Monogamous sperm storage and permanent worker sterility in a long-lived ambrosia beetle

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The life-time-monogamy hypothesis claims that the evolution of permanently unmated worker castes always required maximal full-sibling relatedness to be established first. The long-lived diploid ambrosia beetle *Austroplatypus incompertus* (Schedl) is known to be highly social, but whether it has life-time sterile castes has remained unclear. Here we show that the gallery systems of this beetle inside the heartwood of live Eucalyptus trees are always inhabited by a single core-family, consisting of a lifetime inseminated mother, permanently unmated daughter workers, and immatures that are always full siblings to each other and their adult caretakers. Overall sex ratios are even. Males always disperse and only survive as stored sperm, but female offspring either disperse to mate and found their own colony or assume unmated worker roles, probably surviving for many years without any reproductive potential because tarsal loss precludes later dispersal. A well-supported Platypodinae phylogeny allowed us to infer that parental monogamy evolved before a life-time unmated worker caste emerged, confirming the prediction that monogamy and full-sibling relatedness are a necessary condition for the evolution of such workers. The initially very challenging but ultimately long-term stable nesting habitat in live trees appears to have provided the crucial benefit/cost factor for maintaining selection for permanently sterile workers after strict monogamy and life-time sperm storage had become established in this curculionid coleopteran lineage.