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Leafcutter Ants: Farmers of Fungus

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Leafcutter Ants: Farmers of Fungus

Some ants farm a crop, just as people do. They have done it for tens of millions of years. What do they grow?

This lesson covers the ant farmers, their fungus crop, and the chemical war around it.

> **The idea in brief**
>
> - Farmers: **leafcutter ants** (attine group).
> - Crop: the fungus **Leucoagaricus gongylophorus**.
> - Leaves are **compost**, not food.
> - Ant farming is about **50 million years** old.

The Original Fungus Farmers

Which ants farm fungus?

Leafcutter ants are the best-known fungus farmers. They live in **Central and South America** and the southern United States.

They belong to a bigger group, the **attine ants**. That group has more than **200 fungus-growing species**.

Most attine ants do not cut leaves. They grow fungus on dead plant bits from the leaf litter.

Sources: jic.ac.uk; pmc.ncbi.nlm.nih.gov

Do leafcutter ants eat leaves?

No. The ants **do not eat the leaves**. They use them as **garden compost**.

Workers cut leaf pieces and carry them underground. Others chop and clean the pulp. The ants then plant the fungus on it.

The fungus is the ants' main diet. The fungus is called **Leucoagaricus gongylophorus**.

Sources: pmc.ncbi.nlm.nih.gov; jic.ac.uk

> **Quick check 1.** True or false: leafcutter ants eat the leaves they cut. *(True or False?)* See answer ↓



Leafcutter ants carry leaf fragments to their nest, where the leaves feed a fungus garden. Photo by Rance Hesketh, CC BY 3.0, via Wikimedia Commons.

How the Partnership Works

What does the fungus give back?

The fungus grows special swollen tips called **gongylidia**. They are rich in **lipids and sugars**.

Gongylidia are the **sole food of the ant larvae**. Workers eat them too.

Workers also pass fungal enzymes into their waste. They spread it on fresh leaf pulp. This helps break the leaves down.

Sources: ncbi.nlm.nih.gov; pmc.ncbi.nlm.nih.gov

How does the fungus pass to a new nest?

The fungus is **vertically transmitted**. It passes down from the old nest to the new one, and the ants actively maintain it.

This is how the crop passes to the next generation.

Each garden holds **a single clone** of the fungus.

Sources: ncbi.nlm.nih.gov; jic.ac.uk

> **Quick check 2.** True or false: ant larvae feed only on the fungus garden. *(True or False?)* See answer ↓

How do the ants and the fungus help each other?

Three partners work together here. A fourth, the parasite, tries to break in.

Partner	What it gives	What it gets
Ants	Fresh leaf compost, grooming, and a safe nest	Food from the fungus

Partner	What it gives	What it gets
Fungus	Food in the form of gongylidia	Spread, protection and nutrients
Pseudonocardia bacteria	Antifungal compounds on worker bodies	A home on the ants

Sources: jic.ac.uk; ncbi.nlm.nih.gov

Age and Scale

How old is ant farming?

Fungus-farming ants began about **50 million years ago**. That is a very long time.

The first fungus farmers were **not leaf cutters**. They used dead plant bits. Their nests were small, with dozens to hundreds of workers.

The parasite **Escovopsis** appeared with ant farming about **55 to 60 million years ago**.

Sources: pmc.ncbi.nlm.nih.gov; ncbi.nlm.nih.gov

How big can a leafcutter nest get?

Some nests live **10 to 20 years**. They hold **5 to 10 million workers**.

Such a nest keeps **500 to 1,000 fungus gardens**. The whole nest fills the space of a bus.

Leafcutters eat more vegetation than any other comparable herbivore. That makes them **major farm pests**.

Sources: pmc.ncbi.nlm.nih.gov

> **Quick check 3.** True or false: ant-fungus farming is tens of millions of years old. *(True or False?)* See answer ↓

A Four-Way Chemical War

What is Escovopsis?

Escovopsis is a specialised parasitic fungus. It attacks the fungus garden.

If left unchecked, it can overrun the garden and **collapse the colony**.

Workers fight it with **grooming and weeding**. They remove spores and infected pieces.

Sources: ncbi.nlm.nih.gov

How do bacteria help the ants?

Many ants carry **Pseudonocardia** bacteria on their bodies. These make **antifungal compounds**.

Pseudonocardia is common in **Acromyrmex** leafcutters. It has been lost in **Atta** leafcutters.

The parasite hits back. Its **shearinine** compounds are thought to hamper the ants' grooming and weeding.

Sources: jic.ac.uk

> **Quick check 4.** True or false: Escovopsis has no way to resist the ants' defences. *(True or False?)* See answer ↓

> **Quick check 5.** True or false: the system has at least four players: ants, fungus, bacteria and a parasite. *(True or False?)* See answer ↓

The UPSC 2022 Question

How do you solve the UPSC 2022 question?

The 2022 paper asked which organism cultivates fungi. The choices were cockroaches, crabs, spiders and ants.

The answer is **ants**.

Remember the link: ants plant, feed and protect the fungus.

See the question in the 2022 paper.

Sources: pmc.ncbi.nlm.nih.gov; jic.ac.uk

Exam Traps

Not food: leaves are compost, the fungus is the meal.

Sole larval food: gongylidia.

Bacteria: Pseudonocardia, antifungal.

Parasite: Escovopsis.

PYQ 2022: pick ants.

Practice MCQs

1. What do leafcutter ants do with the leaves they cut?

A. Use them as compost for a fungus

B. Store them as bedding only

C. Feed them to bacteria

D. Eat them directly

See answer ↓

2. Which fungus do leafcutter ants cultivate?

A. Escovopsis

B. Pseudonocardia

C. Leucoagaricus gongylophorus

D. Aspergillus

See answer ↓

3. What are gongylidia?

A. Bacterial spores

B. Ant eggs

C. Swollen fungal tips rich in lipids and sugars

D. Leaf veins

See answer ↓

4. What is the sole food of leafcutter ant larvae?

A. Fresh leaves

B. Dead insects

C. The fungus garden

D. Plant sap

See answer ↓

5. About how long ago did fungus-growing ants begin farming?

A. 500,000 years

B. 50 million years

C. 500 million years

D. 12,000 years

See answer ↓

6. Which parasite attacks the ants' fungus garden?

A. Acromyrmex

B. Leucoagaricus

C. Escovopsis

D. Atta

See answer ↓

7. Pseudonocardia bacteria on ants make what?

A. Venom for prey

B. Silk

C. Antifungal compounds

D. Leaf compost

See answer ↓

8. UPSC 2022: certain species of which organism cultivate fungi?

A. Ants

B. Cockroaches

C. Crabs

D. Spiders

See answer ↓

Answer Key

1. **A.**
   The ants do not eat the leaves. They grow a fungus on them.
   Sources: PNAS commentary, Mueller and Rabeling 2008 · John Innes Centre, Myrmecological News review 2018.
   ↑ Q1
2. **C.**
   Leucoagaricus gongylophorus is the cultivar. Escovopsis is its parasite.
   Sources: John Innes Centre, Myrmecological News review 2018 · Nature Communications, chemical warfare study 2018.
   ↑ Q2
3. **C.**
   They are the fungus's food structures.
   Sources: Nature Communications, chemical warfare study 2018 · PNAS commentary, Mueller and Rabeling 2008.
   ↑ Q3
4. **C.**
   The fungus provides the sole food source for the larvae.
   Sources: Nature Communications, chemical warfare study 2018 · PNAS commentary, Mueller and Rabeling 2008.
   ↑ Q4
5. **B.**
   The commentary dates it at about 50 million years ago.
   Sources: PNAS commentary, Mueller and Rabeling 2008 · Nature Communications, chemical warfare study 2018.
   ↑ Q5
6. **C.**
   Escovopsis is a specialised parasite of the garden.
   Sources: Nature Communications, chemical warfare study 2018 · John Innes Centre, Myrmecological News review 2018.
   ↑ Q6

7. **C.**
   They make antifungal compounds that help protect the cultivar.
   Sources: John Innes Centre, Myrmecological News review 2018 · Nature Communications, chemical warfare study 2018.
   ↑ Q7
8. **A.**
   Ants, notably the attine fungus farmers, cultivate fungi.
   Sources: PNAS commentary, Mueller and Rabeling 2008 · John Innes Centre, Myrmecological News review 2018.
   ↑ Q8

Quick-check answers

1. **False.** They use the leaves as compost. The fungus grown on them is the main food. ↑ 1
2. **True.** The fungus is the sole food source for the larvae. ↑ 2
3. **True.** It began about 50 million years ago. ↑ 3
4. **False.** It makes compounds, such as shearinines, that may hamper grooming and weeding. ↑ 4
5. **True.** The ants farm the fungus. Bacteria defend it. Escovopsis attacks it. ↑ 5

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