

Short Communications

Co-occurrence of mated workers and a mated queen in a colony of *Platythyrea arnoldi* (Hymenoptera: Formicidae)

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A colony of *Platythyrea arnoldi* was found to contain a functional queen and laying workers, both virgin and mated. This form of social organization has never been reported in ants before.

Gepaarde en ongepaarde lêende werkers en 'n funksionele koningin is in 'n kolonie van *Platythyrea arnoldi* gevind. Dié vorm van sosiale struktuur is nog nooit tevore in miere gerapporteer nie.

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Mated workers have been discovered in several ponerine species that lack queens (Peeters 1991), but the co-occurrence of mated workers and queens has been reported only from species where the two do not occur in the same nest (Ward 1983). *Platythyrea arnoldi* has been reported to have a queen caste (Arnold 1915), but several other species of *Platythyrea* rely solely on reproduction by inseminated workers (e.g. Villet 1991a, 1991b; Villet, Hanrahan & Walther 1990a).

A colony of *P. arnoldi* was excavated in Mkuzi Game Reserve (27°36'S / 32°13'E), Zululand, South Africa in late September 1987. One dealated queen and 110 workers were found in the nest, along with many eggs, 57 larvae and 21 cocoons. Twenty alate queens, eleven males and nine workers eclosed from cocoons in the laboratory. Queens were of the normal winged type. They had ocelli, their gasters were slightly larger than those of workers, and they weighed 1,58 times the mass of a worker on average, although their head widths lay within the range of those of workers. Workers were monomorphic, showing a coefficient of variation of 4,7% for head width.

The colony was housed in a modified Lubbock nest in the laboratory, and fed liberally. Ants present when the nest was dug up were marked with Humbrol enamel modeling paint to distinguish them from those which eclosed later in captivity. The queen and a sample of workers were dissected four weeks later to examine their reproductive organs. Spermathecae were burst between a microscope slide and coverslip and examined for sperm under a Leitz Labrolux 11 phase contrast microscope.

Both queens and workers possessed three ovarioles per ovary. The dealated queen was inseminated, with ovarioles 6 mm long. There were mature oocytes and corpora lutea at

the bases of each ovariole, and ovarioles were moderately supplied with tracheoles. Newly eclosed virgin queens had very poorly developed ovarioles which were about 1 mm long. The ovaries of workers were only 1–3 mm long. Newly eclosed workers showed no ovarian activity and the shortest ovarioles, but three-week-old ants had slightly developed oocytes, and older ants were seen laying eggs within the nest. These ants were found to have well-developed ovaries containing corpora lutea and oocytes. Foragers, which can be expected to be the oldest workers in a colony, showed ovarian regression: shortened ovarioles and no oocytes (Table 1).

Both the queen and several workers were seen laying eggs within the nest. Some, but not all, of the ovipositing workers were inseminated. In a sample of twenty worker ants confined to the nest, four were mated. The head widths and scape lengths of mated workers were not different from those of others in the colony (*U* test; $p = 0,89$), and there were no morphological features to distinguish them from other workers.

P. arnoldi presents a form of social organization previously unknown in social insects, where workers generally do not reproduce in the presence of a queen, and certainly never sexually. (Virgin workers may reproduce haploid offspring by parthenogenesis in the absence of a queen.) Since the mated queen laid eggs, she was a functional reproductive, contributing to the worker population of the nest. Her oviposition rate (2,0 eggs/day) was similar to those of queens of other ponerine species (Villet 1990), indicating that she was also healthy. It is therefore unlikely that the participation of workers in the reproductive role was a response to any failure of their queen to fill that role adequately. The occurrence of *unmated*, laying workers with a healthy queen in this nest of *P. arnoldi* implies that any mechanism controlling haploid reproduction by workers has broken down. The presence of *mated*, laying workers further implies that the mechanisms regulating mating by workers have also been altered. Social dominance and the abilities to lay eggs and to mate are closely linked in ponerine ants (Fukumoto, Abe & Taki 1989; Villet 1991a, 1991b; Ito & Higashi 1991). If the mechanism regulating oviposition in workers also regulates their mating behaviour, its failure in this colony would free workers to mate and thus to enter the

Table 1 Ovariole length (mm) and the occurrence of insemination, oocytes and corpora lutea in workers of *Platythyrea arnoldi*

	<i>n</i>	sperm	Length of ovarioles	Oocytes	Corpora lutea
1-week-old	4	NO	1	NO	NO
2-week-old	1	NO	1	NO	NO
3-week-old	4	NO	2	NO	NO
Non-foragers	9	NO	1–3	NO	NO
> 3 weeks old	2	NO	2	YES	NO
	5	NO	2–3	YES	YES
	4	YES	3	YES	YES
Foragers	17	NO	1	NO	NO
	3	NO	1	NO	YES

role of producing diploid offspring.

It remains to be seen if this social system is usual in this species, how other aspects of social behaviour are affected, and whether colonies normally have only one mated queen. *P. modesta*, a close relative of *P. arnoldi* (Villet, Hart & Crewe 1990b), also has a queen caste, but it is not known how similar the reproductive biologies of the two species are.

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The taxonomic status of *Apogon enigmaticus* Smith, 1961 (Teleostei, Apogonidae)

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The validity of the cardinal fish species *Apogon enigmaticus*, described by Smith (1961) from a single specimen, is reassessed in view of a recent discovery of a second specimen of this species, collected by Smith, in the J.L.B. Smith Institute of Ichthyology. Both fish were re-identified as specimens of *A. apogonides* (Bleeker, 1856) on the basis of dentition, pigmentation, and counts of pectoral-fin rays, gill rakers and predorsal scales. *A. enigmaticus* is therefore regarded as a junior synonym of *A. apogonides*.

Die geldigheid van die kardinaalvisspesie *Apogon enigmaticus*, wat deur Smith (1961) van 'n enkele eksemplaar beskryf was, word heroorweeg in die lig van 'n onlangse ontdekking van 'n ander eksemplaar van hierdie spesie, versamel deur Smith, in die J.L.B. Smith Instituut van Viskunde. Albei visse is herbeskryf as eksimplare van *A. apogonides* (Bleeker, 1856) op die basis van die tande, kleur (pigmentasie) en hoeveelheid van pectoraalvinstrale, kieuharke, en predorsale skubbe. *Apogon enigmaticus* word dus beskou as 'n junior sinoniem van *A. apogonides*.

The cardinal fish species *Apogon enigmaticus* was described by Smith (1961) from a single poorly preserved specimen collected in Durban. In his original description Smith (1961) expressed reservations about the validity of this species, but decided to name it 'chiefly for purposes of record in case further specimens come to light.'

The holotype of *A. enigmaticus*, lodged in the South African Museum, Cape Town (SAM), was originally identified as *A. monochrous* (Barnard 1927). The latter name was also used for two other specimens from Durban described by Regan (1916). These two specimens were re-identified as *A. apogonides* (Bleeker, 1856), apparently by J.L.B. Smith himself.

Recently, the author discovered another specimen labelled *Apogon enigmaticus* in the collection of the J.L.B. Smith Institute of Ichthyology, Grahamstown (RUSI). This fish was collected, and presumably identified, by J.L.B. and M.M. Smith, in Transkei, 1948. An examination of this fish revealed that it is a specimen of *A. apogonides*. This finding prompted the author to re-examine the holotype of *A. enigmaticus* and compare both fishes with specimens of *A. apogonides* in order to reassess the validity of the former species.

Material and Methods

Apogon enigmaticus: SAM 13817, 77,2 mm SL, holotype, South Africa, Durban, collected by H.W. Bell Marley, 1915; RUSI 20565, 72,4 mm SL, South Africa, Transkei, Xora, collected by J.L.B. and M.M. Smith, 1948.

Apogon apogonides (comparative material): RUSI 1429, 88,0 mm SL, Reunion Island; RUSI 3094, 58,0 mm SL,