

Scientist Tells of Life Among Ants

Entomology

By MARJORIE MACDILL

On a sunny afternoon some seventy-five years ago a little boy was playing alone in a charming flower-filled garden on the shores of Lac Lemán. Through the long French windows came the sound of one of Beethoven's sonatas. In spite of the beauty of his surroundings, the little boy was lonely and longed for the comradeship of unwashed urchins in the nearby village. But the edict of the author of the piano notes floating out through the clear Alpine sunshine was absolute. Perhaps Mother feared the contaminating effect of the local dialects, of variety and intonation innumerable in Switzerland, on the pure French accents of her son.

However that may be, the boy playing on the terraces, so common in Swiss gardens, made a discovery. There between the stones that made the steps of the terrace was an energetic colony of ants carrying on a most diverting number of fascinating activities. Thereafter the little fellow was no longer lonesome.

"Thus it was," says Dr. Auguste Forel, M.D., Ph.D., member of the French Academy of Sciences, and



AUGUSTE FOREL. . . . "In fury I poured boiling water on the reds, but all in vain"

former professor at the University of Zürich, "that from the age of five, ants, wasps, snails, little creatures in general and ants in particular, were my delight. There were big ants, little ants, black, red and yellow ants. And then, inside their nests, which I overturned, there were little white worms and motionless white cocoons looking as if they

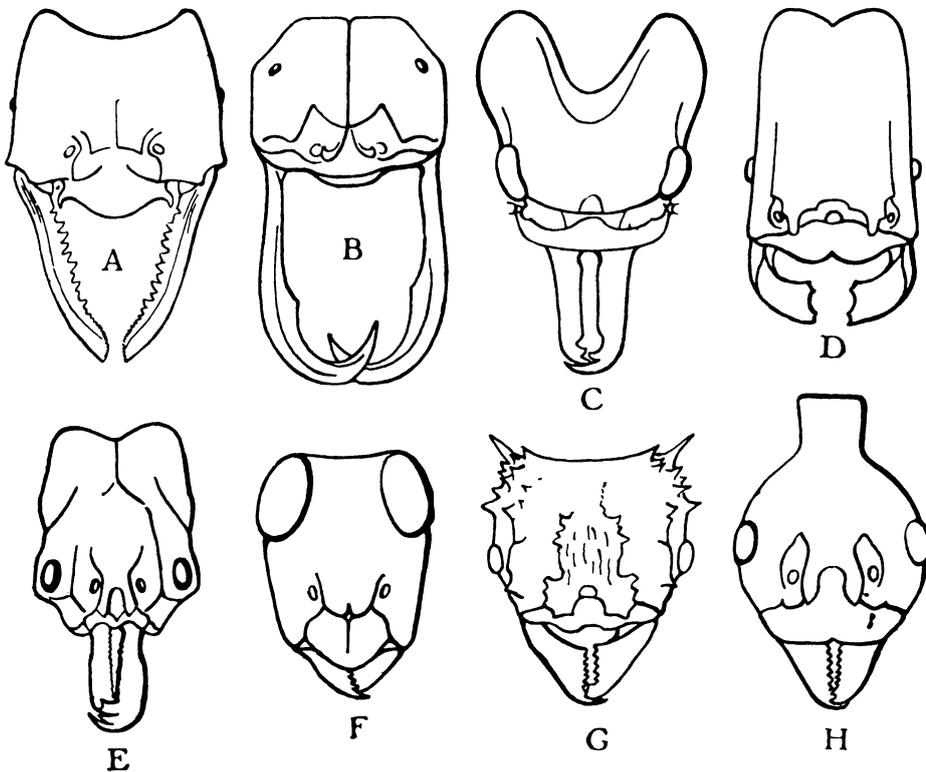
were swaddling clothes. I watched the nimble ants bearing all these curious things with jealous care; but neither my mother nor I could tell what it all meant. These white objects could not possibly be eggs, because they were often as big as the ants themselves, occasionally bigger. Sometimes winged ants could also be seen inside the nest.

"Why did the ants of the terrace—my particular friends—live together with complete understanding, cooperating one with another and taking their food in common when I gave them bread or honey, while they fought savagely with the inhabitants of other colonies?"

"One fine day, my black friends of the terrace were attacked by a troop of large red ants with black bellies. I wanted to help them but was taken away to go for a walk. I was then seven and a half years old. When I came back I saw that the nest of my poor friends had been invaded by the red ants, which had driven the others away and were carrying off their cocoons. In my fury I poured boiling water on the reds, but all in vain. Then I followed them to their nest, about 40 or 50 feet away at the edge of a path. In their midst, I was astonished to find black ants smaller than themselves, just like my friends of the terrace, but living in common with them. Could these be slaves, hatched in this nest from cocoons which had formerly been stolen? Even then I put the question to myself, but was not able to answer it."

Eventually this embryo entomologist grew up to attain a widely heralded name in the fields of medicine, psychiatry and neurology and wrote, among other things, one of the soundest and most comprehensive treatises on that all important subject, sex, that we have in any language; but always he returned to his first love, the ants. Ants with appendages to drill through the brains of their enemies and kill them by paralysis, ants that make slaves, ants that grow mushrooms, ants with beards, ants deformed and hermaphroditic, ants that hoard grain, ants that milk "cows," ants that make paper and ants that weave, all were grist for the busy mill of his mind.

Finally, in the autumn of a long and busy life, (Turn to next page)



ALL ANTS LOOK ALIKE? Oh no! They vary as much as people, as these eight ant faces show. (All illustrations from "The Social World of the Ants," published by A. and C. Boni)

A Life Among the Ants—*Continued*

this learned Herr Professor Dr. Forel of Zürich came to set down on paper the sum total of his knowledge and experience with his "little friends," accumulated throughout a period of seventy years, in two thick volumes called "The Social Life of the Ants."

So much has been said about the means of communication between the minute creatures that make up the complex social structure of the ant world that it is interesting to see what he has to say on this fascinating subject. The prominent feature in such communication, of course, is the antenna, though this organ is not the exclusive factor in the function of such senses as smelling as it was once supposed to be. The following is a vocabulary in the antennal language of ants reported by Dr. Forel:

"It is above all an incitement to collective work, passing from one individual to the other.

"By caressing and lightly tapping a companion with her antennae one ant begs and implores the other to regurgitate for her a little honey dew.

"By striking a companion sharply with her antennae and afterwards moving away in a certain direction, an ant that is about to move her quarters invites this companion to follow her to a new nest.

"In a very similar way, an ant which has somewhere discovered a source of food invites her companions to follow her to such a place.

"By violent blows with the antennae, often delivered with her mandibles open, an ant urges her companions to the attack, or, on the other hand, to flight.

"Blows are often given with the antennae by an ant which wishes to warn a companion of a danger coming from a certain direction.

"By friendly antennal caresses, constantly repeated, ants endeavor to calm the affective excitement of one of their companions.

"Slave-making ants give their companions the signal for departure on an expedition by rapid blows with the antennae or head. In the same manner they point out to them a change of direction as soon as hesitation or stoppage has occurred on the march."

In spite of this elaborate system of communication observed by painstaking naturalists, the Swiss entomologist estimates that fully 95 per cent. of the ant's actions are determined by hereditary instinct. Four per cent. are due to what he calls

"emotional constellations" and a routine of habits fairly rapidly acquired. This leaves only one per cent. for individual reflection which can modify the ant's actions according to circumstances and special cases. This is a very trifling percentage compared with the proportion of thought and will which, it is estimated, control 60 per cent. of the actions of an adult human being.

Notwithstanding their remarkable hereditary instinct, this lack of reasoning power puts ants at a terrible disadvantage in dealing with the problem of the thousand and one "guests" and hangers-on that are quick to take advantage of the protection and convenience of an elaborate system of communal living. Prominent among these parasitic members of insect society are two or three species of beetles that live in the nests of one group of ants, prevailing upon the workers to feed them the food collected for themselves and their young. Then when it is time to produce their own young they migrate to the formicary of a species of ant more suitable for the depredations of their voracious larvae. The female beetle lays her eggs in this second formicary among the eggs and cocoons of her hosts. These helpless ant infants are immediately devoured by her more forward young ones. In proportion as the brood of ants decreases that of the parasitic beetle increases and is tended with loving care by the worker ants who disgorge for them the partially digested food intended for their own young. For the little thieves are not at all averse to a change of diet.

Dr. Forel relates an amusing incident in this connection that he has personally witnessed several times. There is a slave-making species known as the Amazon ant that goes on warlike raids for the purpose of carrying off larvae and nymphs of one of the varieties of ants that are frequently afflicted with the parasitic beetles, in order to hatch them out for auxiliary workers in their own nests. Not infrequently, declares the entomologist, the Amazon will carry off as booty the larvae of the beetles, "another robber almost certain to pay her back in ample measure by devouring her larvae and slyly appropriating from her slaves the honey dew for which it too has such a craving."

As the ant colony becomes more and more infested by these undesir-

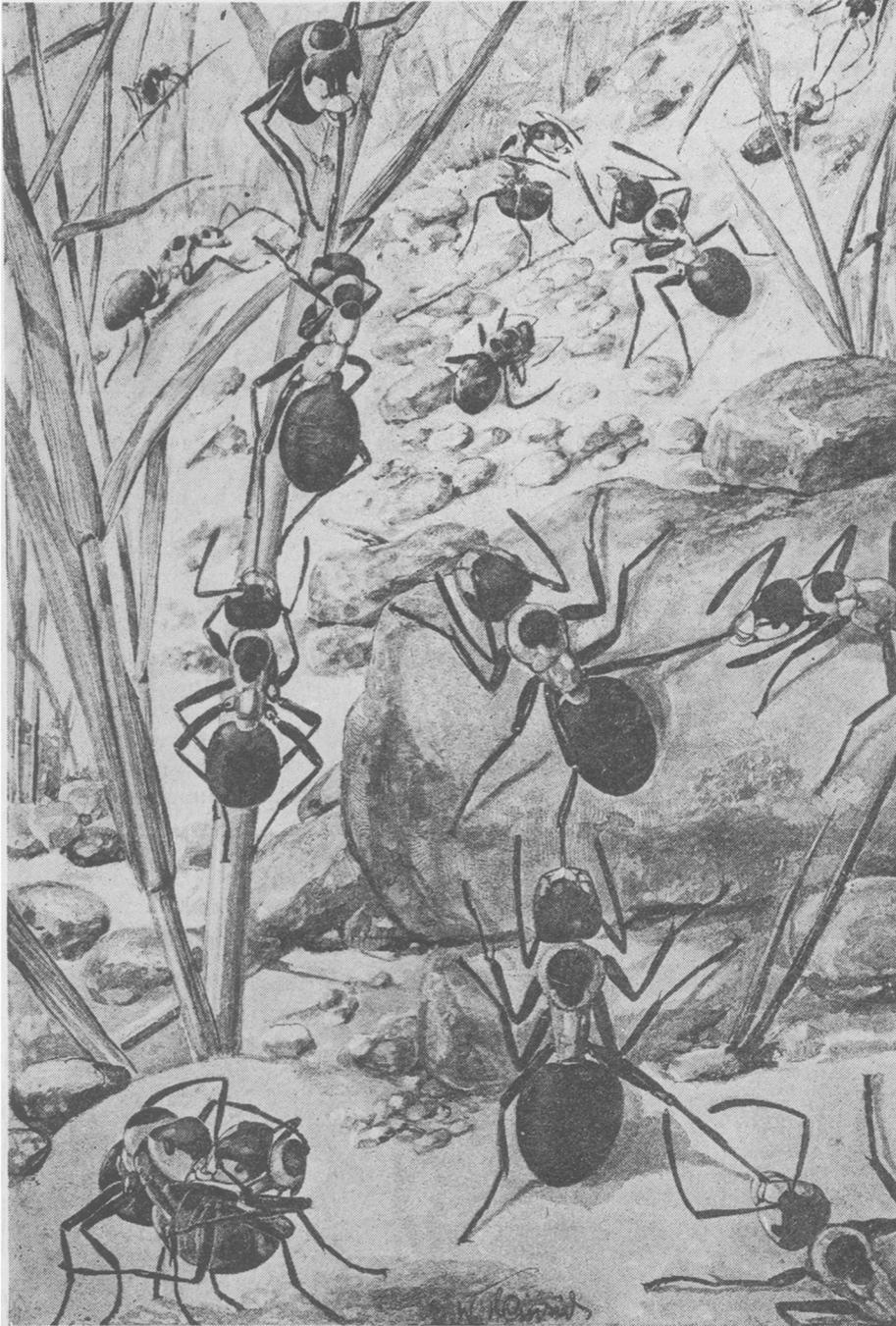
ables there appears in its midst in increasing numbers a curiously degenerate form of worker ant, smaller and less active than its normal sisters, much less capable, of course, of performing its share of the work. An ant queen removed from an infested colony and placed in a healthy one has been found to produce absolutely normal workers, so it is obvious that the deformity is not due to any change in the germ plasm of the eggs. These degenerate forms are found only in the beetle-infested colonies but just what the connection is has not been scientifically worked out as yet.

The reason why these hard-working ants are so taken in by their noxious parasites lies in a curious fact. It is well known that many ants are led by the nose, or rather by the antennae, in their preference for certain odors and foods of especially entrancing smell. Every one is familiar, for instance, with the ability of ants to sniff out honey and sugar, even in the face of formidable barricades. Now, on the backs of these tiny beetles is a group of minute hairs, called trichomes, that give out an aromatic perfume which apparently throws ants into ecstasies of delight, not unlike the response of some human beings to tobacco fumes or strong drink. Microscopic examination has revealed that every trichome is filled with fat cells which secrete the volatile aroma so delightful to the ant. Lured by this seductive odor, she gives up to the wretched intruder the food her social duty to her tribe requires her to give to her own larvae and so brings degeneration on the whole colony.

Not all the ant guests are so deadly. One little beetle performs really useful services in cleaning up the carrion and refuse of the nest and even renders valet services in picking off mites from the bodies of his protectors. Since these beetles are not equipped with the entrancing trichomes, however, they are not so welcome to their respective hosts as the beetles described above are to theirs. Ants, like humans, enjoy being duped.

There are few orders of insects that are not represented among ant guests. They have spiders and cockroaches, even as we, not to mention the members of their own race that inhabit the same nest in various degrees of parasitism. Mimicry, of course, plays an important part in this peculiar social condition among insects, but scientists, who have made (*Turn to next page*)

A Life Among the Ants—Continued



A BATTLE BETWEEN ANTS of the same species. . . . Biting off each other's legs and heads, conflicts sometimes last all day, and the fields of strife are covered with hundreds of dead and wounded

this phase of insect life their special study, have brought out the curious fact that the degree of mimicry on the part of guests is adapted to the quality of the ants' sensations.

"In the case of ants with poor sight," says Dr. Forel, "color-mimicry on the part of the guests is only a rudimentary affair, a rough approximation, but with regard to form, sculpture, hairs and smell, it becomes

all the more striking so as to deceive the touch and topochemical smell of ants. There is also a singular mimicry of demeanor, consisting in the activity of the limbs, in the mutual antennal language that passes between the guest and its ant, in caressing the legs, in its manner of eating and allowing or causing itself to be carried about, etc., and this kind of mimicry is not the least successful means of deceiving

the ant's social instinct in a fashion that is as hypocritical as it is unconscious."

Among the animals that the ants themselves make use of are the well-known ant cows or aphids. By stroking the pestiferous plant louse with its antennae the ant makes it give up tiny droplets of a sweet liquid exudation, the by-product of semi-digested juices of vegetables and flowers. These pests are cared for so solicitously by some ants that they build shelters for them, miniature cow barns, so to speak, around the bases of the plants where they feed. Others rear and tend the brood of the aphids in their own nests in order to make sure of plentiful herds.

Butterfly caterpillars are the favored cattle of some species. They ride around on their backs like microscopic horsemen and defend them furiously from the attack of other insects. The caterpillars turn into chrysalises in the galleries of their ants and are thus secured against their enemies during the helpless pupal stage. The ants protect the chrysalis until it is completely hardened and the caterpillar, in the earlier stages, while it is casting its skin. They likewise render assistance to the emerging butterfly. The secret of this association is not dissimilar to that with the parasitic beetle with trichomes. On the third segment from the end of the caterpillar's back is a tiny slit, which opens from time to time and lets out a minute drop of transparent liquid.

"This liquid is viscous," explains Dr. Forel, "and ants dote upon it. The caterpillar never secretes it except when the ants beg for it or when the creature wishes to appease them. The same caterpillar can secrete it several times a minute or requires a quarter of an hour's coaxing, according to circumstances. Observers assume that it is a sweet liquid, though they have never proved the fact by analysis. Thomann (another entomologist), observed that the secretion came more frequently whenever the caterpillar felt itself in danger. . . . It seems as though it were instinctively trying to please the ant in order to obtain better protection. Thomann thinks it is evident that the honey thus secreted by the *Lycaena* is one of the principal foods, sometimes the principal food of its ant."

"Go to the ant, thou sluggard; consider her ways, and be wise; which, having no guide, (*Turn to next page*)

Tea for Beer Causes Nervousness

Physiology

Substitution of tea for beer as the national beverage in England has probably been responsible for increased numbers of super-sensitive and neurotic people, in the opinion of the English physiologist, Prof. W. E. Dixon, who addressed the British Association for the Advancement of Science. In fact, the growing tendency in civilized nations to substitute tea and coffee for stronger beverages probably has a bearing on the increased nervous irritability among highly civilized peoples at the present time.

"England was once a drunken nation. Before the revolution the consumption of beer alone in England and Wales was 90 gallons a head per annum; now it is about a quarter of this. With this diminution of beer drinking is associated a truly enormous increase in tea and coffee drinking. To me it seems not unlikely that this substitution of tea for beer is not wholly unconnected with the tendency of highly civilized nations to become supersensitive and neurotic, for this is the groundwork upon which drug addiction is built," said

Prof. Dixon.

Prof. Dixon explained that beer is a soothing beverage, while caffeine relieves drowsiness and fatigue by direct stimulation of the brain cells. Unfortunately, it is just the super-sensitive people who drink the caffeine beverages like tea and coffee in excess.

"It is easy to understand the modern tendency in some highly civilized nations to indulge in narcotic drugs like morphine, heroin and cocaine," said Prof. Dixon.

Science News-Letter, July 27, 1929

New Museum of Geysers

Geophysics

The most complete geyser exhibit in the world has been installed in the new museum building at Old Faithful, under the supervision of Park Naturalist Dorr C. Yeager. It consists of specimens of the various types of geyser and hot springs deposits and of diagrammatic paintings showing how a geyser works, and of the evolution of a geyser through the geological ages.

Science News-Letter, July 27, 1929

Ergosterol in Mummy

Physiological Chemistry

The brain of an Egyptian mummy dating from about 500 A. D. has been examined by chemists and found to contain ergosterol, the parent substance of vitamin D. This news comes from Drs. H. King, Otto Rosenheim and T. A. Webster, working at the National Institute for Medical Research in London. They find that ergosterol is remarkably stable in animal tissues (brain, gallstones, blood, skin, eggs, etc.), although it is very unstable when separated from other substances. In the animal tissues it is protected by a closely related substance called cholesterol, which was originally thought to be pro-vitamin D.

Ergosterol has now been found in conjunction with cholesterol in a mummy brain which is about 1,400 years old. The brain was of Coptic origin, and was removed from one of the bodies found in tombs in Antinoe, Upper Egypt. No embalming process had been used, and the organs of the body were preserved in their original position, but of course shrunk and mummified under the influence of the dry atmosphere of Egypt.

Science News-Letter, July 27, 1929

A Life Among the Ants—Continued

overseer, or ruler, provideth her meat in the summer and gathereth her food in the harvest."

These remarks of Solomon's have furnished the nub of many a sermon and, in the early days of entomology, the source of much wrinkling of learned brows and wagging of learned beards. For the ants of northern Europe and America do not follow the praiseworthy habits of their sisters in Palestine and the Mediterranean region. Consequently, discussion over entomological passages in classical writers waxed warm, until about the middle of the eighteenth century, when some naturalist had a bright idea and predicted that ants in hot and cold countries would have different habits.

As a matter of fact, it is not for the short, mild winter that the harvesting ants gather seeds in their granaries, but for the dry season, when they can find nothing else to eat. There used to be a legend that such ants sowed their own grain and then stored their harvest away in their subterranean galleries. Recent observations show, however, that the grain patches around their formicaries are due to seeds that have sprouted and

taken root after being accidentally dropped or thrown out with other nest refuse.

The mushroom-growing ants of South America constitute another tribe that kept their food habits a secret from investigators for many years. They were known chiefly on the plantations in the tropics for their leaf-cutting propensities. They cut off pieces of leaves and carried off great quantities to their nests, choosing usually for the scene of their depredations, plants cultivated by man. It was generally believed that the leaves were used to line their nests. Eventually, indefatigable entomologists unearthed the information that the fodder they dragged off was cut up in little pieces and used to bed down their underground fungus gardens. Some species have been found unable to live without their mushroom diet while at least one species of the mushroom so cultivated proved unable to reproduce and multiply without the care and attendance of the ant-gardeners.

The weaving ants have solved the problem of making a home by utilizing the special gifts of their cocoon-spinning larvae. Every worker

seizes a larva in her jaws, and together with her squad of companions which are doing likewise, carries it to a place between two leaves, fixing its mouth to the edge of one leaf. Meanwhile another squad pulls with all its strength to draw one leaf towards the other, each worker grasping it by the one edge and hanging on to the other with all six legs at the same time. The final result is a compact nest of close and regular silken tissues woven between the leaves. The larvae are provided with relatively enormous silk glands. When the leaves are so far apart that their edges cannot be seized by the same workers, the ants form chains, each ant taking hold of the other until the first is able to hold the other end of the other edge between her six legs. Both then pull the two leaves towards each other, while the other squad of ants weaves with its larvae, if necessary, utilizing the chain of the first squad as a bridge.

This is an example almost unique in nature, Dr. Forel points out, of the use of one living creature by another as a working tool. Certainly such teamwork has few parallels.

Science News-Letter, July 27, 1929