

8 Summary

In Hymenopteran societies, there are often conflicts over reproduction. Therefore, to understand the social behavior and the structure of the colony, it is essential to know the kin structure within the colonies. Kin structure is affected by the mating frequency of queens, the number and relatedness of queen and the allocation of reproduction between the queens. In *Pachycondyla villosa*, the mating system and the colony structure was determined by analyzing these factors genetically with multilocus DNA fingerprinting.

In a population near Itabuna, in North-East Brazil, 25 founding colonies, 6 bigger colonies and 4 colony fragment of *P. villosa* were collected.

The examination of the mating frequency showed, that queens of *P. villosa* only mate once. Additionally the comparison between the intercolonial band sharing-coefficient, calculated from unrelated individuals, and the band sharing-coefficient from monogynous colonies revealed no hind for multiple mating in *P. villosa*.

Thus, because of single mating of the queens, the relatedness between the colony females is reduced mainly by the number of queens.

40% of the 25 founding colonies, were pleometrotic with two (24%) and three (16%) queens. In all 10 founding colonies examined all associated queens laid eggs. The rates did not differ between the single founding queens and those in the two-queen groups, whereas in the groups with three queens the co-foundresses laid significantly fewer eggs. Cooperatively founded colonies normally benefit by producing a greater initial worker force, and in *P. villosa* 21 weeks after collection the pleometrotic associations had produced more workers than colonies founded by haplometrosis.

During the early phase of founding, when no workers were present, ponerine queens leave the nest to forage outside. In each group of *P. villosa*, only one of the queens performed this risky task without apparent aggression between the co-foundresses. Even after the eclosion of the first workers, the time most pleometrotic associations were regulated to monogynous colonies, no aggressive behavior occurred between the associated queens. Thus *P. villosa* seems to be one of the rare cases, where pleometrosis leads to primary polygyny, at least under laboratory conditions, with the queens coexisting in mature colonies without antagonistic behavior.

These polygynous colonies were used to investigate genetically the effective number of reproducing queens in the colonies, their relatedness and the allocation of reproduction between them. According to the reproductive skew models, unrelated queens should contribute equally to the progeny. In *P. villosa* the band sharing-coefficients revealed no relatedness between associated queens. And the genetic analysis showed that in 6 out of 7 colonies worker reproduction and in the two colonies studied queen production were evenly shared by the cooperative queens. Only in the production of males there was a skew between the queens in 3 out of 7 colonies, and the observed skew could be due to differential oophagy. Therefore colonies of *P. villosa* are truly polygynous, with queens equally contributing to the progeny, and without aggressive interactions.

In contrast to the polygynous colonies overt conflicts over reproduction occurred in worker groups of *P. villosa*. The workers engaged in aggressive interactions and by that established linear dominance hierarchies. These hierarchies normally not led to the monopolization of egg laying by the α -worker, since in every group several workers laid eggs. Genetic maternity analyses revealed that the observed egg laying rates as well as the number of eggs successfully deposited on the egg pile occasionally differed strikingly from the number of males finally produced. In all 10 groups examined, the α -worker was most successful in producing male, although in some groups other workers showed similar or even higher fecundity. Among subordinate workers there was no such correlation between social status and reproductive success. This might in part be explained by the destruction of subordinates eggs mainly by the α -worker. Reproductive success of subordinate workers was determined by the number of eggs successfully deposited on the egg pile. But this also was not positive associated with rank in the dominance hierarchy, since mostly workers with medium social status produced more males than workers ranging just below the α -worker. Thus in worker groups of *P. villosa* only the top position in the hierarchy appears to guarantee high reproductive success, due to high fecundity and aggression by the oophagy, whereas otherwise no correlation exists between social rank and reproductive success.

The reproductive system of *P. villosa* was discussed with regard to existing reproductive skew models.