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Short communication

Age identification of a Namib desert tenebrionid beetle

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An individual's age is of importance for various fields of biological research such as population demography and behavioural ecology. In Arthropods one is often restricted to methods of age determination which apply only to dead animals (Allsopp, 1979; Ellison & Hampton, 1982; Hoc & Charlwood, 1990; Moore *et al.*, 1986). Those methods are clearly not applicable if natural populations are investigated and destructive sampling should be avoided. Marking individuals is one way to obtain age-related information, but may be afflicted with side-effects or may simply be impractical, especially in small or shortlived organisms. There is thus a need for methods of age determination which are independent of marking individuals and which can be applied in field studies (Acosta *et al.*, 1983; Berman *et al.*, 1989; Le Foll *et al.*, 1989; Henocque, 1987; Hornung & Vajda, 1988; Lehane & Hargrove, 1988; McVey, 1985; Pang *et al.*, 1987; Zouhourian-Saghiri *et al.*, 1984; Zuk, 1987).

This note describes how age of adult *Onymacris plana* Allard (Tenebrionidae: Adesmini) can be identified in the field. The species is endemic to the Namib desert. It inhabits vegetationless windblown dunes and the stable vegetated bases of dunes where it is mainly found in the vicinity of the Nara-plant (*Acanthosicyos horrida*, Curcubitaceae) or the perennial grass *Stipagrostis sabulicola* (Poaceae). This flightless beetle is one of the fastest running terrestrial Arthropoda. Its daily activity pattern varies with season. In summer, activity is bimodal, i.e. the beetles come out to forage and mate in the early morning hours, shelter by burrowing into the sand during the extremely hot hours around noon and early afternoon and re-emerge in the late afternoon to stay above the sand surface till dusk. In winter they appear in the late morning and are active until the early evening hours. During a large proportion of their activity period males search for, guard and defend females. Males either try to keep track of an active female until she burrows into the sand and mates, or they dig out a buried female.

Living on and in quartz sand leads to deterioration of body appendages such as tibial calcaria and tarsal claws. Furthermore, the exoskeleton of *O. plana* is studded with many sorts of inconspicuous setae which show wear with age. Of these the pretarsal bristles are especially suited for identification of adult age (Fig. 1, above), as they are comparatively densely packed and extremely exposed to the sandy substrate. By using a 10-fold magnifying glass one can easily check the condition of the bristles in the field.

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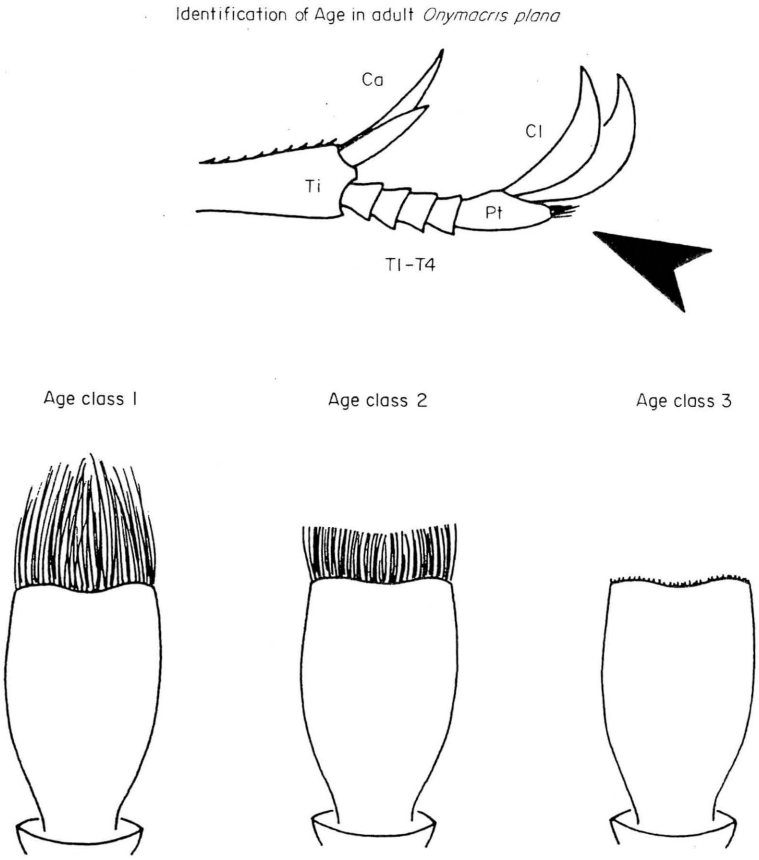

Fig. 1. Identification of age in adult *Onymacris plana*. Above: Distal part of the first, right leg in lateral view. Ti (tibia), Ca (tibial calcaria), T1–T4 (tarsal segments), Pt (pretarsus), Cl (pretarsal claws). The arrow indicates the group of bristles at the tip of the praetarsus used in age identification. Below: Pretarsus and group of bristles in dorsal view. For definition of the three age classes see text. The degree of deterioration of pretarsal bristles was highly correlated among all six legs. One can therefore rely on checking only one leg.

According to the degree of deterioration we defined three age classes as follows (Fig. 1, below). Class 1: (a) The bristles are on average slightly longer than the fourth tarsal segment and they are of different length. The bristles appear shiny and their tips are pointed. (b) Bristles are reduced to less than two thirds of their original length. The tips are comparatively less pointed. Class 2: The length of the bristles is reduced to between two thirds and one third of their original length. Most of the bristles are worn down to the same length. Their tips are blunt. Class 3: If at all, only stumps of setae are left which reach less than one third of their original length.

Laboratory observations indicated that the rate of deterioration of the bristles is constant over time, and that the age classes 1(a + b), 2 and 3 should be homogenous with respect to the period of adult lifespan covered. As age class 1(a) represents individuals which molted recently, it is not considered to be homogenous with age class 1(b), 2 or 3. Nevertheless, by splitting age class 1 into two sub-classes we are able to differentiate between very young individuals (a), and those that are slightly older, but still younger than one third of their expected adult lifespan (b).

In December 1990 we caught 100 males and 100 females, marked them, checked the

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Table 1. *Rate of ageing in male and female* Onymacris plana. *Individually marked beetles were repeatedly caught 90 days after the initial catch. The table shows how many beetles were still found to belong to the same age class (0), and how many had moved to one age class (1) and two age classes higher (2) than at the initial catch*

Difference between age classes	Male	Female
0	23	12
1	18	9
2	21	5

pretarsal bristles and released the beetles again in the field. Three months later we were able to recapture 62 of the males and 26 of the females (Table 1). In males 37·1% and in females 46·2% did not show significant signs of deterioration and were still placed in the same age class. Twenty-nine percent of males and 34·6% of females had moved to one age class higher, and the remaining 33·9% (males) and 19·2% (females) had moved from age class (1) to age class (3). There was no difference between the rate of change to older age classes by males and females ($Chi^2 = 1{\cdot}9206$, FG = 2, $p > 0{\cdot}3$). We currently attribute three months to each age class, but need still more mark-recapture data to quantify exactly the period of time covered by each age class. At present our method already enables us to study the age structure of *O. plana* populations by using relative criteria.

Identification of age by deterioration of bristles might be suitable not only in *O. plana*. There are thirteen species of the genus *Onymacris* in the Namib (Penrith, 1975). All of them carry setae on various regions of the body and legs and could thus be aged in that way. Moreover, all those flightless Coleoptera that inhabit similar habitats might be candidates for our method.

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