



PART 2

Read the text below and answer questions 14–26.

ANTS AND ACACIAS: COEVOLUTION AND CONFLICT

A

Myrmecophytes—literally “ant-plants”—are species that have evolved to house ants as part of their normal biology rather than as an occasional accident of habitat. In the tropical Americas, the swollen-thorn acacia now often classified as *Vachellia cornigera* is a classic example, widely cited because its partnership with ants is both dramatic and measurable. Although the interaction is frequently presented as a neat mutualism, field ecologists emphasise that it is better understood as a negotiated relationship maintained by selective pressures on both sides. What looks like cooperation is, in many cases, a dynamic balance of costs, benefits, and enforcement, shaped over generations by herbivory, competition, and the availability of alternative partners.

B

The tree’s “investment” is substantial and multi-layered. First, it provides housing in domatia—specialised living spaces formed by swollen thorns that ants hollow out and occupy as nest chambers. Second, it feeds ants through extrafloral nectaries, glands located outside the flowers that secrete sugary liquids regardless of pollination. Third, in several swollen-thorn species, the plant produces Beltian bodies: small, detachable structures rich in protein and lipids that are harvested directly from leaf tips. None of these rewards is metabolically free. Producing constant nectar flow and nutrient-dense bodies diverts energy that could otherwise be used for growth or reproduction, which is why ecologists describe the association as most stable when partner fidelity is high—when the resident ants reliably “repay” the plant’s costs through defence.

C

The ants’ contribution goes beyond occasional aggression. Colonies patrol leaves and stems continuously, and when a branch is disturbed they can recruit nestmates rapidly using pheromone alarms. This can deter not only insects but also large browsing mammals, as swarming ants bite sensitive tissues and make feeding costly. Ants also reduce plant competition: by cutting back seedlings, vines, and encroaching shoots around the trunk, they create a small exclusion zone where the acacia faces fewer rivals for light and soil nutrients. Some researchers describe this as “allelopathy by proxy”—the plant gains the competitive effect without producing the toxins itself, because ant pruning performs a similar ecological function. Together, patrolling, rapid recruitment, and



competitor removal explain why “bodyguard” ants are often associated with increased survival and faster growth in heavily browsed habitats.

D

Yet mutualism contains built-in conflicts of interest, and one of the most striking is sterilization—ant behaviour that reduces the plant’s reproduction. In some systems, resident ants damage flower buds or remove developing inflorescences, effectively steering the plant away from reproduction and toward producing more leaves, which generate more nectar and Beltian bodies. From the ants’ perspective, flowers can be a poor investment: they may attract non-resident insects, increase exposure to predators, or allocate plant resources away from the food and housing the colony depends on. From the plant’s perspective, sterilization is clearly costly, even if the tree remains well defended. The key point is that “mutualistic” partners can still impose costs when their fitness interests diverge, and the interaction is therefore better viewed as conditional and contested rather than automatically beneficial.

E

A second source of instability arises from cheating. Not all ant residents are equally protective; some species behave like parasitic ants, occupying domatia and consuming rewards while providing weak defence or abandoning patrolling during peak herbivore pressure. Such ants can persist because the plant’s rewards are difficult to restrict perfectly, especially when nectar is produced continuously. However, trees are not passive. Experiments and observations suggest that acacias can sanction underperforming colonies by reducing nectar flow or altering the placement of rewards so that effective patrolling is encouraged. These sanctions are not “punishments” in a human sense but evolved mechanisms that change incentives: colonies that fail to defend may be less well-fed and more likely to be replaced. In this way, partner fidelity can be stabilised by selective pressures acting on plant traits that bias the interaction toward defensive residents.

F

Context dependency becomes clearest when the ecological threat that originally favoured defence is removed. A long-term study by Palmer and colleagues in Kenya showed that when large herbivores such as elephants or giraffes are excluded, the value of aggressive ant defence declines. Under reduced browsing pressure, some acacias exhibit phenotypic plasticity: they invest less in defensive traits, including reduced thorn development and lower reward production. Over time, the ant community can shift as well, with highly aggressive defenders being replaced by more passive species that exploit resources without intense patrolling. The partnership, in other words, can relax or partially break



down when the selective environment changes, illustrating that coevolutionary “fits” are maintained by ongoing ecological pressures rather than by permanent harmony.

G

Taken together, ants and acacias demonstrate that coevolution is not simply friendly cooperation. It is reciprocal exploitation that can stabilise under particular conditions—especially where herbivory is intense and reliable defenders are available—but can unravel when costs rise or benefits decline. Domatia, extrafloral nectaries, and Beltian bodies are best interpreted as bargaining tools as much as gifts, and ant aggression can be both protective and manipulative. The broader lesson is that mutualism is often an outcome of conflict management: biological systems evolve mechanisms to align incentives, limit cheating, and maintain partner fidelity, yet those mechanisms remain vulnerable to environmental change.

Questions 14–18

Which paragraph contains the following information?

Write the correct letter, **A–G**.

14 a reference to ants altering the plant’s reproductive output by damaging its flowering structures.

15 an explanation that defensive traits and ant communities can change when large herbivores are no longer present.

16 details of multiple food rewards provided by the plant, including sugar secreted outside flowers and nutrient-rich packets.

17 a description of ants using chemical signals to recruit nestmates rapidly during an attack.

18 an introduction to ant-plants followed by the view that their apparent cooperation is maintained through selection acting on both partners.

Questions 19–22

Look at the following descriptions and the list of ant types below.

Match each description with the correct ant type, **A–C**.

You may use any letter more than once.

19 takes plant-provided resources while delivering little protective value in return.



20 responds to disturbance by rapidly recruiting nestmates and can deter large browsing animals.

21 receives specialised housing and food rewards as standard benefits supplied by the tree.

22 maintains the partnership when its defensive behaviour reliably offsets the plant's energetic costs.

List of Ant Types

A Mutualistic ants only

B Parasitic ants only

C Both mutualistic and parasitic ants

Questions 23–26

Complete the summary below. Choose **NO MORE THAN TWO WORDS** from the text for each answer.

Rewards and Tensions in the Ant–Acacia Relationship

In swollen-thorn acacias, the specialised housing provided for ants has the technical name **23** The plant also produces protein- and lipid-rich structures known as **24** The passage terms the reduction of plant reproduction caused by ants **25** When large herbivores disappear, acacias may reduce their defensive investment, including reduced **26** development.

Answer Key

14. D

15. F

16. B

17. C

18. A

19. B

20. A

21. C

22. A



23. domatia

24. Beltian bodies

25. sterilization

26. thorn