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NOTE

A *Camponotus fellah* queen sets a record for Israeli ant longevity

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Despite the importance of longevity and mortality of social insect colonies, data on these aspects are rare (Hölldobler and Wilson, 1990; Schmid-Hempel, 1998). Those anecdotal data that do exist for a few ant species suggest greater potential for ant queen longevity compared with non-social insects. This note is a first record of the remarkable longevity of a *Camponotus fellah* queen. In the spring of 2009, a *C. fellah* queen died after being kept in an artificial nest for 26 years.

Unlike some polygynous species, in monogynous ants the queen is rarely replaced, and the colony itself dies a short while after the queen's death (Bourke and Franks, 1995; Schmid-Hempel, 1998). Consequently, the queen's longevity determines the longevity of the colony (Pamilo, 1991; Schmid-Hempel, 1998). Following the nest-founding stage, the queen of a monogynous species is usually protected from predation and other external factors, being well sheltered inside the nest (Hölldobler and Wilson, 1990; Keller and Genoud, 1997; Heinze and Schrempf, 2008). In general, monogynous queens live longer than polygynous queens (Keller and Genoud, 1997).

An orphanage stage follows the queen's death, when in some species (belonging to the genus *Leptothorax* (Heinze et al., 1997), *Acromyrmex* (Boomsma and Dijkstra, 2007), and many others (see Choe, 1988)), the workers start to lay eggs (Oster and Wilson, 1978; Bourke and Franks, 1995). The duration of this stage in the colony's life cycle depends on the longevity of the workers (Bourke and Franks, 1995), which is rather short. The queen can live ten-fold longer than workers (Schmid-Hempel, 1998) and up to 500-fold longer than conspecific males (Keller and Jemielity, 2006). Males usually die after one or a few matings, depending on the species' mating strategy (Boomsma et al., 2005; Shik and Kaspari, 2009). Whereas some queens are known to live for 1–30 years (Hölldobler and Wilson, 1990; Keller, 1998), in *Cataglyphis* and *Pogonomyemex*, for example, workers live for only 30 days, and in *Aphaenogaster* and *Myrmica* for up to 2–3 years (Gordon and Hölldobler, 1987; Hölldobler and Wilson, 1990). The queens with the greatest known longevity belong to the genera *Camponotus*, *Pogonomyemex*, *Formica*, and *Lasius*, and some have been known to live for 18–30 years (Hölldobler and Wilson, 1990). Anecdotal reports from other *Camponotus* species suggest that the queens live, on average, 5–8 years, and can live up to 21 years, such as was recorded for a *C. perthiana* queen from Australia (Hölldobler and Wilson, 1990).

The cosmopolitan genus *Camponotus* is very diverse (Wilson, 2003), consisting of 24 species in Israel alone, six of which are considered endemic (Vonshak and Ionescu-Hirsch, this volume). Most *Camponotus* colonies are monogynous and founded by a single queen (Klotz et al., 2008). *Camponutus fellah* is the most common species of this genus in Israel (Kugler, 1989). A few massive nuptial flights take place, usually on hot days in early spring, but also at a lower density during summer nights (Kugler, 1989; Levin et al., 2009; and the authors' unpublished data). In early spring, queens usually begin to lay eggs 1–7 days after their nuptial flight and mating. About 1.5–2 months later, the first workers, usually 8–10, emerge. The queen uses her body reserves to rear these first workers, which start to exit the nest and gather food for the developing colony (A. Shlagman, unpublished data).

In the spring of 1983, Shlagman collected a mated *C. fellah* queen in Tel Aviv, immediately after her nuptial flight. This queen founded a colony in an artificial nest, where it was kept for the next 26 years. The artificial nest consisted of a 50 × 40 × 5 cm Perspex box divided into three units, with plaster floor and transparent cover, in addition to two external "yards"; one was covered with metal mesh to allow ventilation and used by the ants for waste (38 × 6 × 9 cm); and the other was used for feeding (38 × 17 × 20 cm). The ants were fed with either sugar water or honey, and dead crickets (*Acheta domestica*) about once a week.

The queen laid fertile eggs throughout this time, producing hundreds of diploid workers on an annual cycle; eggs were laid during the summer, whereas during winter larvae stopped developing, remaining at the larval stage until the temperature rose at the end of March (onset of spring). Although by 2009 the queen had formed a large colony with several thousand workers, no alates were reared during this period. Therefore, we can clearly state that the queen was not replaced.

In the spring of 2009, the queen was no longer detected. At that point there were no eggs in the nest but many young larvae were present that developed from eggs that had been laid before winter. In the following weeks the workers continued to tend to the brood, which was eventually reared into hundreds of workers and about 150 gynes and two males. The two males are possibly the product of the last eggs laid by the queen. No additional eggs were found during the six months between the queen's death and the emergence of the first new queens. About ten days later, several of the alate queens shed their wings (usually an indication of mating), new eggs were found in the nest, and shortly thereafter the first larvae were observed. As no eggs had been observed during the absence of queens, we assume that the workers were not reproducing and that the new eggs were laid by the new queens. However, we cannot determine at this point whether these eggs had been fertilized or not, i.e., whether queens had mated inside the nest. A few months later, in February, almost all of these queens were still alive, and a few clusters of eggs and some young larvae were found. No developed larvae, pupa, or new adults were found in the nest at this time, therefore although no aggression was observed in the nest, we assume that either the workers or other queens had harmed the previously laid eggs and the larvae, and that the observed eggs and larvae were new ones.

It is possible that under natural conditions the new alates would have left the nest during the next nuptial flight, and perhaps founded new nests, spreading the colony's genes. A more practical question is what will happen to the old colony? Will it perish after the last worker dies of old age, or will one, or even a few, of the new queens be able to take over the old queen's place and become the new reproductive queen of the nest, assuming that she had mated? We found that the colony was able to produce new gynes from the small larvae or eggs still found in the nest after the queen's death. Only two males were found in the nest, although workers may be able to lay unfertilized eggs that develop into males (known from a few other *Camponotus* species, Choe, 1988; Hölldobler and Wilson, 1990). The queens usually mate during the nuptial flight outside the nest. However, if a gyne can mate inside the nest, the orphan colony may recover in the laboratory and possibly, also in the field.

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