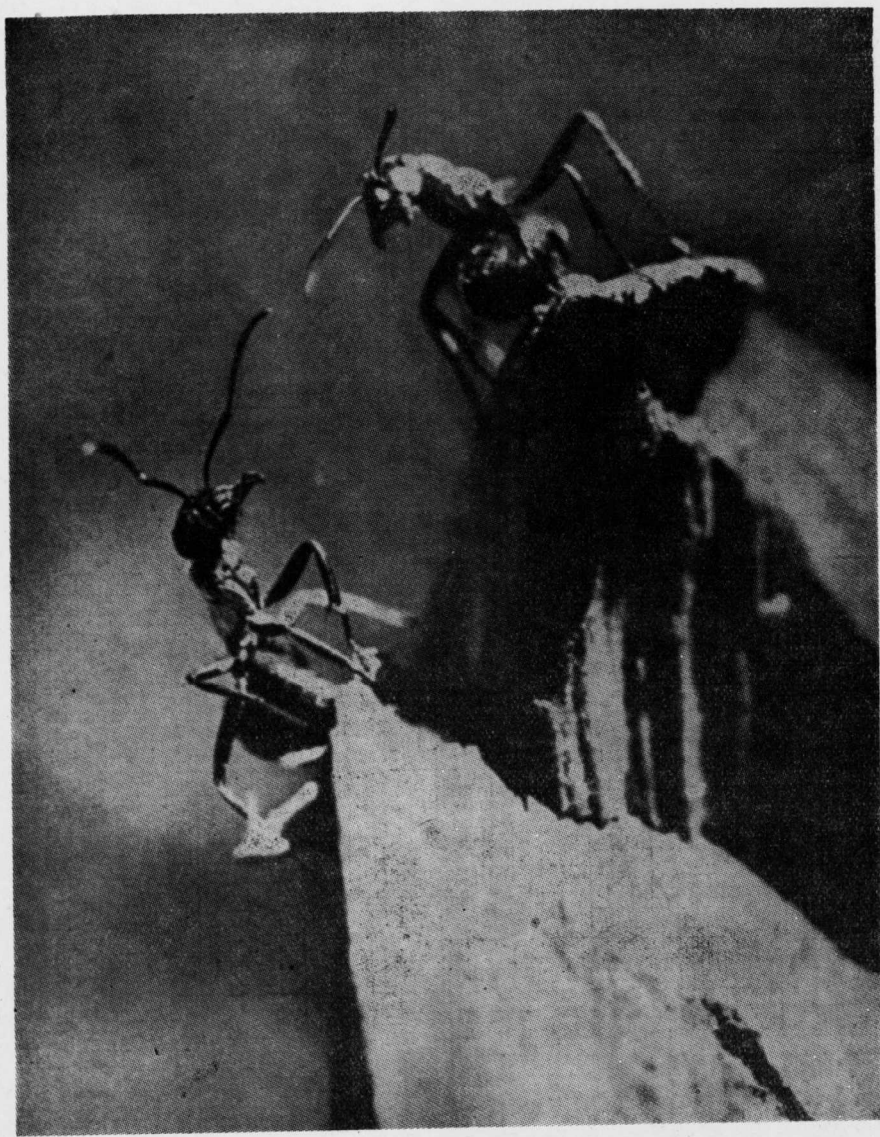
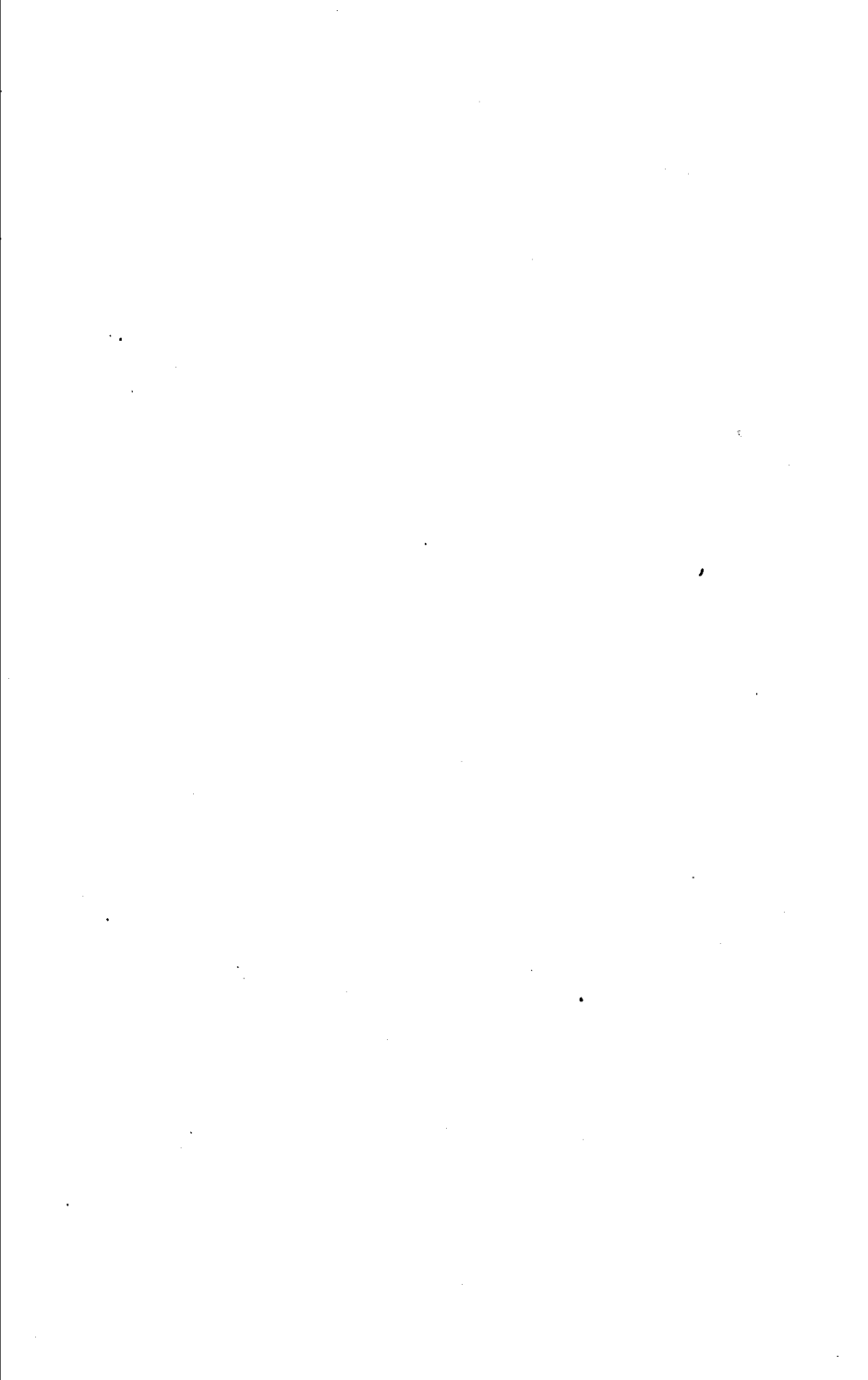


*Derek
Wragge
Morley The
Evolution
of
an Insect
Society*



1. Wood Ant workers at the alert to defend the nest against the human watcher. *Raymond Kleboe.*



*The Evolution
of an
Insect Society*

Derek Wragge Morley

LONDON

George Allen & Unwin Ltd

First published in 1954

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Printed in Great Britain
in 12 on 13 point Bembo type
by Hunt, Barnard & Co., Ltd.
Aylesbury

PREFACE

IN this book I have endeavoured to unravel the many elements that combine together to form the pattern of social life in the Wood Ants. The historic incidents recorded are all drawn from my own personal observation. The anonymity of the community has been preserved in order to prevent the Wood Ant society which still survives, from being disturbed by human agents to any greater extent than has already occurred.

In placing this history against the wider background of Wood Ant life in general, I have drawn freely on such Wood Ant lore as I possess after some twenty years of observation of their habits, and on much that has been garnered from other students of ants such as A. Raignier (*Vie et Moeurs des Fourmis*, Paris, 1952), and the multitudinous works of K. Gosswald and many others. I am deeply in debt, as are all students of ants to the late W. Morton Wheeler, for his classic studies in the mutual feeding of grubs and adults and on the regurgitation of food, and to those other great students of ant life, Auguste Forel and Horace Donisthorpe for their various elucidations of its mysteries. I am also indebted to T. C. Schneirla and Caryl P. Haskins for their work on the Doryline army ants and the Bulldog Ants (*Myrmecia*) of Australia respectively. The former's analyses of the social organisation of the ants have proved particularly useful. I must mention also the work of G. Le Mesne (1952) and C. P. Haskins and R. M. Wheldon (1954), who have proved beyond doubt that regurgitation occurs, though in a primitive form in a number of species and genera of the Ponerines (despite earlier failure to find it by Haskins) – a discovery of major importance.

All explanations of societies are by their nature syntheses, part fact, part theory, and therefore open to future modification or denial. Yet I believe that the main trends which I have described here are somewhere close to the truth, and hope therefore that

they may be of some use to those who would understand the simple elements which lie behind these complex societies of the Wood Ants - and perhaps behind many another seemingly complex society besides.

DEREK WRAGGE MORLEY
Hampstead
July, 1954

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THE ANTS

John Clare

*What wonder strikes the curious, while he views
The black ant's city, by a rotten tree
Or woodland bank! In ignorance we muse:
Pausing, annoyed, we know not what we see,
Such government and thought there seems to be;
Some looking on, and urging some to toil,
Dragging their loads of bent-stalks slavishly;
And what's more wonderful, when big loads foil
One ant or two to carry, quickly then
A swarm flock round to help their fellow-men.
Surely they speak a language whisperingly,
Too fine for us to hear; and sure their ways
Prove they have kings and laws and that they be
Deformed remnants of the fairy days.*

CHAPTER 1

The Society is Discovered

THE heaths and woodlands of Eurasia, Japan, and North America are the homelands of the Wood Ants. Their large mounds, two, three, or four feet high, and sometimes larger, are known to men of many kinds and many countries. These hillocks are made of twigs, pine needles, bits of dead petioles of leaves, or whatever material is most abundant near at hand. The mounds themselves form only a part of the nest, which is continued below ground to a depth of from two to three feet, as a series of excavated chambers and connecting galleries tunneled out of the earth.

The individual nests are not isolated communities, as is the case in most ant species. Each one is a self-sufficient unit which forms part of a larger whole, the commune. The size of these communes varies greatly, but each consists of one or more larger and older nests and a series of from three or four to a dozen daughter nests, which are linked together by clearly defined, well-populated trails. These daughter colonies are founded by the fertile offspring of the older colonies, the queens, which after mating on the roof of the hillock, set out with a small band of workers to the site of the new city.

A commune of Wood Ants consisting of a dozen such nests will have a population of more than a million individual ants. Of these, perhaps three or four hundred individuals will be egg-laying queens and, except at breeding time in midsummer, the rest of the ants will be workers. These workers are undeveloped females, whose ovaries have remained rudimentary. They do not possess the seminal pouch in which the queens, after their mating, retain and keep alive the male semen for the ten or fifteen years during which they continue to lay fertile eggs.

At breeding time, thousands of large, cumbersome winged

males swell the population of the nest. They do not work and are not allowed outside the hillock until the mating day arrives, when they are allowed to fly away in search of cousin nests, or else forced to fertilize a virgin queen from their own nest. By dusk that night their usefulness is over and they are usually outcast from the community and die within a few weeks.

Throughout the warmer months of the year each larger hillock also contains some ten thousand grubs which require constant feeding and cleaning, a slightly smaller number of eggs which must be licked to keep them moist, and several thousand cocoons which contain full-grown grubs undergoing their final metamorphosis before emerging as adult ants.

A large part of the adult worker population of each hillock will also be found inside the city caring for these helpless offspring and for the queen mother of the community. The nest must also be cleaned, repaired, enlarged, and strengthened. The passageways and chambers must also be kept clear of unwanted visitors of many kinds. These tasks occupy the attention of a further, by no means inconsiderable labour force.

The myriad scurrying ants on the trails outside and in the surrounding vegetation represent, therefore, only a fraction of the population of each nest. They number perhaps a third of the adult workers and on them falls the task of food-getting and of finding and transporting to the nest the materials needed for repair or enlargement.

Thus each Wood Ant nest within the commune is a complex society in which the well-being of each individual ant depends not solely on its own efforts, but also on the efficiency with which other ants carry out a wide range of different tasks. Thus the well-being of the Wood Ant community, like that of a human community, depends on both the efficiency of the individual workers (including that of the queens in their egg-laying), and the proper adjustment of the labour forces engaged on the different tasks. The relationship between the different nests within the larger social unit, the commune, likewise affects the well-being of each individual nest and ant. More prosaic factors such as the abundance

or paucity of the food supply, the growth or decay of the vegetation and other factors, like the weather, also play their part.

In order to understand the organization of the communes we must study their sociology, their history and their evolution. Since in ant sociology, as in human sociology, the thorough study of a single typical community is the most rewarding starting point, this book concerns the story of a particular commune of Wood Ants occupying a wooded heath in southern England. Their society is typical of all other Wood Ant societies, whether in the New World or the Old, the Orient, or the Scandinavian forests.

To understand its structure the reader must journey far back into ant pre-history and then return to the daily records of the immediate past.

The commune is not a large one and consists of five nests in all. The mother nest, from which the others stemmed, is large and old. It dates back some forty years, so records tell us, and the manner of its foundation is unknown. It may be the sole surviving daughter nest of an earlier commune which has long since disappeared, or which has removed to another part of the heath. It may be the result of the successful attempt at colony foundation by a single newly wedded queen which, instead of seeking aid from the workers of the matriarchal nest, spread its wings and flew off into the, as yet, unpopulated wilds. We do not know: there are so many possibilities.

The mound of this mother nest stands nearly six feet high. Below ground the nest extends a further three and a half feet at its deepest point. Within it there lives a population of nearly half a million worker Wood Ants, and more than three score of egg-laying queens.

These worker Wood Ants are formidable creatures; the largest measure a full centimetre from head to tail. Their heads, shaped like a somewhat flattened pear, are ruddy-brown in colour; their thorax and legs are russet-red; and their cone-shaped gasters, or hind-parts, are matt blackish-brown. At the fore end of their heads are two trowel-shaped mandibles, which interlock when

closed, each of which bears five saw-like teeth. At the rear end of their gaster is an orifice ringed round with hair which serves both as an outlet for their excreta and a faucet through which they can squirt formic acid at their enemies. This acid, which derives its name from these ants, is manufactured by two glands inside the gaster. When fighting, or disabling their prey, the ants will either spray it from a distance towards the enemy, or squirt it from close at hand into a wound they have already opened with their mandibles.

The whole surface of their bodies, including their legs, is armour-plated with chitin, a horny yet flexible material made from a compound of glucose and protein. This chitin plating serves both as a protective armour for the ant and as its skeleton. In the latter function it is equivalent to our bones. The weak points in the ant's armour are its joints. The ant's long legs are built up of five separate units, fastened together by flexible joints. There is a joint between the head and the thorax, and a joint between the thorax and the hind body. The latter it is true is protected by a hexagonal scale which stands up at right angles to the chitin waist and so prevents an enemy obtaining too easy a grip; but all these joints are danger points. The thorax is mainly a container for the alimentary tube in its passage from the head to the hind-body, and the body muscles which move the three pairs of legs which are attached to it. The gaster contains the heart and organs of digestion and excretion. The head is the seat of the brain and the main organs of sensation. A pair of large compound eyes, each with six hundred separate but adjacent lenses, are mounted on either side of it. The antennæ, which are the noses of the ant, as well as being their organs of touch, are attached to the fore part of the top of the head. Here there is another danger point, the vulnerable basal joint by which each antenna is joined to the head; but this is protected by a ruck in the chitin armour.

It will be apparent from this brief description that the worker Wood Ant is well equipped for war. While this is a correct and perfectly justifiable assumption, it is important also to remember that the Wood Ant cannot pick up her weapons when war com-

mences and put them down again when peace returns. Her weapons are a part of her being, growing as she grows and ever-present throughout her life. The toothed mandibles have peacetime uses in hunting and killing prey and carrying materials of all kinds. They can be used as shovels to excavate new chambers and knives to cut up bulky insect flesh for food, or rotting carrion which is fouling the nest or trails. The acid also is of use to kill prey; but only in wartime is it squirted to maim a distant quarry.

The armour not only protects and serves as the skeleton on which the body tissues are hung, but is also a container for the blood which the rhythmic pulsing of the heart moves slowly to and fro.

The Wood Ants may seem excessively warlike in appearance and well-adapted to the arts of conflict, but warfare dominates their behaviour no more than that of man. A worker life-time of seven to eight years, may well be lived through its entirety, with little more than a skirmish to break the peace. As with man, so it is with these ants of the Southern heathland: the days of single combat are gone except for wrestling struggles waged in play. Unlike man, on the other hand, the ants are limited in the nature of their weapons by the ability of their bodies to grow them. This difference is important for as the weapons grow, so the instinct for their best use to gain survival for their possessors, grows with them; a circumstance which prevents the Wood Ants from developing weapons too powerful for the good of the species.

The queen ants of this matriarchal nest are much like their worker offspring, but half as large again, with humped swollen thoraxes. These housed the great muscles used to move their wings. They are evenly coloured a deep reddish-brown all over their bodies, and their bodies are shining instead of being dull like those of the workers. Today, as we find them in the nest their gasters are swollen with eggs whose bulk has moved apart the chitin staves of the armour to expose the weaker, thinner, and more elastic joints between them. This gives their gasters a striped appearance in which the red-brown chitin armour bands alternate with whitish bands of the more elastic skin. The gasters of the

incoming workers, it will be noticed, have a similar appearance when their crops are filled with food. This crop is the shopping basket of the Wood Ant, the container into which the food collected out foraging, can be packed for the journey homewards. It is situated in the gaster at the end of the long throat which extends throughout the thorax and is capable of great expansion. It contains no gastric juices and is kept separate from the rest of the digestive tract by a special valve, called the gizzard. This valve permits only a single drop of food at a time to pass through into the ant's real stomach. The food carried back to the nest in the crop is regurgitated to feed the other members of the community.

The males, which are present only in June, July, and perhaps August, resemble the queens in size, but have smaller heads with bigger eyes, and gasters of a more elongate and cylindrical shape with large paired claspers at their hind end for gripping the queens during mating. They are blacker in colour and their skins are matt and not shiny like those of the queens. Unlike the queens they never lose the flying wings with which they are born.

At present this large nest is marvellously well hidden. It lies barely ten feet to one side of a well-used path across the heath, yet it is probable that few of the score or more humans who pass by each day are aware of its existence.

Its core is built round a decaying pine stump, felled probably in the year of its foundation. An arm of a largish gorse bush grows out through its firmly thatched dome of twigs and helps to camouflage it against even close inspection. A ring of birch saplings, their branches straggling at heights ranging from three feet at their lowest point to ten or twelve feet at their highest, prevents the human busybody from overlooking the nest. A mass of bracken and some other neighbouring gorse bushes help to perfect its hiding place. On one small sector only is the nest exposed and that is on its southern face, away from the path and facing the noonday sun. Secretiveness is not a usual quality of Wood Ants' nests, as will be seen when the daughter colonies are described, nor has this nest been always so well hidden. A root to