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Records (manuscripts and publications) on the mating of the queen with drones in the air in the years 1763 - 1776 from Slovenia

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Abstract

Experienced Upper Carniolan beekeepers were certainly familiar with the process of mating between a queen bee and drones in mid-air as early as in the 18. century, but most likely, even before that. The first person in the world to publish about it was Scopoli (1763) in his book *Entomologia carniolica*, in which he described the Carniolan honey bee (p. 303 – 304). Scopoli also reports about mating of queens with drones in the air in the *Dissertatio de Apibus* (1770). Mating between a queen bee and drones in mid-air was also described by Peter Pavel Glavar in his work *Response* (1768) and by Furlan in his book *Practical Beekeeping* (1768 – 1771(?)). In 1769 Humel observed mating between a queen bee and drones in mid-air. The Carniolan Agricultural Society had his records validated and in 1771 they were confirmed by Peter Pavel Glavar and Matej Furlan. Humel's article was published in 1773 in *Abhandlungen und Erfahrungen* and in 1775 in an abridged version in *Wochentliches Kundschaftblatt des Herzogthum Krain*. The process of mating between a queen bee and drones was also described by Anton Janša in both textbooks: *Discussion of the Swarming of the Bees* (1771) and *The Complete Guide to Beekeeping* (1775). Many people falsely ascribe this discovery to Janša. Janša lectured on old Upper Carniolan findings on the mating of queen bees. He found out that a queen bee is inseminated by several drones. Mating between a queen bee and drones in mid-air was also described by Peter Pavel Glavar (1776) in his textbook *Discussion About Bee Swarms* (*Pogovori o čebelnih rojih*). Mating of queen bees with drones in mid-air is an original Slovenian contribution to our knowledge of the biology of honey bees.

Keywords: mating of queen bees, drones, Upper Carniolan beekeepers, Scopoli, Humel, Furlan, Peter Pavel Glavar, Anton Janša

1. Introduction

Mating refers to the sexual union of the queen and drones during a mating flight. Many researchers have studied the mating of queens and often concluded that it happens in the hive when the drone touches the queen, though no one saw it. In Janša's (Janscha) book *“Abhandlung vom Schwärmen der Bienen (1771)”*, special attention was paid to the description of queens mating with drones in the air (see & 63). This record in his book was even considered a mistake, and in order to prove it, some people in Vienna announced a prize of 20 or 30 ducats to the one who could confirm that the queen is already mated in the hive. Even before Janša, mating of queens with drones in the air, (which is an original Slovene discovery), were known to Gorenjska (Carniolan) and other Slovene beekeepers who wrote about it. In this essay, we will present the currently known evidence (manuscripts and publications) chronologically.

2. Scopoli: The first on mating of a queen with a drone in the air - 1763

Scopoli (1763), a physician in Idrija and a naturalist, published the book *“Entomologia Carniolica”* in Latin. He described 1,153 species of insects and arthropods he found in Carniola. Among the hymenopterans, *Apis Mellifica* (honey bee) is described on pages 303-304 under number 811. Scopoli wrote about the queen: **“it is surrounded by several drones; she flies away, flying in the air she becomes fertilized... «. This is the first record in the world that drones in the air mate a queen.** Scopoli was not a beekeeper and he learned this from conversations with old Gorenjska (Carniolan) beekeepers.

3. Glavar: The first professional description of Slovenian beekeeping - "Answer" - 1768

On 28 January 1768, the Vienna court office sent the *“Vorschläge zur Verbesserung der Bienezucht in den Kaysl. Königl Erbländern (Proposals to improve beekeeping in the royal imperial hereditary lands)«*, prepared by a Lower Austrian company. This document and others related to it are kept in the Archives of the Republic of Slovenia. The Carniolan Agricultural Society also asked its member Peter Pavel Glavar, the priest and owner of estate Lanšprež, to judge it and write an opinion on the matter. Thus, in the same year (July 7, 1768), his famous *„Vorschlag Beantwortung zur Verbesserung der Bienezucht in den den Kaysl. Königl. Erbländern“*, short *“Answer”* was written in German (Glavar et al. (2017)), which is the first professional description of beekeeping in Carniola. On the back of the manuscript, the remark “sent on July 30, 1768,” is written, suggesting that the Carniolan Agricultural Society sent the *“Answer”* to Vienna. The Answer, written by Glavar on the basis of his 24 years of practical beekeeping experience and reading foreign beekeeping books, describes beekeeping in Carniola in detail and professionally. He also mentions the mating of bee queens:

Answer, paragraph 23 (p. 260): From this brood, the queen bees will raise a young queen, which will then mated. (Glavar and many other beekeepers in our country knew very well in the 1760s, and probably even earlier, that **queens are mated outside the hive in the air** - note 22B).

Answer, paragraph 30 (p. 261): It should be noted that the young queen of those hives that swarmed, as well as the second and third swarms, **fly for mating in a few days between 12 and 2 o'clock.**

4. Furlan: Practische Binen Oeconomie (Practical beekeeping....) - 1768/1771 (?)

Matej Furlan was a priest and a well-known beekeeper who helped Humel with his explanations in Humel's observations of the queen's mating in the air. The Archives of the Republic of Slovenia contain an extensive manuscript in Gothic and German (65 pages) with beekeeping content - title: "*Praktische Binenoeconomie... (Practical Beekeeping...)*". The author of the manuscript is not mentioned and the probable author of the book was judged the famous beekeeper priest Matej Furlan.

About the mating of queens is written the following:

Chapter Six: On the Fertilization and Multiplication of Bees

»... Here, however, I intend to talk about the queen in the second or third swarm, which is by no means yet fertile, and therefore incapable of laying eggs. After we put it in the hive with a swarm, such a **queen flies out of the hive on the third day and drones after it. However, as it rises into the air, also drones rise behind it, attacking the queen and performing fertilization.** Due to the mating instinct, a ball is made and it often happens that they all fall to the ground together with the queen, whereby the most skillful drone gets the game, which I once saw to my great surprise."

5. Humel: Queen mating with drone in the air - 1769, 1771, 1773

Humel (1771) wrote a letter to the Carniolan Agricultural Society about his observations queen mating with drone in the air in 1769. Slovenian beekeepers Matej Furlan and Peter Pavel Glavar have been asked for an assessment and opinion. Later the Carniolan Agricultural Society acquainted Humel's record with the Beekeeping society in Oberlausitz, attached a positive assessment of Glavar and Furlan, and emphasized that these new findings about queen mating were worthy of attention. The Society first reported on Humel's observation of queen bees with a short note in 1772 and 1773, mentioning "Peter Paul Glovar and Matthai Furlani." The Humel's whole article was published by the Beekeeping Society in Oberlausitz in 1773 with the title: "Physische Erfahrung, dass der Weisel wirklich von den Drohnen ausser den Bienenstock befruchtet werde, von Anton Humel, Stadtchirurgo in Laybach im Herzogthum Crayn, der Societät gesandt". At that time there was still speculation about the method of fertilization of the queen. This article was a big surprise for the world beekeeping professional public.

- Humel's letter - 1771

Summary: ... Humel, a city surgeon from Ljubljana and an amateur beekeeper, explains in the introduction that it is still unresolved whether the drones fertilize the queen or not. Because of this, he paid particular attention to bees' behavior at his apiary. In June 1769, he noticed in the second swarm the next day that the bees were fanning, that the queen was on the alighting board and then the queen flew into the air. She returned half an hour later and immediately entered the hive, where about 40 bees followed her. He saw this for the first time after five years of beekeeping, and asked experienced beekeepers, of whom there are many here in the country. They said that they had

known this for a long time. **It was always a good sign if the queen flew out so early and came home with a white sign on its abdomen.** Humel noticed this in the new second swarm and even more so in subsequent swarms and subsequent years. The priest Matej Furlan, who was an experienced and famous beekeeper, explained to him that his observations are not new because he has noticed this many times during his twenty-two years of beekeeping. He also recounted that he saw two times a ball of drones falling in front of the apiary to the ground, and when he examined it, he always found in the middle a queen that was joined to the drone. Humel concludes that it is now explained that the queen is mated with drones in the air and encourages other beekeepers to pay attention to this phenomenon to make themselves sure. He especially advises those who have doubts about this... .

- **Glavar 's assessment of Humel's letter - 1771**

Summary: ... Glavar says from the very beginning that Humel's work deserves all the recognition, because **experienced beekeepers from Gorenjska also told him about the queen's flying with drones in the air and that he saw it several times.** Therefore, there can be no more doubt about that. After laying, the queen no longer allows reunion with drones and, except with the swarm, no longer flies out of the hive and remains fertile for the whole life. At the end, he concludes with a recommendation to the agricultural company that, if it deems it worthwhile, he should send this letter to the beekeeping society in Oberlausitz with a recommendation to publish Humel's record in his beekeeping publication... .

- **Publications of Humel 's observation of the queen mating - 1772**

The beekeeping society in Oberlausitz first reported in 1772 about Humel's observation of queen mating in 1769:

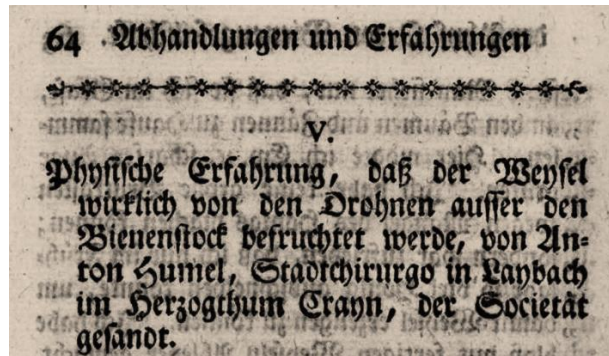
Summary: ... Although there is no longer any doubt that the fertility of young queens is related to the mating with drones, an analogy with aphids is sought. **Now, three experienced Austrian bee connoisseurs claim about queens' fertilization by mating with male semen outside the hive, a few days after birth, which was clearly seen by Mr. Anton Humel, a city surgeon in Ljubljana, who first informed the company.** This was followed by the Carniolan Agricultural Society, which sent our society the opinions of two priests (Mr. Peter Pavel Glavar from Lanšprež and Mr. Matija Furlani from the monastery in Mekinje), who confirm this based on their many years of beekeeping experience. This occurs mostly from the second to the twelfth day after the swarming, when the queen emerges from the hive, allows to be fertilized, and returns with a white thread-covered abdomen. We ask all bee lovers to pay attention to this and to take the time and patience to observe it

- **Schirach, III. Queen mating with drones in the hive - 1773**

Summary: ... Reaumur has never seen mating a queen with drones in a hive. Perhaps now in this unexplained matter three Austrian connoisseurs of bees are discovering a new view. The Carniolan Imperial Royal Society for Agriculture and Useful Skills communicated these new findings to us as worthy of attention. **Mr. Glovar and Mr. Furlang (Furlan), both venerable priests from Carniola, and Mr. Humel, a city surgeon from Ljubljana confirmed for many years about the mating of the**

fertilization dance queen outside the hive during the so-called noon. This was most clearly confirmed during the swarming. **The queens returned with a white thread on their abdomen** and the drones were found free around the young queen or in the grass. We welcomed this report... .

- **Publication of Humel's essay on the mating of queens with drones in the air - Gemeinnützige Arbeiten 1773**



Humel's essay on the mating of the queen with drones in the air - Gemeinnützige Arbeiten..., 1773, p. 64 (https://reader.digitale-sammlungen.de/de/fs1/object/display/bsb10293787_00090.html).

Title translation:

"The physical experience about the queen fertilizin outside the hive; from Anton Humel, a city surgeon in Ljubljana in Carniola, who sent it to the Society. "

- **Publication in the Wochentliches Kunschaftblatt des Herzogthum Krain – 1775**

The publication of the abbreviated article "*Praktische Eröfnung eines Binnen Liebhabers, dass Weiser wirklich von Trohnen auffer den Binnenstock befruchtet werde*" - is without mentioning the author in the Wochentliches Kundschaftblatt des Herzogthum Krain (1775).



Wochentliches Kundschaftsblatt des Herzogthum Krain - publication on the mating of a queen with drones in the air. 1775 p. 321

(<https://babel.hathitrust.org/cgi/pt?id=nyp.33433013584010&view=1up&seq=329>)

Title translation:

»A message from practice that the queen is mated by drones out of the hive.«

6. Scopoli: Dissertatio de Apibus - 1770

In 1770, in the Annus historico naturalis, Scopoli included in the first chapter the work Dissertatio de Apibus written in Latin.

The tenth observation states:

»... 37 The purpose of the swarming out is considered by some people as a mating, while others argue that asexuals (worker bees) do not build honeycombs **before the queen has brought some thin thread into the hive. "S c o p."**

7. Janša: Abhandlung vom Schwärmen der Bienen - 1771 and Vollständige Lehre von der Bienenzucht – 1775

- General information about the queen's mating with drones in the air in Janša's time

In Janša's time, there was still speculation about the queen's mating. Most thought it was happening in the hive but no one had seen it yet. Janša's publication in both books, and especially in the first, that the queen mates with drones in the air, aroused much interest and opposition among beekeeping experts. Most people mistakenly attributed this discovery Janša. Even before the publication of Janša's first book in 1771, in the beekeeping literature, where Carniolan (Slovenian) beekeeping is described or presented, this is written in the publications: Scopoli (1763) and (1770), Glavar (1768), Humel (1771) and Furlan (1768-1771 (?)). Here are also described the signs of fertilization of the queen, which are visible at her return - a white thread on her backside. Janša's discovery related to the queen's flying in the air is that several drones fertilize the queen. There is also a living oral testimony that Gorenjska (Carniolan) beekeepers knew from their many years of beekeeping experience that the drones fertilize the queen in the air.

- About the queen's mating with drones in the air in Janscha's first book - 1771 & 63

... Mating flight of the queen depends on the weather and honey flow... on the third or fourth day after birth... **On a beautiful day, between nine in the morning and three or four in the afternoon, the queen arrives with a large entourage of bees and drones from the hive.** On the alighting board it is looking in all directions for a while to remember the hive; then rises into the air. It flies in circles in front of the hive for a while and then rises into the air. When it returns from the mating flight, it does not enter immediately the hive, but flies some time in front of it. On this occasion, **attention should be paid to the following signs, by which we recognize that the queen has been pollinated. If the back of the queen where the bees have a sting, is open or if something white, similar to a thin thread, hangs from the back and looks as if the back is broken, then the queen has certainly been mated...**

- About the queen's mating with drones in the air in Janscha's second book - 1775

& 8

... Drones are male; their only task is to mate the queen. **At the time of swarming, on a beautiful, warm day, each unfertilized queen is accompanied by many drones and bees into the air, where the drones fertilize her... .**

IX. Chapter: On Queen mating

& 51: Mating time; & 52: Fertilization; & 53: Mating signs; & 54: The benefit of cognition; & 55: Age of the queen for mating

8. Peter Pavel Glavar: A Conversation on Bee Swarms – 1776

Glavar (1776) writes about the mating of queens in XXXI. and XXXII. conversation - paragraphs 349-361.

357 paragraph

"When the queen flew in the company of some bees and drones from the hive, drones descend from the hive behind her one after the other and a few shots far from the apiary fly together over a beautiful plain and there in the air they fly here and there with a great murmur. The drones are pressing harder and harder against the queen, taking it in the middle and sticking together, so that they fall to the ground several times in the form of a ball... «

9. Conclusions

The presented records on the mating of queens with drones in the air testify that these are original Slovenian contributions to the biology of the honey bee. Undoubtedly, Scopoli, who learned this from the stories of old Gorenjska beekeepers, was the first in the world to write about it in the *"Carniolan entomology (1763)"*. The famous beekeeper Huber discovered this in 1788. It took quite a few decades for this to be accepted even by the greatest skeptics.

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