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CONSTRUCTING DOMINANCE HIERARCHIES IN A PRIMITIVELY EUSOCIAL WASP

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It is well known that dominance-subordinate interactions form an important part of social organisation in primitively eusocial wasps (1). In many studies of social insects, the rank of an animal is based merely on the frequency with which it shows dominance behaviour. This is misleading because a high frequency of dominance behaviour may be accompanied by an equally high frequency of subordinate behaviour. Moreover showing dominance over a high ranking individual should be weighed differently from showing dominance over a low ranking individual. For these reasons, we have used a modified version of the index of fighting success that was developed for red deer to solve similar problems (2). Thus we compute an index of dominance for each animal in a colony of n individuals as:

$$\sum_{i=1}^n B_i + \sum_{j=1}^m \sum_{i=1}^n b_{ji} + 1$$

$$\sum_{i=1}^n L_i + \sum_{j=1}^p \sum_{i=1}^n l_{ji} + 1$$

where B_i measures the rate at which the subject shows dominance behaviour towards colony members and b_{ji} measures the sum of the rates at which all animals dominated by the subject in turn show dominance behaviour towards colony members. 1 to m are thus the individuals towards whom the subject shows dominance. Similarly L_i measures the rate at which the subject shows subordinate behaviour towards colony members. l_{ji} measures the sum of the rates at which those animals towards whom the subject show subordinate behaviour in turn show subordinate behaviour towards colony members. 1 to p are thus the individuals towards whom the subject shows subordinate behaviour. Indices of dominance calculated in this fashion permit the construction of a simple linear hierarchy with relatively few ties. Animals which do not participate in dominance-subordinate interactions are of course all tied with a dominance index of 1.0.

1. Pardi, L. 1948. *Physiol.Zool.*, 21:1-13.
2. Clutton-Brock, T.H., Albon, S.D., Gibson, R.M. and Guinness, F.E. 1979. *Anim.Behav.*, 27:211-225.