

Long-Term Observations of Interactions Between Two Honey Bee Species Following Cohabitation Swarming at Kennin-ji Temple, Kyoto

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Abstract

This study documents interactions between the Japanese honey bee (*Apis cerana japonica*) and the Western honey bee (*Apis mellifera*) in an urban temple environment in Kyoto, Japan.

Japan is one of the regions where the native honey bee *Apis cerana japonica* coexists with the introduced *Apis mellifera*. In some areas of Japan, both species occur in close proximity, allowing opportunities to observe interspecific interactions.

In 2025, a small swarm of *A. mellifera* occupied a hive installed within the grounds of Kennin-ji Temple. The hive had originally been prepared as a waiting box for *A. cerana japonica*. Shortly after colony establishment, more than ten individuals of *A. cerana japonica* repeatedly entered and exited the hive. This cohabitation continued until mid-July, even after the original *A. cerana* colony had absconded, lasting for more than one month in total.

During this coexistence period, workers of both species visited the same feeding station and were observed engaging in close-contact behaviors, including grooming and proboscis contact. Individuals of *A. cerana japonica* were also observed near waggle dance activity of *A. mellifera*. Defensive reactions to hornets were observed in both species.

These observations document interspecific behavioral interactions between two honey bee species sharing the same urban environment.

1. Introduction

Urban environments support diverse pollinator communities, and honey bees are commonly observed even in densely populated cities. However, how managed Western honey bees (*Apis mellifera*) and native honey bees utilize the same urban environment and influence each other remains poorly understood.

In Japan, the Japanese honey bee (*Apis cerana japonica* Radoszkowski) is a native subspecies that inhabits many regions, including urban environments. In recent years, urban beekeeping using *A.*

mellifera has also become increasingly common, creating situations in which both species may coexist in the same locations and potentially interact.

Kennin-ji Temple in Kyoto provides an urban habitat containing traditional gardens and seasonal floral resources. Founded in 1202, it is the oldest Zen temple in Kyoto, located in the historic Gion district where traditional architecture, small gardens, and dense urban infrastructure coexist. Despite being situated in a highly urbanized landscape, the temple grounds include a traditional garden where various plants bloom throughout the seasons. Hedges of *Camellia sinensis* bloom annually from late autumn to winter, providing valuable floral resources during a season when nectar sources are generally scarce.

Long-term observations conducted at Kennin-ji over the five-year period from 2019 to 2024 confirmed that large numbers of honey bees visit these flowers during the same season. Both *A. cerana japonica* and *A. mellifera* utilize these floral resources.

The temple has set up hives for *A. cerana japonica* to nest in, and colonies are observed in these hives every year. In addition, wild colonies that arrive annually utilize empty hives for nesting. A managed apiary containing *A. mellifera* colonies is located approximately 1.7 km from the study site.

In 2025, a small swarm of *A. mellifera* occupied a hive installed within the temple grounds that had originally been prepared for *A. cerana japonica*. Because both species were already utilizing the same floral resources in the same season, individuals of the two species were subsequently observed interacting at the same hive site.

This study documents the sequence of events during this coexistence period and describes interspecific behavioral interactions between the two species.

2. Materials and Methods

2.1 Study area

The study was conducted at Kennin-ji Temple in Kyoto, Japan. The temple grounds include traditional gardens and multiple floral resources that bloom throughout the year. In addition to *Camellia sinensis*, various flowering plants are present across seasons, providing continuous foraging opportunities for honey bees.

The temple has installed hives for *Apis cerana japonica*, and swarms are observed arriving and occupying these hives almost every year.

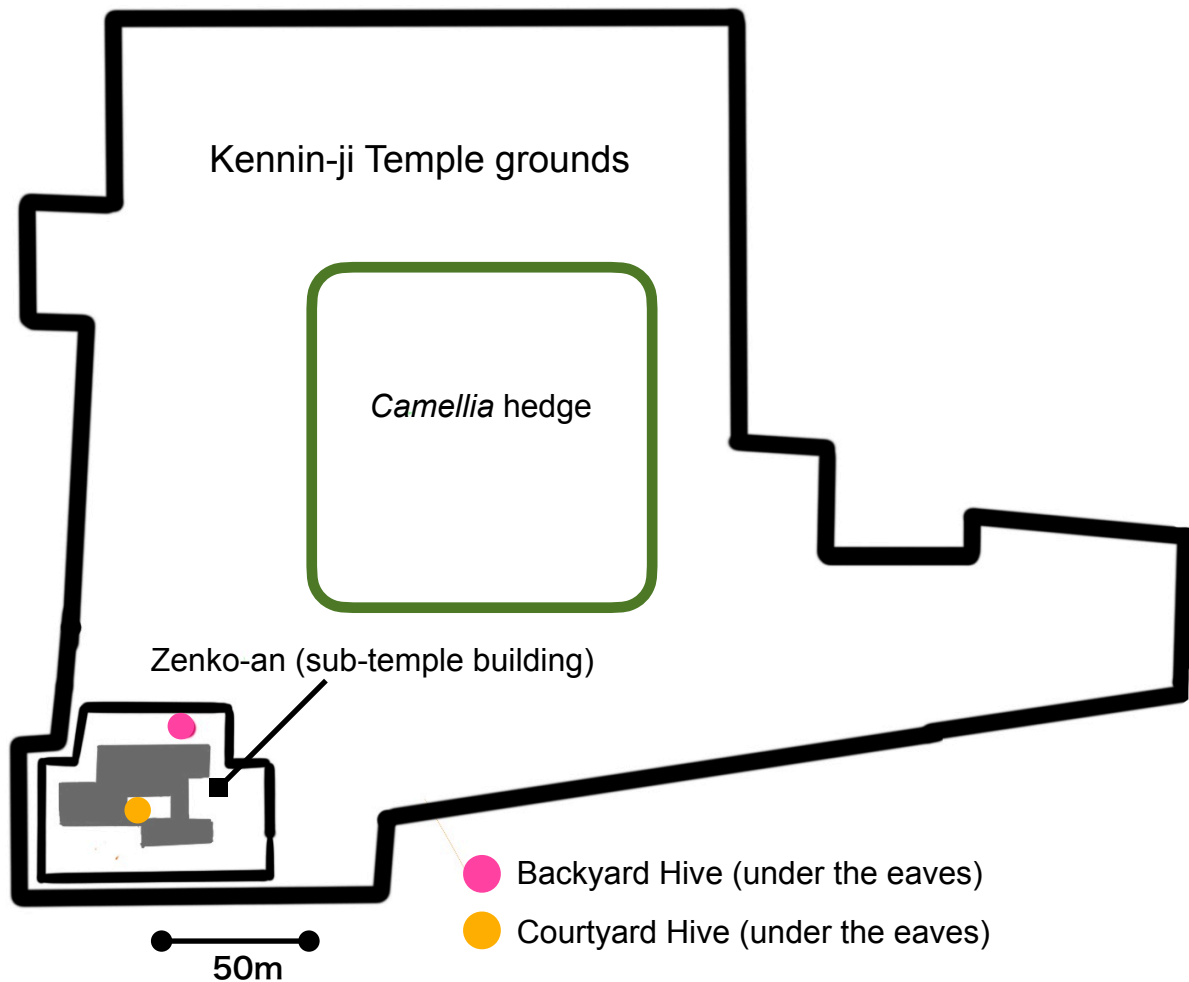


Figure 1. Schematic map of the study site at Kennin-ji Temple, Kyoto, Japan.

The temple grounds cover approximately 3,300 m².

The grey area indicates the Zenko-an building.

The orange circle shows the *Apis mellifera* colony located under the eaves in the courtyard, and the pink circle indicates the former *Apis cerana japonica* colony located under the eaves in the backyard.

2.2 Behavioral observations of worker interactions

In 2025, two independent swarms were established within the temple grounds: a swarm of *Apis cerana japonica* in April and a swarm of *Apis mellifera* in June. Both colonies originated from swarming events within the same year.

After the establishment of the *A. mellifera* colony, observations of interactions between workers of the two species were conducted at and around the hive.

Observations were carried out repeatedly during daytime hours. Behavioral interactions between workers of the two species were recorded, including close-contact behaviors such as grooming and proboscis contact.

Video recordings were made using a smartphone (iPhone) to document these interactions.

4. Results

4.1 Temporary coexistence of two honey bee species

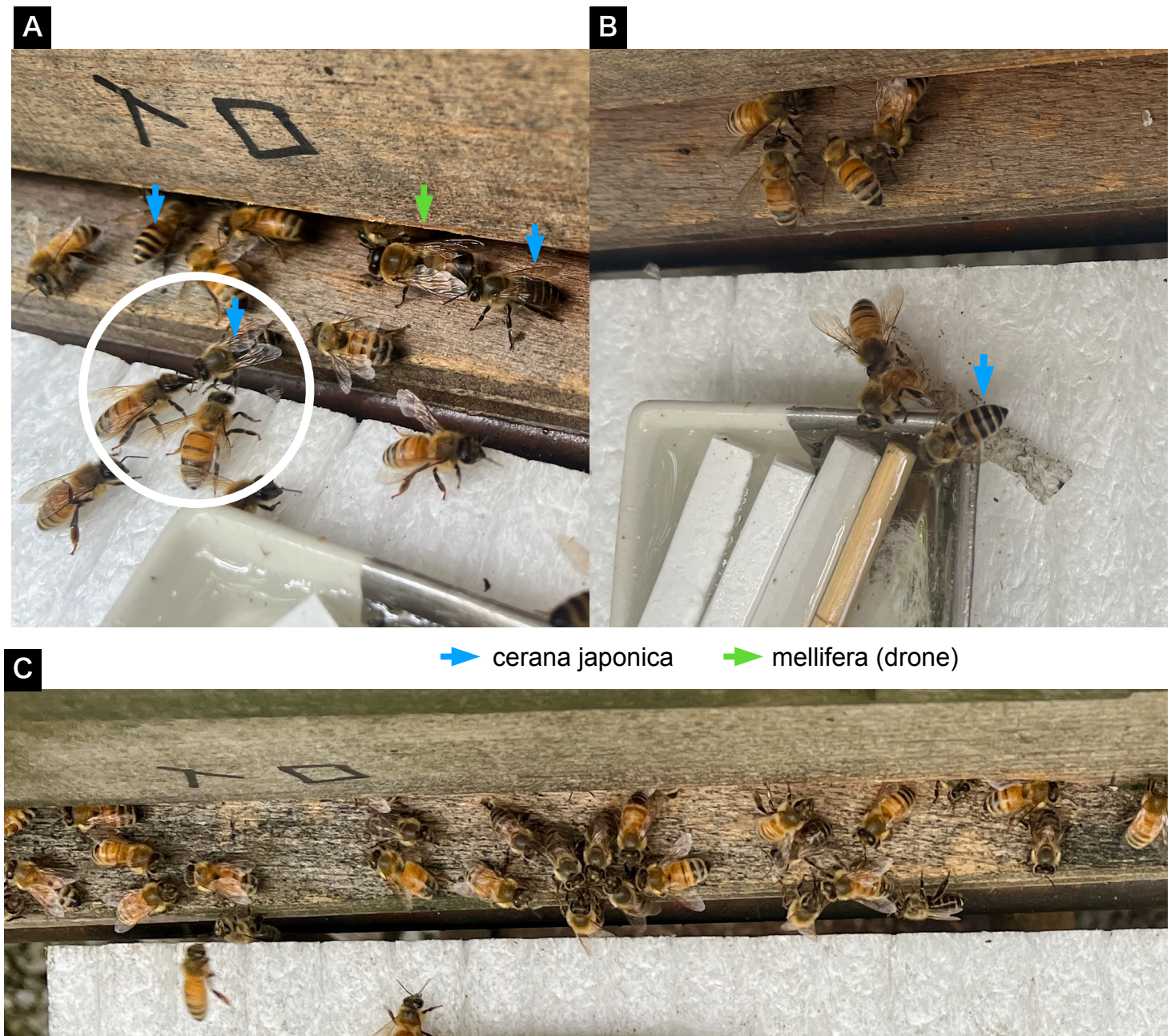


Figure 2. Early-stage interactions between *Apis cerana japonica* and *Apis mellifera*.

(A) contact observed shortly after colony establishment (June 8).

(B) Shared feeding at a sugar-water station on the following day (June 9).

(C) Mixed activity at the hive entrance several days later.

Soon after the *A. mellifera* swarm occupied the hive, more than ten individuals of *A. cerana japonica* were observed repeatedly entering and exiting the hive.

This temporary coexistence lasted for approximately two weeks. During this period, *A. cerana japonica* individuals frequently visited a feeding station located near the hive, and both species collected sugar water from the same source.

Individuals of both species were observed flying repeatedly around the hive entrance.

4.2 Dance-following behavior



Figure 3. Dance-following behavior observed near the hive entrance.

Apis cerana japonica individuals were observed following the waggle dance of *Apis mellifera*.

Dance-following behavior was observed near the hive entrance, with *Apis cerana japonica* individuals appearing to follow the waggle dances of *Apis mellifera*.

These behaviors were frequently observed during the early stage following swarm establishment. Although interpretation requires caution, the observations indicate that *A. cerana japonica* individuals responded to waggle dance activity of *A. mellifera*.

4.3 Close-contact interactions



Figure 4. Close-contact interaction between *Apis mellifera* and *Apis cerana japonica*.

A Western honey bee worker was observed grooming an individual of *Apis cerana japonica* near the hive entrance. This interaction was recorded after the original Japanese honey bee colony had already absconded.

Close-contact interactions between the two species were frequently observed near the feeding station and hive entrance.

These interactions were observed over a longer period than the dance-following behavior.

In several cases, *Apis mellifera* individuals were observed grooming *Apis cerana japonica*. One individual of *A. cerana japonica* was photographed being groomed 11 days after the original Japanese colony had already absconded, suggesting continued presence at the hive site.

Proboscis contact between individuals of the two species was also observed..

4.4 Defensive reactions

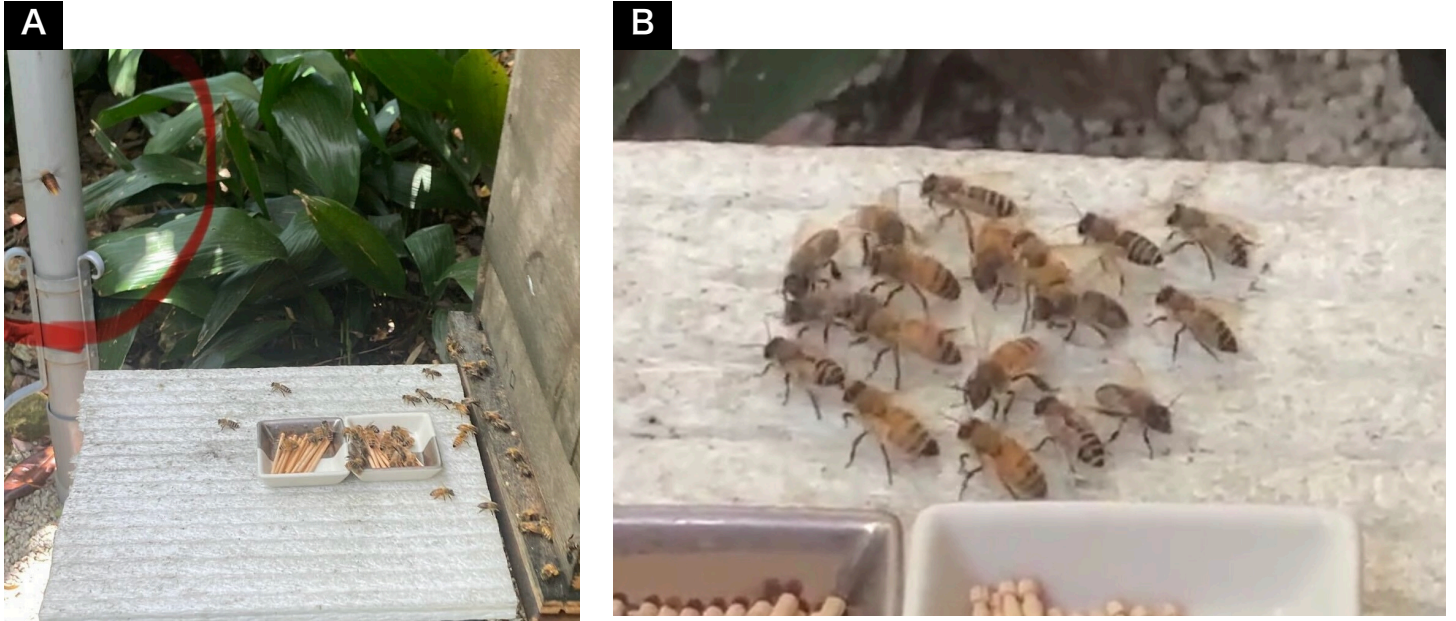


Figure 5. Defensive reactions triggered by hornet presence.

(A) giant hornet passing near the hive without direct attack.

(B) Workers exhibiting collective abdomen-raising behavior near the feeding site.

On several occasions, both honey bee species were observed reacting to the presence of large hornets near the hive entrance.

Individuals of both species displayed defensive postures and alarm behaviors when hornets approached the hive area.

4.5 Later colony development

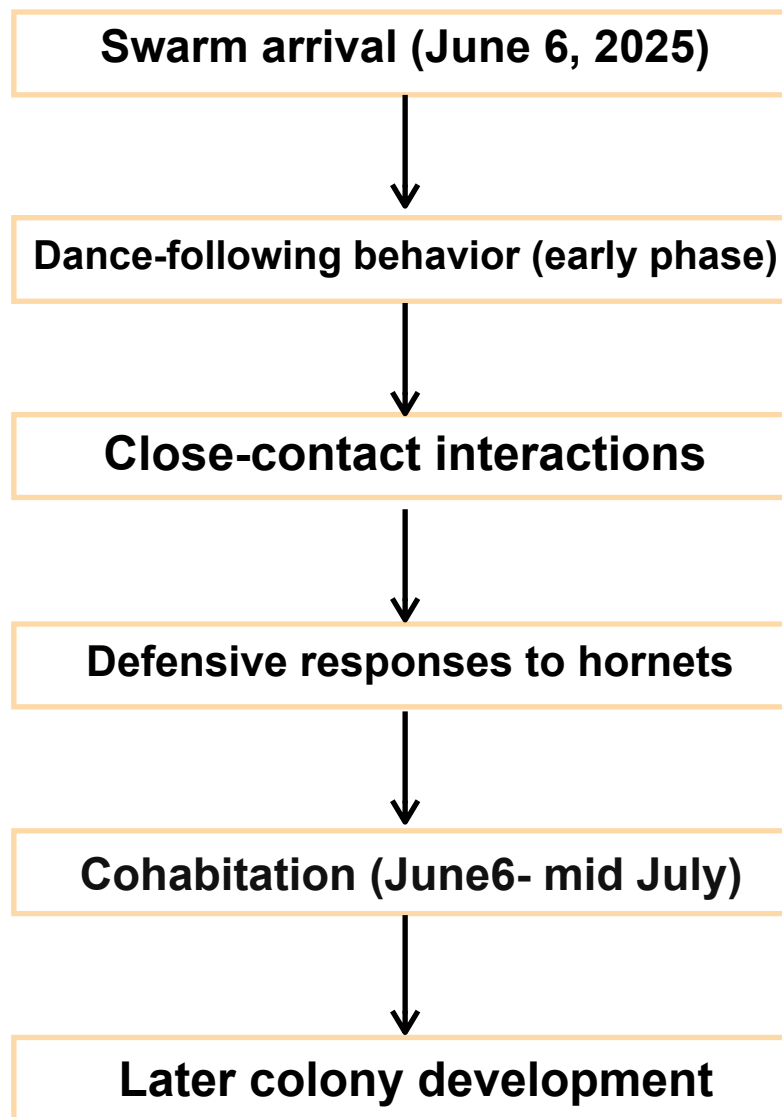


Figure 6. Timeline of observed interactions and colony development following swarm arrival.

The sequence of events observed after swarm arrival on June 6, 2025, including early dance-following behavior, close-contact interactions, defensive responses to hornets, and a cohabitation period from June 6 to mid-July, with an early phase lasting approximately two weeks, followed by later colony development.

In mid-August 2025, the *Apis mellifera* colony produced multiple queen cells. Several queen cell caps were found outside the hive, and multiple mating flights were observed during this period. These observations suggest that the colony temporarily maintained more than one queen, although the long-term stability of this structure was not determined.

5. Discussion

The observations at Kennin-ji Temple document a sequence of events involving temporary coexistence and behavioral interaction between two honey bee species.

Individuals of *A. cerana japonica* continued visiting the hive site after the establishment of an *A. mellifera* colony. Close-contact behaviors, including grooming and proboscis contact, were observed between individuals of the two species, and *A. cerana japonica* individuals were also observed near waggle dance activity of *A. mellifera*.

These interactions occurred in an urban environment where both species utilized the same floral resources, particularly *Camellia sinensis*.

The coexistence of two honey bee species in Japan provides an opportunity to observe interspecific interactions that are rarely documented in regions where only one honey bee species is present.

Further observations are needed to clarify the mechanisms underlying these interactions.

6. Conclusion

This study documents several forms of interspecific interactions between *Apis cerana japonica* and *Apis mellifera* at a single hive site in an urban temple environment.

The observations include temporary coexistence of two honey bee species, close-contact behavioral interactions, dance-following behavior, and defensive reactions to predators.

These findings contribute to understanding how different honey bee species may interact when sharing the same environment.

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