Indirect Methods of Determining the Emergent Weight of *Oryctes rhinoceros* (L.)[1]

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ABSTRACT

Correlations are presented relating the adult emergent weight of *Oryctes rhinoceros* to its pupal weight and approximate elytra area. These correlations make it possible to determine the emergent weight of the beetle before or after emergence.

While investigating correlations between the percent emergent weights and the physiological state of the rhinoceros beetle, *Oryctes rhinoceros* (L.), it became necessary to determine the adult emergent weight by methods other than direct measurement. This note describes methods for estimating the emergent weight, either before or after emergence, which can be used in the laboratory or the field.

Laboratory-reared rhinoceros beetles varied 4.0–12.0g upon emergence from the pupa. This large variation is reflected in the size of the pupa, and we found that the pupal weight is directly proportional to the emergent weight of the adult (Fig. 1). This correlation provides a method for determining the emergent weight prior to adult emergence. Ludwig (1931) found a similar relationship for the Japanese beetle (*Popillia japonica* Newman). *Oryctes* pupal weight remains constant throughout the 18- to 24-day pupal period, indicating a greatly diminished metabolic rate, as has been found in other insects during pupation (Agrell 1964). Measurement of the pupal weight at any time is sufficient for the estimation of the emergent weight.

Late 3rd instars were allowed to complete their development in glass containers, where they normally constructed their pupal chamber at one of the sides, forming a window into the chamber. When the pupa was formed it could be removed, weighed, and either placed in the original or an artificial chamber.

The exoskeletal size of the adult beetle does not vary after emergence, and is correlated with the emergent weight. The best relationship was found between the emergent weight and the approximate 2-dimensional area of the elytra (Fig. 2), conveniently measured as indicated in Fig. 3. Although the approximate flat area of the beetle also gives a good

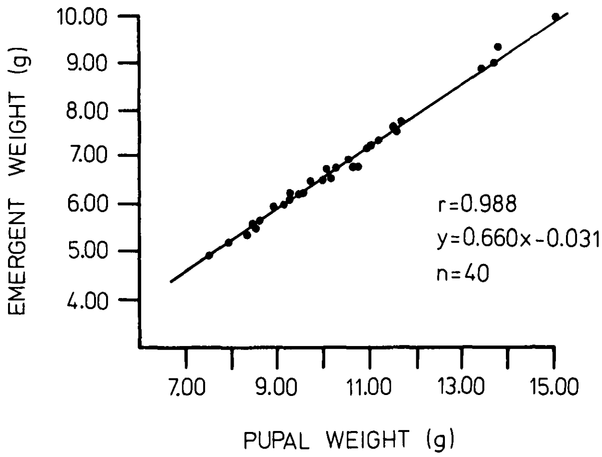

FIG. 1.—The relationship between the emergent weight of the rhinoceros beetle and its pupal weight.

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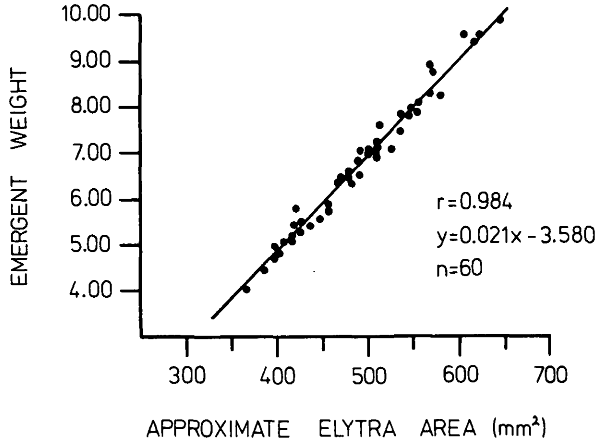

FIG. 2.—The relationship between the emergent weight of the rhinoceros beetle and its approximate elytra area (Fig. 3).

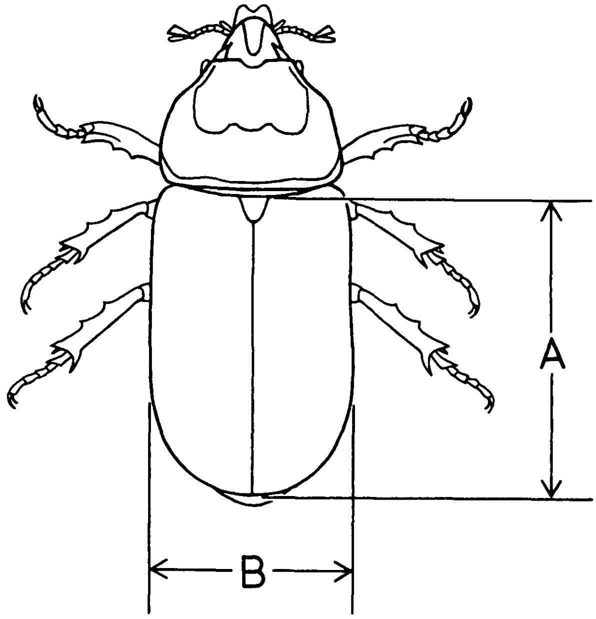

FIG. 3.—The dimensions used for determining the approximate elytra area (A $\times$ B) of the rhinoceros beetle.

correlation ($r = 0.977$, $n = 60$), the accuracy of the overall length measurement is limited by the variability of the head position in live adults.

Less satisfactory relationships were found between the emergent weight and overall length ($r = 0.928$, $n = 60$), elytra length ($r = 0.971$, $n = 60$) and adult dry weight ($r = 0.945$, $n = 42$). The dry weights were determined by drying adults that had died, to a constant weight at 70°C, and cooling in a desiccator prior to weighing.

The above correlations provide an accurate means of estimating the emergent weight of the rhinoceros beetle under a variety of conditions. These relationships may also be applicable to Coleoptera other than those mentioned.

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