**AUTUMNAL POPULATIONS OF WASPS NESTS**

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**INTRODUCTION**

This note draws attention to the wide range of composition of autumnal populations of wasps nests of the ground-building species of the genus *Vespula*.

Apart from the data of WEYRAUCH (1935) the published records are scanty, both in respect of the numbers of the different forms and stages of wasps and of their parasites. Moreover, as RICHARDS and RICHARDS (1951) indicate, Weyrauch’s records for *V. vulgaris* L. are the least satisfactory in that the nests were taken too early in the season for the sexual forms to have matured.

We have recently examined two nests of *V. vulgaris* in the grounds of the Imperial College Field Station. Both nests were in stacks of sods cut and stored under large trees, and separated by some 100 yards. They were taken within a short period of one another (18th. September and 3rd. October, 1957) and were as likely to be comparable as naturally occurring nests ever are, yet the proportions of the inhabitants were quite different. Both nests were taken by pouring some 100 ml. of liquid hydrogen cyanide into the entrance hole, and blocking this hole with a cotton wool plug loosely tamped so as to allow sufficient gas to diffuse through the plug to kill returning foragers flying into the space between the plug and the external entrance. In this way, up to 100 workers have been taken at each nest, having spent the night outside the nest, when, as in this instance, the entrance is blocked after dark the previous evening. Towards the end of the season these straying workers will return in diminishing numbers from first light until midday (BLACKITH, 1957).

Should the passage through the earth be more than about a foot, most of the wasps and their parasites will recover from the cyanide on prolonged airing when the nest is dug out, though this recovery may take up to 24 hr... Doubtless the strong sorption of hydrogen cyanide on damp soil is responsible for the low concentrations reaching the nest; with a short passage it is difficult to judge the dosage so as to avoid killing the nest contents.

**POPULATIONS OF WASPS**

Table I shows the number of wasps of different castes and stages found in each nest. The adult counts are probably accurate to a few individuals, those of the larvae and pupae are rather more difficult to classify and may be biassed. In any event there is a considerable overlap between the maturation of the last virgin queens and males to be produced and the nest-leaving of those which mature earliest, so that nothing but a census of wasps leaving the nest throughout the daylight hours for some weeks would ensure accuracy in this respect. Our taking of the nests was timed...
by a third nest kept in a beehive fitted with an observation entry tube in which the various groups of wasp could be distinguished as they left the nest. We are glad to acknowledge the collaboration of Mr. N. G. M. Hague in this part of the experiment.

Nest A is noteworthy for the excessive number of males, and the entire absence of those virgin queens which are conveniently called gynes (Brian, 1957). An obvious explanation for the excess of males would be the death or disfunction of the queen. We were able to recover her from the nest and she laid an egg whilst recovering from the cyanide anaesthesia, and then took some sugared water. An ample supply of ovarial eggs was found on dissection, but unfortunately the queen died during the night before dissection, so that our inability to find sperm in the spermatheca could have been due to the death of the sperm (Richards and Richards, 1951). On the other hand, sperm may have been absent either because the original fertilisation was inadequate, as Ruttner (1956) found to occur in a queen honey-bee if the sperm is not pressed home by the muscles surrounding the oviduct, or the wasp queen may have exhausted her supply.

The large number of immature workers found in nest B is the chief abnormality in this autumn population, since the workers cease to be produced, or so it is generally supposed, when the sexual forms are laid down (See, for example, Richards, 1953). The physiological age of all but a few of these workers was younger than that of the immature sexual forms, most of which had passed into the advanced stages subsequent to the sealing of the cell. The possibility exists that the worker larvae were neglected for those of the sexual brood, but had yet been laid before the sexual cells were constructed. However this may be, the presence of large numbers of worker larvae is difficult to reconcile either with the view that the change to sexual brood is associated with a particular worker-larvae proportion, or, alternatively, with the idea that transition to the production of sexual brood is irreversible. In either event, some of the later sexual brood must have matured whilst an overwhelming proportion of the worker larvae needed attention from the adult foragers and nurses.

THE DISTRIBUTION OF WASPS IN THE NEST

One feature of the records which we have not seen recorded in the literature is the substantial degree of segregation of the adult forms within the nest. In nest B, whose population was very rapidly killed by the cyanide, almost all the workers were found in or on the envelope. Of the 526 males found in the nest, only 47 were in the top 7 combs, the remainder lying in the bottom of the envelope or in the lowest three combs. The adult queens were found, on the contrary, to be mainly confined to the top combs, especially numbers 3-7 inclusive. This segregation bore no apparent relationship to the cells from which the different forms had