

# ENCYCLOPAEDIA CINEMATOGRAPHICA

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*E 1901/1974*

**Apis mellifera (Apidae)**  
**Landing and Take-off**  
**Collecting Behavior on Blossoms**

With 1 Illustration

GÖTTINGEN 1974

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INSTITUT FÜR DEN WISSENSCHAFTLICHEN FILM



Film E 1901

***Apis mellifera* (Apidae)  
Landing and Take-off  
Collecting Behavior on Blossoms**

J. KEFUSS, Oberursel/Ts.

**General Remarks<sup>1</sup>**

The honey bee (*Apis mellifera* syn. *Apis mellifica*) collects pollen and nectar from many different plant species. Its collecting behavior often differs greatly from specie to specie due to differences in shape, size and location of the anthers and nectary. Bees which collect pollen and nectar from the same plant must usually utilize completely different collecting methods. As an example when a bee collects nectar from *Impatiens Roylei* walpers (grandiflora), it lands on the lip of the basal petal and walks directly to the back of the floral tube where the nectary is located and sucks. After obtaining the nectar it backs out of the tube and flies to the next flower. In contrast those bees which collect pollen from the same plant alight on the basal petal, walk to the entrance of the floral tube, where rotating their bodies 180° as they walk, they enter the tube upside down. After reaching the dorsally located anther, the bee hooks its hind legs on the outer rim of the dorsal petal, hangs from the anther with the middle pair of legs and rapidly moves the first pair of legs over the pollen. It may transfer some of the pollen to the hind legs and these legs may move together slowly, but usually it backs out of the floral tube rotating to an upright position and then flies away. As it flies it moves its hind legs rapidly together and by the time it lands on the next flower most of the pollen is packed into the corbicula. Those bees which collect pollen and nectar from *Solidago canadensis* face an entirely different problem. Here the body of the bee is too large to enter the small floral tube. In this

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<sup>1</sup> Film data and summary of the Film (English, German, French) see p. 6 a. 7.

case the stamens are in a position where their anthers easily make contact with the hairy legs and ventral surface of the bee. The bee alights on one end of a raceme and traverses the entire length, sometimes going straight, but often in a zigzag pattern. During this traverse the antennae actively make contact with and orient the bee to the floral tubes. Upon reaching a tube the bee inserts its glossa (tongue) inside and the antennae which were pressed against the sides of the tube are again free to locate the next floral tube. Upon reaching the end of a raceme it may move its hind legs

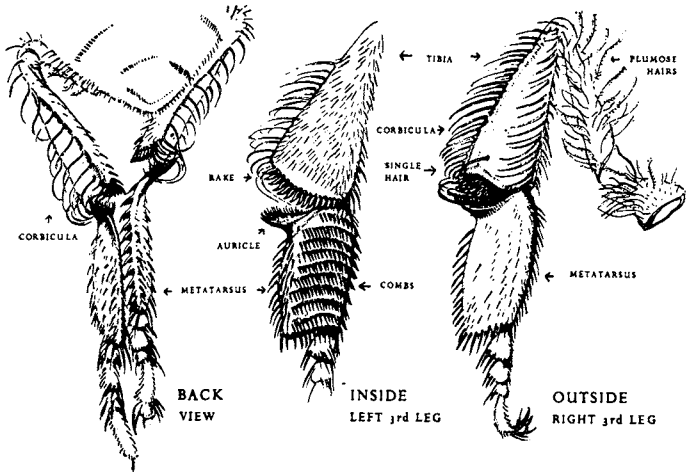


Fig. 1. Anatomy of the hind legs of the worker bee  
(HODGES [4])

together a few times, but more often the bee hovers in the air and with rapid movements packs the pollen on its hind legs. The activity sequence for pollen/nectar collection can be summarized as follows:

1. Flight to plant and approach for landing;
2. Landing on the plant;
3. Collecting (and sometimes pollen packing) on plant;
4. Take-off;
5. Pollen packing and cleaning behavior during the flight to the next blossom.

CHADWICK [1] has stated using the bumble bee as an example, that the flight of most insects begins with a jumping movement. This jumping movement causes loss of tarsal contact which in turn initiates flight. NACHTIGALL [2] has reinforced this view by demonstrating in the case of *Muscina*, *Calliphora* and *Sarcophaga* flies that a jumping movement can

initiate flight. However in the case of the honey bee it is seen in this film that flight may begin prior to loss of tarsal contact or even without any evidence of a jumping or falling movement.

A bee extends its legs outwards towards each side when it approaches a plant for landing. Initial contact is usually made with the first, then the middle and finally the third pair of legs (fig. 1). When a bee does not land it will usually draw its legs back to its body and extend them again on its next landing attempt.

## Film Contents<sup>1</sup>

24 f/s

1.—2. View of bees collecting nectar and pollen from white sweet clover (*Melilotus albus*).

600 and 2000 f/s

3. Bee landing on white sweet clover. Initial contact is made with the first pair of legs.

4. Hind view of landing bee. As the bee approaches the plant it extends its legs outwards towards each side. Last contact is made with the third pair of legs. The antennae are spread in a wide V-shape.

5. Pollen and nectar collection on goldenrod (*Solidago canadensis*). The antennae are used to make contact with the floral tubes. The bee scrapes pollen from its abdomen with its right hind leg and then both hind legs are brought together.

6. Pollen and nectar collection on goldenrod. A load of pollen can be seen on the left hind leg. As the bee walks the floral tubes pass between the antennal flagella which are extended downwards. Antennal contact is also made around the rim of the floral tubes and sometimes the antennae are thrust into the floral cup. The bee sticks its glossa into the floral tubes as it walks.

7.—8. Searching behavior on goldenrod.

9. A bee initiates flight with a backwards falling movement and begins to beat its wings before loss of tarsal contact.

10. The bee rests on its hind legs and cleans both antennae with its 1st pair of legs. The middle pair of legs wave free in the air. Then it begins to beat its wings and fly away without any evidence of a jumping movement.

11. Flight starts from a hanging position. Thorax and abdomen twist in opposite directions as the bee flies away.

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<sup>1</sup> The headlines in *italics* correspond with the subtitles in the film.

12. Recovery from a fall. As a bee is walking on white sweet clover it beats its wings slightly and falls from the plant to a horizontal position. Then it rises vertically to the right.
13. Changing of racemes with a combination of walking-flight movements.
14. Initiation of flight without any evidence of a jumping movement.
15. A pollen collector hangs upside down from a white sweet clover raceme. As the bee starts to turn, all the legs on the left side hang free in the air. The bee flies away without any evidence of a jumping movement. It begins to pack pollen after it changes from a vertical to a horizontal trunk position. Its tarsi vibrate as it flies upwards.
16. Initiation of flight with a falling movement.

### Literature

- [1] CHADWICK, L. E.: The flight muscles and their control. Chapter 4 of Insect Physiology, K. D. Roeder ed., (1953), 650.
- [2] NACHTIGALL, W.: Elektrophysiologische und kinematische Untersuchungen über Start und Stop des Flugmotors von Fliegen. Z. vergl. Physiol. 61 (1968), 1—20.

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### Film Data

This film is a research document and has been published for use in research and university education. Silent, 16 mm, black and white, 90 m, 8½ min (running speed 24 f/s).

It was taken in 1969 and 1970. Publication from Institut für Bienenkunde (Polytechnische Gesellschaft) der Universität Frankfurt a.M., Oberursel/Ts., J. KEFUSS, and the Institut für den Wissenschaftlichen Film, Göttingen, Dr. H. KUCZKA; Aufnahme: R. DRÜSCHER.

### Summary of the Film

This film shows landing, take-off and collecting behavior on *Melilotus albus* and *Solidago canadensis*. Landing is characterized by an extension of the legs away from the body. Initial contact is usually made with the first pair of legs. On the plant the bee is guided from one small floret to the next with aid of the antennal flagella. A jumping movement with subsequent loss of tarsal contact is not required for the bee to take-off.

### **Inhalt des Films**

Der Film zeigt Landung, Start und Sammelverhalten der Biene bei *Melilotus albus* und *Solidago canadensis*.

Beim Landen werden die Beine vom Körper abgespreizt; die erste Berührung mit dem Untergrund erfolgt gewöhnlich mit dem ersten Beinpaar. Mit Hilfe der Fühlergeißel wird die Biene auf der Pflanze von Blüte zu Blüte geführt. Beim Start ist eine Sprungbewegung, durch welche die Biene den Kontakt zum Untergrund verliert, nicht erforderlich.

### **Résumé du Film**

Ce film montre l'atterrissage, le décollage et la manière de récolter sur *Melilotus albus* et *Solidago canadensis*. L'atterrissage est caractérisé par une extension des pattes loin du corps. Le premier contact est fait d'habitude avec la première paire de pattes. Sur la plante, l'abeille se guide d'un petit fleuron au suivant à l'aide de ses flagella des antennes. Un mouvement de saut suivi de la perte du contact du tarse n'est pas nécessaire pour le décollage de l'abeille.