Probing the Secrets of

THE TOWN ANT

by JOHN C. MOSER

"DARN those town ants!" These, and stronger words, are heard time and again in the hill country of east Texas and west-central Louisiana—the only part of the world that this ant calls home.

Why all the fuss about an ant that doesn’t even sting? The answer lies in the bare remains of a vegetable garden, or in a bed that was full of flowers yesterday and empty today, or in a pine plantation stripped naked of every needle.

Town ants are not a new problem—they were here when the first settlers arrived. Despite the battle to stamp them out, they are as widespread now as 100 years ago.

The trouble does not seem to be in the weapons employed against the ants. Methyl bromide and carbon disulfide, used to fumigate nests, are heavy gases capable of penetrating every gallery in the vast underground network. Both fumigants give satisfactory control, but the ants are not easily defeated. New nests are started by queens from adjacent areas about as fast as the old ones are poisoned. Consequently, continual vigilance is needed to protect farm crops and pine plantations. The farmers and foresters who must inspect many acres of newly planted land would be enthusiastic about a new type of control.

To improve control methods is the aim of a basic research project—the only one of its kind on this ant—recently started by the Southern Forest Experiment Station's research center at Alexandria. Here, the deepest secrets of the ant's nests and biology are being probed for a vulnerable point. This article summarizes three years' work, and shows how findings to date will guide future investigations.

Spade Work in the Library

Digging (if you include the slang meaning) for information on town ants was not restricted to field work. Town ants have a number of close relatives in South America that also destroy crops to obtain green vegetation. So great is their damage that researchers have studied them for more than four decades, but many of the findings are reported in Portuguese, Spanish, and German. Qualified translators, if they could be found, were too expensive for most investigators. Recently, the Alexandria Research Center spent the necessary money and time to obtain...
Summarizing Three Years of Research and Study of Laboratory and Underground Nests, Which Sometimes Occupy Over Five Acres

and study translations of the South American publications. These papers helped_shape and guide the entire town ant research program.

In South and Central America, where labor is inexpensive, nests are opened by meticulous hand excavations. At Alexandria a bulldozer, used with skill and planning, was “delicate” enough to prove that Louisiana town ant nests are basically the same as those excavated by hand in South America. This was a tremendous step, for it allowed scientists to build upon the accumulated wealth of South American information. In doing so, they have advanced knowledge of the town ant farther and faster than would otherwise have been possible.

Two facts stand out from the South American work: control measures are almost identical to ours, and rapid reinvasion prevents complete eradication of ants—fumigating the nests merely holds the ants in check while crops are grown.

The Ants—Good Farmers

Town ants vary in size, ranging from 1⁄6- to 3⁄4-inch long. Queens, the largest, are rarely seen because they spend their entire lives underground, except for one brief mating flight. Contrary to popular belief, a nest may contain more than one queen—Alexandria scientists found seven in one nest. Variations in the number of queens may explain why some nests enlarge slowly while others expand with startling rapidity.

Medium-sized workers do most of the foraging—and thus most of the damage. They piffer green vegetation which they take, piece by piece, into the nests for the garden “soil” on which to grow a fungus that is the only known food of the ant.

As the leaf pieces arrive underground, small and medium-sized farmer ants take this material and carefully lick it over and over. Their saliva apparently contains an antibiotic which kills foreign fungi that might contaminate and destroy the food-fungus. Next, the ants cut the leaves into smaller pieces, and place them on the top and sides of the fungus garden. Thousands of pieces of green material are needed for each garden, and a sizeable nest may contain 100 or more gardens. Great numbers of the smaller workers constantly care for the gardens, keeping them free of contaminating organisms. They must be good farmers, for a fungus garden destroyed by foreign fungi has never been observed, even though the chances are great for contamination through the new ma-
terial continuously brought into the nest.

Large worker ants, which are relatively few, serve a dual role for the colony. They forage along surface trails with the other workers, but also stay ready to use their powerful jaws to defend the nest against predators.

Architects and Engineers

Town ants are marvelous architects. Their underground nests consist of hundreds of fungus-garden cavities, dormancy cavities, and dump cavities, plus tunnels and galleries that connect these cavities with each other and with the surface of the nest. These features are not constructed haphazardly, but in a highly efficient manner and in a way that protects vital parts of the nest from flooding.

The underground nest may occupy more than five acres, even when the mounds on the surface cover an area not much more than 50 feet in diameter. After a bulldozer gets 15 feet down it has usually exposed most cavities, but almost always there will be galleries leading still deeper. Galleries are of course destroyed by bulldozing, but they can be studied by making casts of them—pouring down watery cement and digging away the surrounding soil after the cement has hardened.

Just uncovering one of these huge nests is a big job, but think of the engineering feats necessary to build such an elaborate underground network—a grain at a time, and in complete darkness!

Fungus-garden cavities, located near the center of the nest, are dome-shaped, and average a foot in diameter. Occasionally, one is big enough for a man to stand inside. Gardens are found more than eight feet below the surface in the winter, and clustered close together. In warmer weather, gardens are more numerous and are in cavities closer to the surface, where they are dispersed over a broader area. It appears, then, that winter fumigation is best since gardens are less numerous and are closely grouped.

Garden Structure

Fungus gardens are the heart of the nest, and it is here that the ants display their finest engineering. The cavities containing the gardens are protected against flooding by air
traps. If water runs into the nest, air
pockets keep it from filling the cavities
and ruining the fungus. Vertical
galleries extend deep below the nest
in areas around the gardens, presum-
ably to drain off water that may get
into the town.

As the material of the gardens is
depleted of nutrients, it is deposited
in dump cavities. These cavities are
all sizes and shapes, and are gen-
erally isolated from the fungus
gardens. Dormancy cavities are
a mystery to researchers. They are
multi-shaped chambers packed with
fresh “soil,” ants, eggs, larvae, pupae,
and some times green leaves or sand.
The ants in these cavities are torpid,
but quickly become active when ex-
posed. Why or how thousands of
ants pack themselves together and re-
main inactive continues to baffle en-
tomologists. Fumigants penetrate
these cavities readily, and kill almost
dormant ants.

Galleries connect the three types
of cavities. They are merely oval or
round pathways for the ants’ travel
inside the nest, from one cavity to
another.

Tunnels are the narrow outlets of
a nest, used by the ants in foraging.
They connect outlying holes, where
leaf fragments are first taken below
ground, to the fungus-garden cav-
ties. About the diameter of a cigar,
they radiate in all directions from the
nest. Well-defined surface trails may
extend 100 feet or more beyond these
so-called “feeder holes” to trees or
other plants being stripped of leaves.

The internal structure of a nest is
so extensive that fumigation with a
heavy gas, as now done, still appears
most practical. There does not seem
to be much chance of controlling the
ants with insecticidal or fungicidal
dusts blown into the nests.

Watching the Queens

The town ant’s love life is one of
the strangest and most difficult
aspects of its biology to study. Lar-
vae of the sexual forms are reared
deep in the nest in the winter. By
late March, they transform into wing-
ed males and females, called alates.
In early May, they are mature
enough for their mating flights.

Whether through accident or in-
stinct, mating flights appear to take
place only when conditions are ideal
to protect the alates. At any rate,
all flights observed thus far by the
entomologists at Alexandria have oc-
curred shortly before daybreak, on
dark, still, moonless nights. More-
over, flights have been confined to
periods following rain, when the soil
is wet enough for easy digging by
the newly mated queens.

The dark nights chosen for flights
have prevented researchers from
learning how high and far queens go
during and after the mating flight.
But they know that huge numbers of
sexuals are produced in the older
nests. In 1961, for example, about
6,500 sexuals—half of which were
queens—were counted as they issued
from four nests. No wonder the ants
can quickly invade areas previously
fumigated!

A colony’s males and females do
not all emerge and fly in one night.
Rather, flights occur over a period
of several weeks. Thus the colony is
protected against a catastrophe—an
unfavorable change in weather or an
abundance of predators, for example
—that might destroy all the sexuals
at once.

After mating in the air, a queen
drops to the ground, clips off her
wings, and immediately digs a small
gallery. She plugs the entrance and
begins to lay her eggs. During her
mating flight, she carries in her
mouth a small piece of fungus with
which she starts a garden in her new
nest.

Predators

Control through natural enemies is
always a hope of the entomologist
working on a tough insect problem.
Unfortunately, there is little promise
that such a solution will be possible
with the town ant.

Birds eat males and queens during
the mating flight. Armadillos, birds,
and ground beetles capture some
mated queens as they drop to the
ground. Otherwise, the ants live vir-
tually free of enemies other than
man.

More than 40 species of insects
have been found in the towns exca-
vated at Alexandria, but none were
observed to prey on the ants. Most
were in the dump cavities, not closely
associated with ants. The eight spe-
cies found intermingled in fungus
garden cavities apparently live in
peaceful coexistence, but further in-
vestigations may show some to eat
brood or fungus.

Searching for insect predators is
time consuming. Not only is it neces-
ary to find the insects, but enough
observations are needed to determine
if they are harming the ants.

Although no predator has yet been
found, researchers continue to keep
a watchful eye for potential enemies.

Laboratory Colonies

With nests deep in the ground, the
town ant almost defies detailed study
in the field. Therefore, the Alex-
andria Research Center regarded it as
a real triumph when, after sev-
eral years’ trials, it successfully estab-
lished three colonies in the labora-
tory. This is the first time that even
one reproducing town ant colony has
thrived in artificial surroundings.
Ants and fungus are in transparent,
plastic canisters that are connected
with plastic tubes, which serve as
galleries. Two colonies have queens,
while the other is functioning with-
out a queen. Leaves placed outside
the canisters are readily foraged and
added to the gardens. In one nest,
the fungus garden, which was the size
of a baseball when the colony was
moved in from the field, now fills
four one-gallon canisters; the ant
population has more than doubled.

The artificial towns are only 10
months old, so their full potential has
not yet been realized. But in this
short time they have yielded valuable
information. For the first time, re-
searchers have carefully watched
queens laying eggs, workers cutting
and licking leaves prior to placing
them on the gardens, and the pain-
taking care of the fungus by tiny
workers. Future observations should
give valuable information on the
longevity of workers and queens, the
production of larvae of sexual
forms, the effects of poisonous baits
and forage material treated with
fungicides, and many other mys-
teries.

What’s Ahead?

In the future, researchers at Alex-
andria will concentrate largely on
how ants reinvade areas that have
been fumigated. The distance of the
queens’ honeymoon flight must be
measured so that estimates can be
made of the size of buffer zones
needed to keep areas free of ants.
New nests must be observed closely
to learn how rapidly colonies grow,
at what age they are large enough
to cause serious damage, and how
old the nests are when they begin
to produce sexuals.

As about one nest in five now
survives initial treatment, improve-
ments in control measures are also
needed. The best placement of fumi-
gants to obtain high kills must be determined. If real progress against the town ant is to be made, nests must be treated when they are relatively small, before they are capable of infesting surrounding areas. Therefore, the possibilities of applying cheap insecticides to the surfaces of small nests must be fully explored.

As the laboratory colonies grow, individual canisters with ants and fungus will be removed for work with fumigants, insecticides, and fungicides. One of the many possibilities to be tested is whether ants can be induced to carry toxic materials into the nests.

Cooperative work with the Entomology Research Department at Louisiana State University was recently initiated to extract trail-marking and excitory substances from the glands of the ants. If the chemicals can be identified, it may be possible to manufacture them synthetically so that they can be used to disrupt the ant’s behavior.

Town ants are tough opponents that have withstood man’s best efforts to eradicate them. The only hope for devising more effective treatments is through research to obtain a clearer knowledge of their life history and biology.