Order 29

HYMENOPTERA
(ANTS, BEES, WASPS, ICHNEUMON FLIES, SAWFLIES ETC.)

Insects with 2 pairs of membranous wings, often with the venation greatly reduced; the hind wings smaller than the fore pair and interlocked with the latter by means of hooklets. Mouthparts primarily adapted for biting and often for lapping or sucking also. The abdomen usually basally constricted and its first segment fused with the metathorax; an ovipositor always present and modified for sawing, piercing or stinging. Metamorphosis complete; larva generally apodous with a more or less well-developed head, more rarely eruciform with locomotory appendages; tracheal system usually holopneustic or peripneustic throughout life, or at least in the final instar. Pupae adecticous, exarate (rarely obtect) and a cocoon generally present.

This order is one of enormous extent comprising more than 100,000 described species and many thousands of forms still await discovery. If the Hymenoptera be judged by their behaviour, they must be regarded as including the highest members of their class. Structurally the majority of their species have attained an advanced degree of specialization which is only surpassed by the Diptera. In certain species of the order the individuals have acquired the habit of living together in great societies, as in the case of the ants, wasps of the family Vespidae and bees of the family Apidae. A large proportion of the females of these societies have undergone structural changes, in some cases slight, in others more pronounced, so that they constitute a separate caste or type of individual known as the worker whose power of reproduction is either in abeyance or usually limited to the laying of male-producing eggs. Their functions include those of nest-building, feeding and tending the brood and the defence of the colony. The normal reproduction of the species in the social Hymenoptera is either performed, as in certain wasps, by many of the female members of a colony or more usually by a single individual often of large size known as the queen. The sole
function of the males is that of impregnating the females, an act which often comparatively few succeed in consummating.

Indications of what, in the higher Hymenoptera, constitutes social behaviour are found among solitary wasps and bees (Wheeler, 1928). Most solitary bees and wasps practise 'mass provisioning' — i.e. they store their cells with sufficient food to satisfy their developing offspring and close them down before the eggs hatch. There are, however, species which feed their larvae from time to time ('progressive provisioning'), thus becoming acquainted with their offspring. Among tropical Vespidae of the tribes Ropalidiini and Polybiini many colonies are perennial and contain numerous fecundated females; their larvae are reared by progressive provisioning. Workers are often hardly differentiated and sometimes numerically weak. Such colonies, when fully developed, emit swarms consisting of fecundated females, usually accompanied by workers. This pleometrotic state is sometimes considered more primitive than what obtains among the Vespidae of temperate zones, whose colonies are haplometrotic, i.e. dominated by a single fecundated female or queen: such colonies are seasonal only and the worker caste is usually clearly differentiated. Among the social bees (Michener, 1974) the most primitive are the species of *Halictus* (s.l.) p. 1255 and the Bombinae. Humble bees construct no true comb but the larvae are reared in waxen pockets. They are at first fed by mass provisioning but in some species the older larvae are fed periodically. Their colonies are haplometrotic and last only for a season. Among the Meliponinae and Apinae the colonies are perennial, haplometrotic and give off swarms. *Melipona* and *Trigona* practise mass provisioning and close their cells; apart from *Halictus*, they are the only social Hymenoptera where there is no contact between parent and larva; in many cases the three castes, which appear to be genetically determined, are all reared in identical cells on a similar diet. In *Apis* the cells are open throughout larval development: the castes are reared in differentiated cells, at least in *A. mellifera*, and queen-producing larvae are fed on a specialized diet. Among ants the castes exhibit their maximum differentiation: the larvae are reared in clusters, there being no cells, and there is a more intimate relation between the workers and the brood than in other social Hymenoptera.

Wheeler attributed great importance to the phenomenon of *trophallaxis*, or the mutual exchange of food between imagines and their larvae. Ant larvae seem to produce a secretion highly acceptable to their nurses. In some species it is saliva, in others an exudation of the integument, while in the Pseudomyrmiciniae it is a product of special papillae known as exudatoria. It appears that avidity for these larval secretions helps to sustain the bond between ants and their brood and it further accounts for the relations which ants have acquired with alien insects and other arthropods (Wheeler, 1923). Trophallaxis also occurs in the Vespidae but in them its function is less certain; it may be merely the disposal of excess water produced by the larvae (Brian and Brian, 1952) but in some Vespinae (pp. 1247–48) there is an important exchange of food. Among bees the phenomenon seems to be wanting. An