

EDITORIAL

Which side of the tree is more basal?

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When a tree is rooted, it has a base. Everything near that base is basal. A clade branching off near the base is a basal clade, isn't it? Does this make sense? No, it doesn't.

As editors of *Systematic Entomology* we regularly receive discussions of 'basal' clades or taxa. We find them in a great proportion of submitted papers and even in a widely used textbook (Forey *et al.*, 1992: 134; eliminated from the second edition). Google found 100 hits for 'the most basal clade' and seventy-five for 'the most basal taxon', including a few from *Systematic Entomology* (search on 14 January 2004). Although we try regularly to convince the authors individually that this doesn't make sense, we have decided to raise this issue in an editorial.

Why one clade cannot be most basal

Every branching in a (phylogenetic) tree is rotatable (see Fig. 1). Of course, the tree has a base, and there is a most basal branching and a next most basal branching, but there is no such thing as *the* most basal clade. Because branchings are rotatable, there are always *two* most basal clades (if the most basal branching is completely resolved, Fig. 1) or even more most basal clades (if the most basal branching is not completely resolved, e.g. in Polyneoptera in Fig. 1). Both branches originating from a node (i.e. the two sister groups) are of equal age and have undergone equivalent evolutionary change. Whether a group has branched off early (basal)

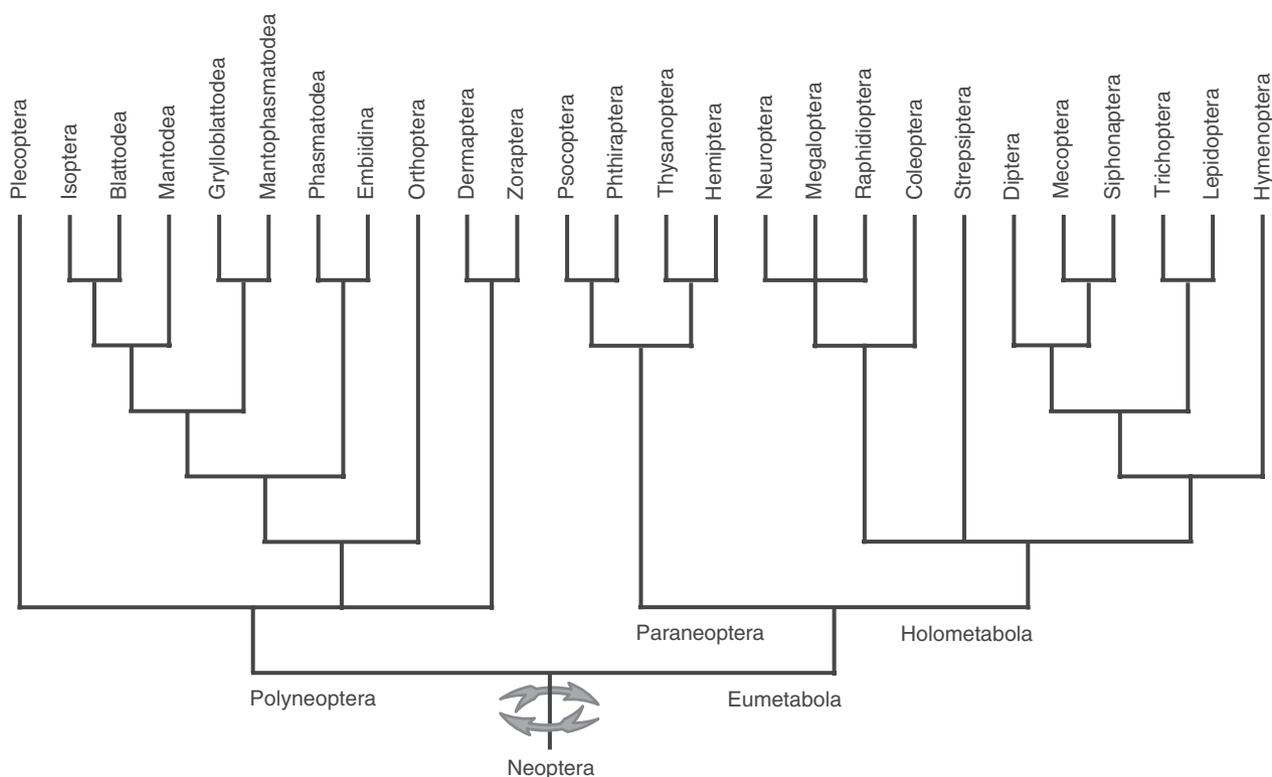


Fig. 1.

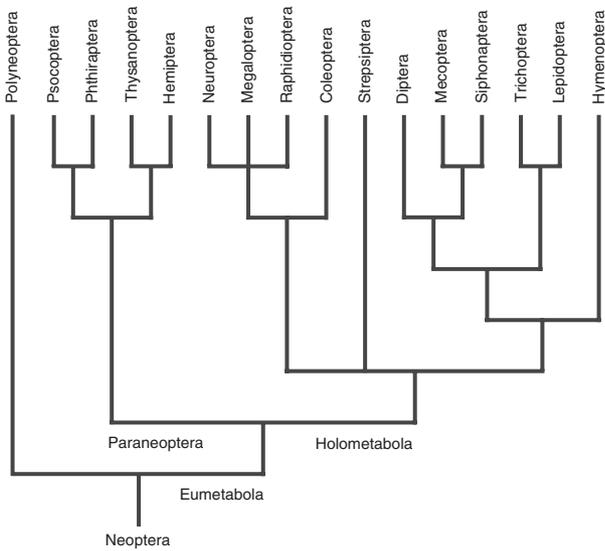


Fig. 2.

or later in the phylogeny contains no information about this particular group, but information about both this group *and* its sister group, because both branched off at the same time. By notation we tend to portray one branch (the species/taxa-poor one) as being on the left, and the other (species/taxa-rich) as right – but this infers nothing about their evolutionary development, only about their taxon richness (speciation less extinction) at a given geological period (mostly the present), or, even worse, about the taxon sampling pattern in the particular study. Different taxon sampling leads to different interpretation about ‘the most basal clade’. In Fig. 2, the Polyneoptera are ‘the most basal clade’ of the Neoptera; in Fig. 3 it is the Eumetabola. As both trees represent exactly the same phylogeny, calling one of the equivalent sides of the tree the most basal side makes no sense.

Considering clades or taxa as ‘basal’ is not only sloppy wording, but shows misunderstanding of the tree and may have severe semantic and argumentative implications. Declaring one sister group to be basal gives the other sister group a higher or at least a different value (‘the basal clade’ vs. ‘the derived clade(s)'). If the Polyneoptera is the most basal clade of the Neoptera, then the rest of the Neoptera (the Eumetabola) is given a higher value (as the ‘main’ body of the group). Admittedly, it contains more species, but this is not a quality necessarily granting it higher value. The number of taxa in a tree is a consequence of taxon sampling (method, see Figs 2 and 3), general knowledge of the group, and unknown extinctions (history). The ‘most basal clade’ might have contained many more terminal taxa in a former period of geological time than the ‘main body’ of the extant tree. With an alternative taxon sampling, ‘the most basal clade’ might contain many more taxa than its sister group (Fig. 2 vs. Fig. 3). Selective (i.e. unavoidably subjective) taxon sampling, voluntary choice of the geological period

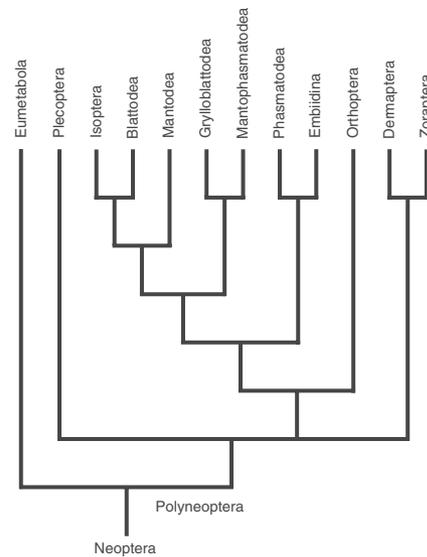


Fig. 3.

from which the terminal taxa are considered (mostly the present) and incomplete knowledge of the fossil record are a weak base for weighting branches. In phylogenetic systematics/cladistics there is no reason and no justification to weight clades at all. Sister groups always have the same rank and the same weight or value in the phylogenetic system. Aves and Crocodylia have the same rank as sister groups within the Archosauria, although few authors (e.g. Hennig, 1983; Mickoleit, 2004) dare to degrade the traditional and cherished ‘class Aves’ to what it is, the sister group of the traditional and cherished ‘order Crocodylia’. It makes no sense to call the crocodiles the basal clade of the Archosauria and the speciose Aves the derived group (or the other way round). The whole argument about basal and derived status of sister groups reminds us of the old Hennig–Mayr argument (Mayr, 1974; Hennig, 1975) about higher ranking of one of two sister groups (e.g. Aves) because it has reached a different adaptive level (or, in our case, contains many more taxa/species) – an argument we believed was overcome decades ago.

When to use the notation ‘basal’?

Nodes or branchings near the base are basal nodes or basal branchings. The ‘basal branch’ is the branch between the most basal node (the last common ancestor of the members of the study group) and the root (Kitching *et al.*, 1998: 200). A ‘basal clade’ is a part of the tree ending at a node before two or more terminal taxa. A ‘basal taxon’ is a (hypothetical) ancestral species, a species of the stem line, not a terminal taxon. All other use of the notation ‘basal’ is incorrect and misleading.

However, because the cladistic method does not allow identification of ancestors, even the correct notation ‘basal

taxon' is unlikely to play a major role in phylogenetic discussions. Also 'basal clade' is of minor interest in discussions of relationships of terminal taxa. Generally, 'basal' should be much less abundant in phylogenetic discussions than it is.

The best solution: argue with sister-group relationships

If the phylogenetic tree in Fig. 1 is correct, Polyneoptera and Eumetabola are sister groups. There is no necessity to term either as 'basal'. Even if one wants to avoid the little-used name Eumetabola, it is easy to describe the Polyneoptera as the sister group of the remaining Neoptera. Argumentation with sister-group relationships is easy and shows relationships much more clearly than declaring one sister group to be basal. The 'basal position' within an ingroup always means 'sister to the remaining taxa', so say so!

Acknowledgements

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