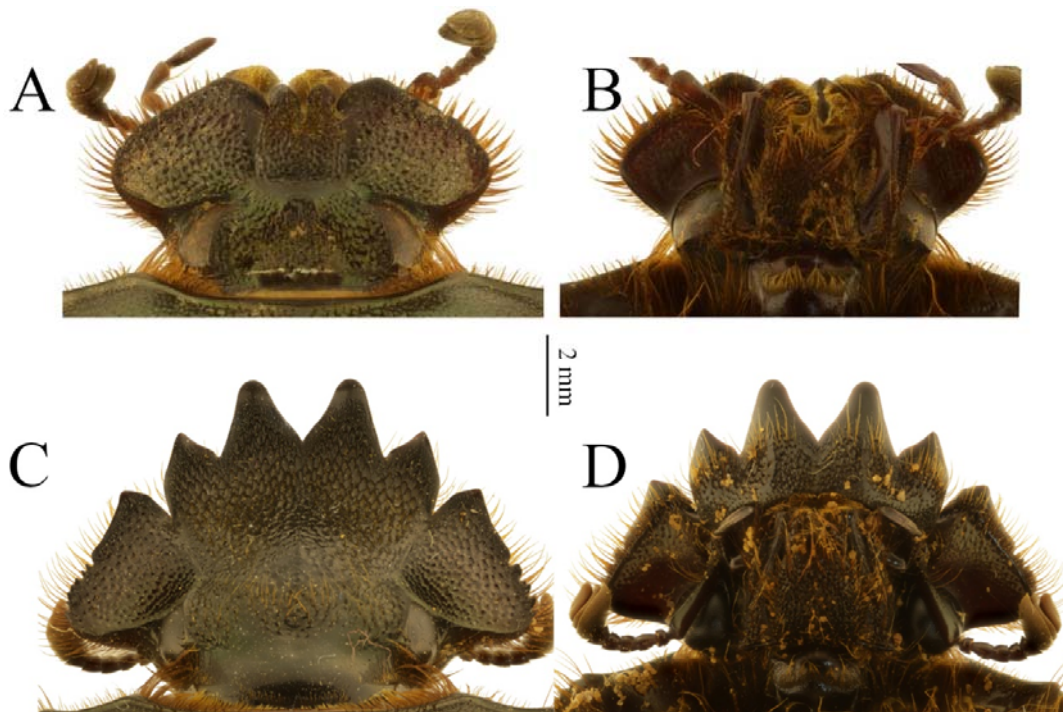


Fig. 1. Head of the teratological specimen in dorsal, A) and ventral, B) view compared to the head of a normal specimen of *Kheper cupreus* (Laporte de Castelnau, 1840) in dorsal, C) and ventral, D) view.

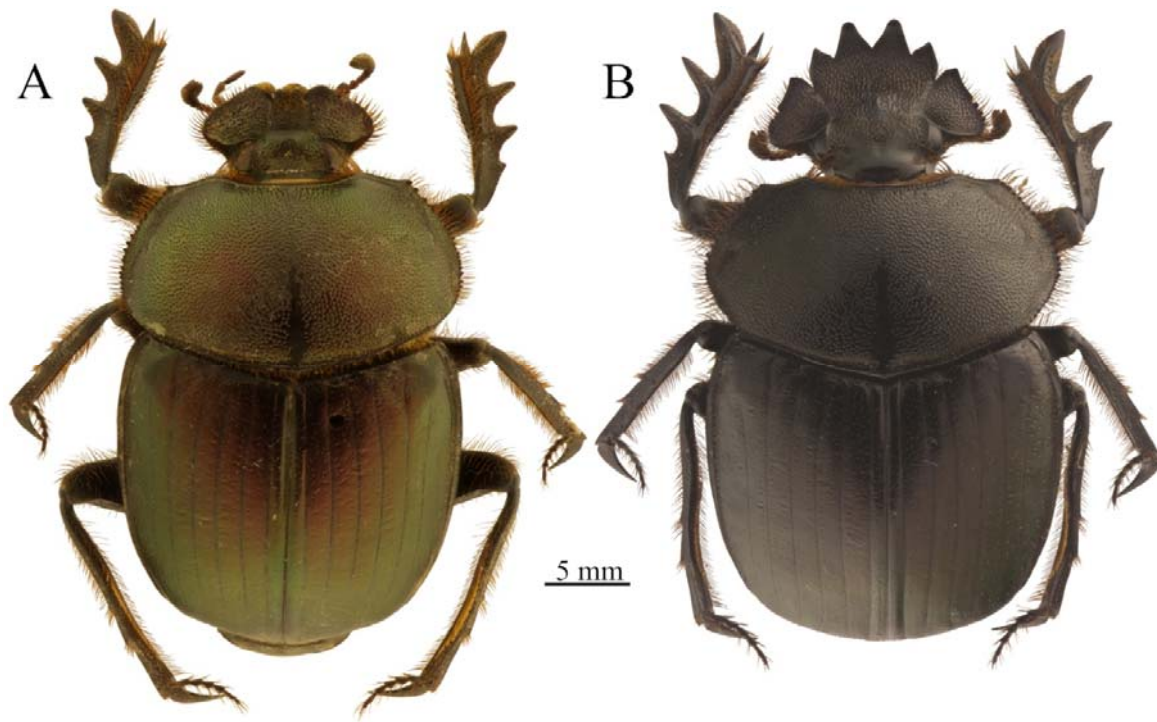


Fig. 2. Habitus of *Kheper cupreus* (Laporte de Castelnau, 1840) showing the teratological and a normal specimen, A) and a normal specimen from Opuwo (northern Namibia), B). Note the green tinge in the coloration of the teratological specimen from the hotter and lower Mazowe (Zimbabwe) compared to the black coloration in the specimen from the cooler highlands of northern Namibia.

The figures in this note were made using a Canon 760D camera body mounted with either a Canon MPE 65mm or 100mm macro lens.

Description of the teratology:

The deformation is only present in the head area of this specimen(Fig. 1a,b). Deformed area almost perfectly symmetrical. *Dorsal view*: Median and outside pair of clypeal teeth reduced and fused, appearing as a single pair that is visible as stubs with rounded ends only. Genae seems modified by being moved forward and inward with the result of compressing the two pairs of clypeal teeth. The evident serration normally seen at the posterior half of the outside edge of the genae is reduced. Genal sutures modified to run somewhat parallel straight forward and curving inward terminally, frontoclypeal suture somewhat normally situated but abnormally wide and better defined than in normal specimens. Frontal tubercle much reduced with a deep fovea posteriorly. Area between the eyes in normal specimens smooth with

scattered punctures but strongly sculptured and wrinkled in this specimen. Although the eyes seem normal, the forward shift of the genae caused the dorsal area of the eyes to be exposed slightly more than normal and therefore resulting in a slight offset of the position of the dorsal and ventral eyes. *Ventral view*: The mouthparts and antennae seem unaffected by the teratology.

This specimen seems to have lived a somewhat normal life as it was fully sclerotized and there are signs of wear on the front tibiae visible. Despite the much reduced and distorted clypeus, it managed to consume food as the hind guts were filled with faeces.

The specimen is curated in the private collection of CMD.

Acknowledgements:

We wish to thank Alan Gardiner for donating the specimen and the two reviewers of the original manuscript for their constructive remarks. Frank Krell (Denver Museum of Nature and Science) is especially thanked for giving additional information on teratological specimens with references.

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