
Figures and figure supplements

Evolution of thorax architecture in ant castes highlights trade-off between flight and ground behaviors

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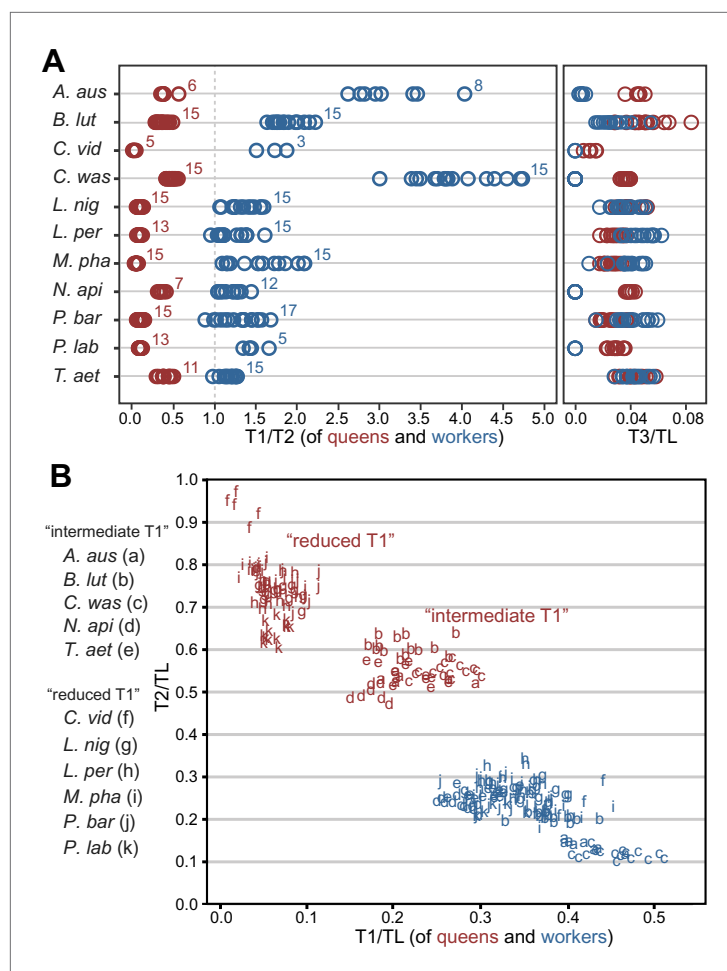


Figure 1. Variation in length of first (T1) and second (T2) thoracic segments in ants shows characteristic differences depending on caste and species. **(A)** Relative lengths of T1 and T2 (left) show clear differences between queens and workers for 11 ant species. T3 (right) constitutes a small portion of the total length of the thorax in both queens and workers and, when present (when T3/TL > 0.0), is indistinguishable between castes. Numbers correspond to sample sizes and are equal for both panels (**Table 1**). **(B)** Gradient of investment in neck strength vs flight/storage musculature sorts individuals into three categories. Queens fall into two discrete categories based on the relative lengths of T1 and T2. While the use of T1/T2 in **(A)** emphasizes the distinction between workers and queens and within species variation, T1/TL and T2/TL in **(B)** enables the distinction between queen types across species with large differences in body size. Measurements and ratios are available in the Dryad data repository under DOI doi: 10.5061/dryad.d62p2/1 (**Keller et al., 2014**). Species codes: *A. aus* = *Amblyopone australis*; *B. lut* = *Brachyponera lutea*; *C. vid* = *Carebara vidua*; *C. was* = *Catantopus wasmanni*; *L. nig* = *Lasius niger*; *L. per* = *Leptothorax pergandei*; *M. pha* = *Monomorium pharaonis*; *N. api* = *Neoponera apicalis*; *P. bar* = *Pogonomyrmex barbatus*; *P. lab* = *Polyrhachis laboriosa*; *T. aet* = *Tetraponera aethiops*.

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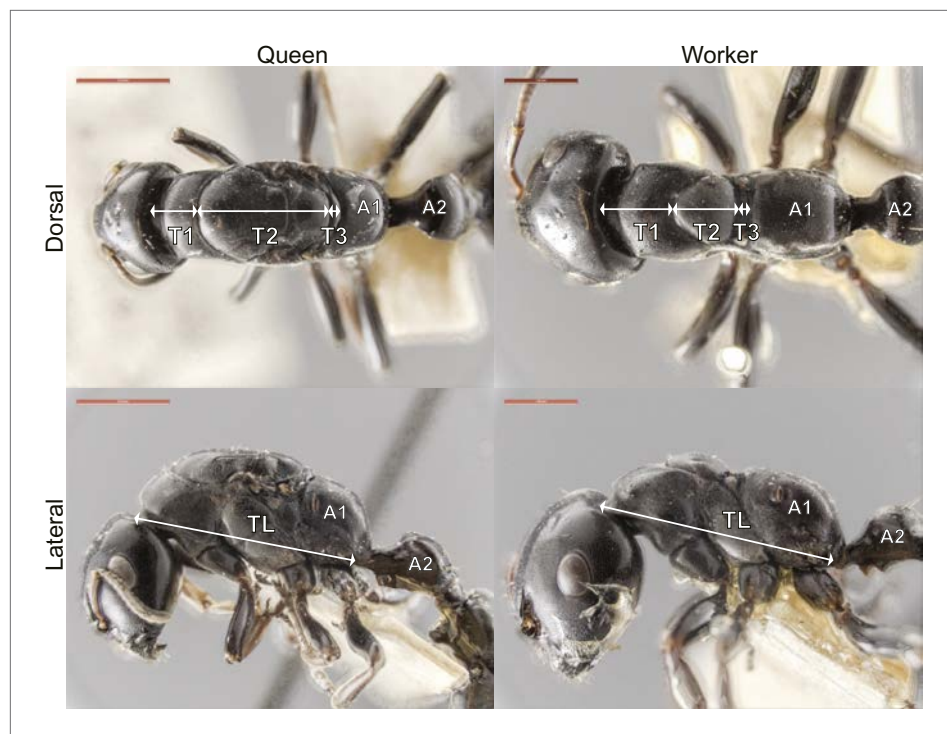


Figure 1—figure supplement 1. Measurements used in this study.

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Figure 1—figure supplement 2. Differences in length proportion of thoracic segments among castes in nine representative species from different subfamilies.

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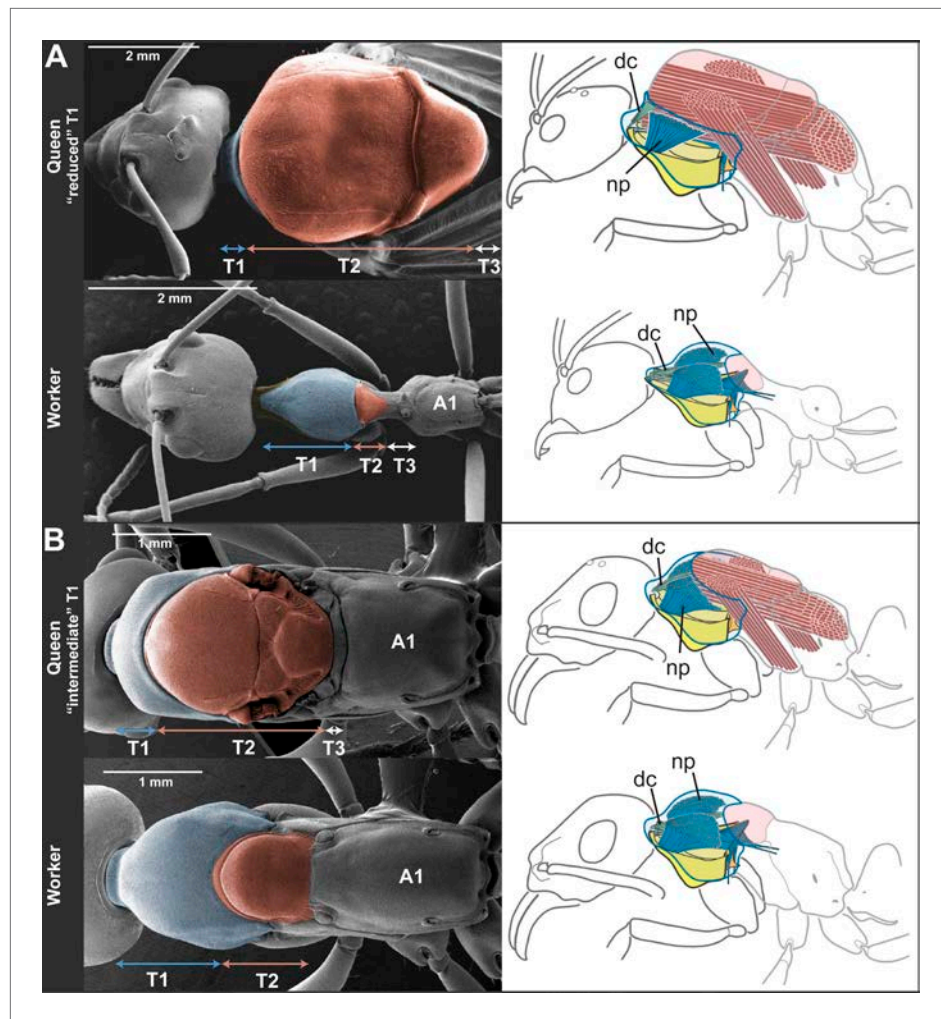


Figure 2. Skeletomuscular specialization of queens and workers in ants. The dorsal plate of T1 is always enlarged in workers relative to queens (left column; multiple individuals from 52 genera examined, **Table 2**). Queens can either (A) have a reduced T1 and huge T2-associated wing muscles (represented here by *Oecophylla smaragdina*), or (B) show a slightly enlarged T1 and associated neck muscles (represented here by *Neoponera apicalis*). T1, T2, and T3, first, second and third thoracic segments respectively; A1, first abdominal segment. Workers of *N. apicalis* lack a discernible T3. Internally (right column), the wing muscles in queens (red) fill most of the thoracic cavity, while the T1 muscles (blue) are narrow and close to the thoracic wall. In all workers examined (see **Table 1** for list of species and sample sizes), the T1 notopleural muscles (np, dark blue) that support the anteroventral plates (yellow) fill the anterior portion of the cavity. The dorsal cervical muscles (dc, light blue; see also **Figure 2—figure supplement 1B**) that in winged queens originate at the anterior phragma and pull the head up at contraction, show a shifted position in workers. In the absence of phragma, these muscles originate at the dorsal boundary between T1 and T2. Rather than being short and thin, they form long and thick bundles that stretch the entire length of the enlarged T1 cavity to their place of insertion on the back of the head (**Figure 2—figure supplement 2**). **Figure 1—supplement 1** has photos of many more species of ‘reduced T1’ and ‘intermediate T1’ species for comparison of external thoracic morphology.

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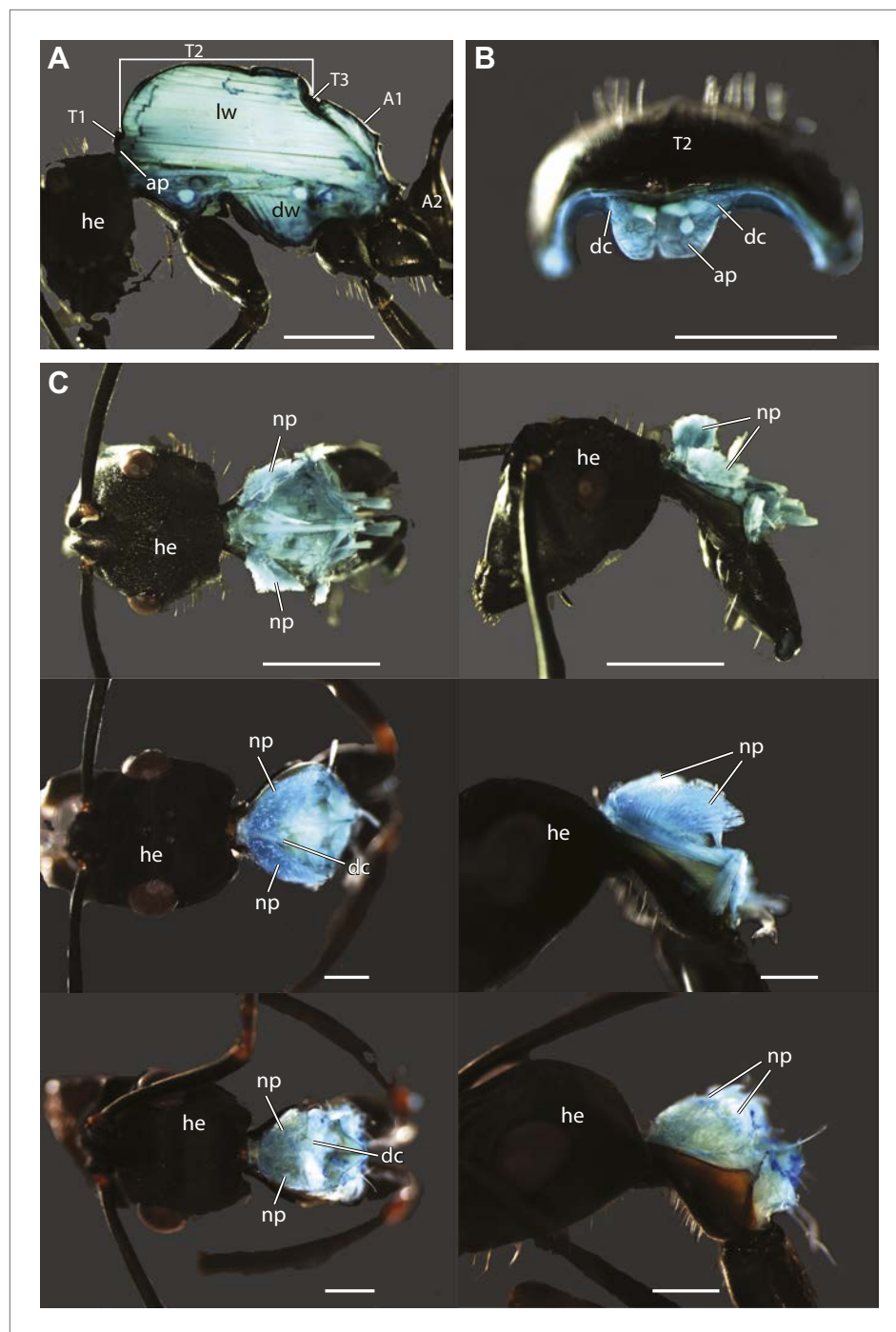


Figure 2—figure supplement 1. Thoracic musculature in queen and worker ants.

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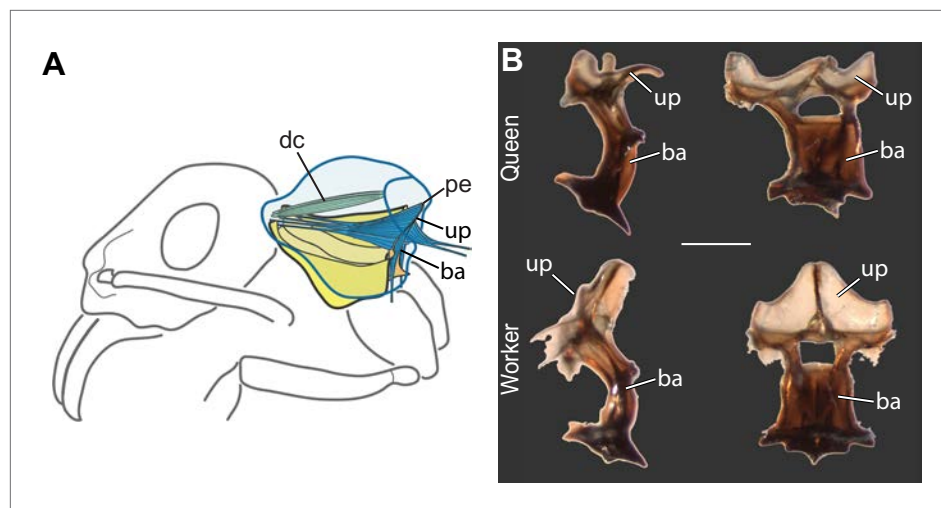


Figure 2—figure supplement 2. Internal anatomical adaptations in ant workers for powerful head movement.
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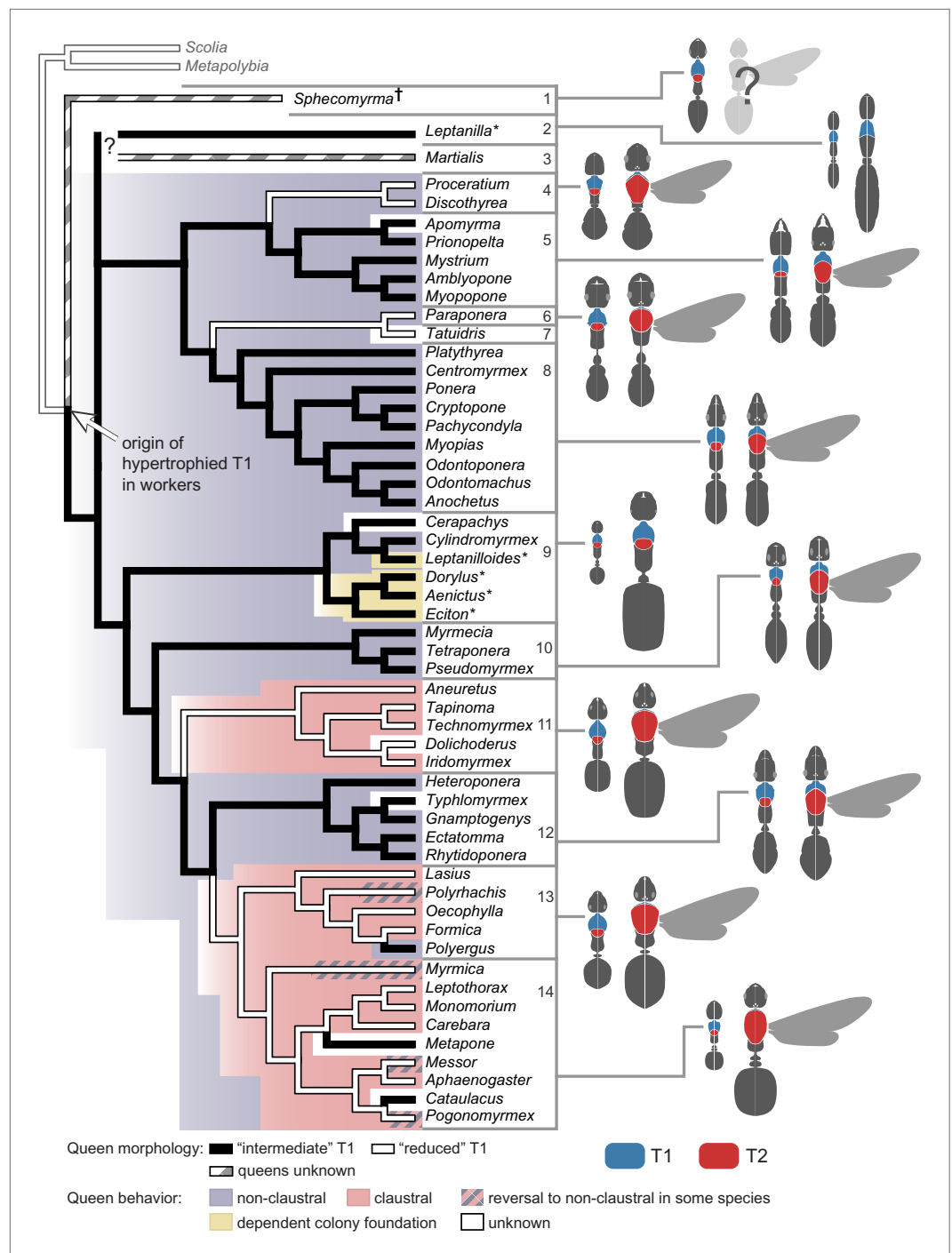


Figure 3. Phylogenetic reconstruction reveals a single origin of a hypertrophied T1 in workers and multiple independent origins of 'reduced' T1 in queens. The latter is associated with modifications in modes of colony foundation. Tree branches and tree background are colored for queen morphology and founding behavior respectively, according to the parsimony ancestral reconstruction. Typical queen-worker dimorphism shown to the right to illustrate ratio T1/T2 (not to scale). Species with wingless queens are marked with an asterisk. Phylogeny was pruned from [Moreau et al. \(2006\)](#). Placement of *Sphecomyrma*[†] and *Martialis* after [Grimaldi et al. \(1997\)](#) and [Rabeling et al. \(2008\)](#), respectively. *Metapolybia* and *Scolia* wasps are included as outgroups. Data on the species are analyzed, and their morphology and type of colony founding behavior are summarized in [Table 3](#). Numbers correspond to major taxonomic groups within Formicidae after [Ward \(2007\)](#): 1, Sphecomyrminae[†]; 2, Leptanillinae; 3, Martialinae; 4, Proceratiinae; 5, Amblyoponinae; 6, Paraponerinae; 7, Agroecomyrmecinae; 8, Ponerinae; 9, dorylomorphs; 10, myrmeciomorphs; 11, dolichoderomorphs; 12, ectaheteromorphs; 13, Formicinae; 14, Myrmicinae.

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