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RECORDS OF THE MATING OF THE QUEEN WITH DRONES IN THE AIR IN THE YEARS 1763 - 1776 RELATED TO SLOVENIAN BEEKEEPING

Prof. Emer. Andrej Šalehar, PhD

Ljubljana, April 30, 2026

P.S.: Translations assisted by DeepL Translator and Google translate

I dedicate this work
to the long-time secretary of the Beekeepers' Association of Slovenia,
my friend
ANTON TOMEC (1955 - 2025)

Records of the mating of the queen[1] with drones in the air in the years 1763 - 1776 related to Slovenian beekeeping

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[1] Queen = Bee Queen = Queen Bee

Content

Records of the mating of the queen with drones in the air in the years 1763 - 1776 related to Slovenian beekeeping 7

Abstract 7

Zapisi o prahi matice s troti v zraku v letih 1763 - 1776 povezani s slovenskim čebelarstvom 8

Izvleček 8

Introduction 9

Giovanni Antonio Scopoli 13

Matej Furlan 17

Peter Pavel Glavar 22

Anton Janša 35

Discussion and conclusions 50

Sources 52

RECORDS OF THE MATING OF THE QUEEN WITH DRONES IN THE AIR IN THE YEARS 1763 - 1776 RELATED TO SLOVENIAN BEEKEEPING

Abstract

Experienced beekeepers from the Gorenjska region already knew the process of mating between the queen and drones (males) in the air in the 18th century, and according to oral tradition, probably even earlier. The first to publish this was Scopoli (1763) in his book Entomologia Carniolica, in which he describes the Carniolan bee (pp. 303–304). Scopoli also reports on the mating of queens with drones in the air in his work Dissertatio de Apibus (1770). The mating between the queen and drones in the air was also described by Peter Pavel Glavar in his work Odgovor (1768) and by Furlan in his book Praktično čebelarstvo (1768–1771(?)). In 1769, Humel observed the mating of the queen and drones in the air. The Carniolan Agricultural Society confirmed his records. In 1771, Peter Pavel Glavar and Matej Furlan confirmed them. Humel's article was published in 1773 in Abhandlungen und Erfahrungen and in 1775 in Wochentliches Kundschaftblatt des Herzogthum Krain. The process of mating between the queen and drones was also described by Anton Janša in both of his books: Discussion of the Swarming of the Bees (1771) and The Complete Guide to Beekeeping (1775). Many incorrectly attribute this discovery to Janša. Janša lectured on the old Carniolan findings regarding the mating of queens. He found out that a queen was inseminated by several drones. The mating between the queen and drones in the air was also described by Peter Pavel Glavar (1776) in the book Conversation on Bee Swarms. The mating of queens with drones in the air is an original Slovenian contribution to the knowledge of honey bee biology.

Keywords: queen mating, drones, Carniolan beekeepers, Scopoli, Glavar, Furlan, Janša, Humel

ZAPISI O PRAHI MATICE S TROTI V ZRAKU V LETIH 1763 - 1776 POVEZANI S SLOVENSKIM ČEBELARSTVOM

Izvleček

Izkušeni gorenjski čebelarji so že v 18. stoletju, po ustnem izročilu pa verjetno še celo prej, poznali proces prašenja med matico in troti (samci) v zraku,. Prvi, ki je to objavil, je bil Scopoli (1763) v svoji knjigi Entomologia carniolica, v kateri opisuje kranjsko čebelo (str. 303 – 304). Scopoli prav tako poroča o parjenju matic s troti v zraku v delu Dissertatio de Apibus (1770). Parjenje med matico in troti v zraku sta opisala tudi Peter Pavel Glavar v svojem delu Odgovor (1768) in Matej Furlan(?) v svoji knjigi Praktično čebelarstvo (1768 – 1771(?)). Leta 1769 je Anton Humel opazoval praho matic s troti v zraku. Kranjska kmetijska družba je potrdila njegove zapise. Leta 1771 sta jih potrdila Peter Pavel Glavar in Matej Furlan. Humlov članek je bil objavljen leta 1773 v Abhandlungen und Erfahrungen in leta 1775 v Wochentliches Kundschaftblatt des Herzogthum Krain. Proces parjenja med matico in troti je prav tako opisal Anton Janša v obeh knjigah: Razprava o rojenju čebel (1771) in Popolni nauk o čebelarstvu (1775). Mnogi napačno pripisujejo to odkritje Janši, ki je učil in pisal o starih gorenjskih ugotovitvah o parjenju matic. Njegova ugotovitev pa je, da matico opraši več trotov. Parjenje med matico in troti v zraku opisuje tudi Peter Pavel Glavar (1776) v knjigi Pogovor o čebelnih rojih. Parjenje matice s troti v zraku je izviren slovenski prispevek k znanju o biologiji medonosnih čebel.

Ključne besede: parjenje, praha matice, troti, gorenjski čebelarji, Scopoli, Glavar, Furlan, Janša, Humel

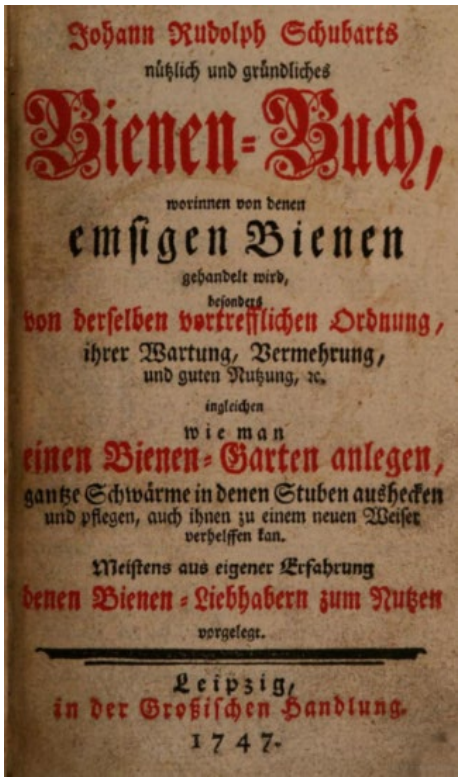
INTRODUCTION

Mating means the sexual union of the queen and drones during a mating flight. Many researchers have studied how queen fertilization occurs and often concluded that this occurs in the hive when drones touch the queen. However, no one has seen fertilization. In Janša's book Abhandlung vom Schwärmen der Bienen (1771), the description of the fertilization of queens with drones in the air received special attention (see & 63). This record was even considered a mistake and, in order to prove it, a reward of 20 or 30 ducats was announced in the daily newspaper three times to anyone who could confirm that the queen was already inseminated in the hive. Even before Janša, the mating of queens with drones in the air, which is an original Slovenian discovery, was known to the beekeepers from Gorenjska[2] and other Slovenian beekeepers wrote about it. In the essay, we will present this chronologically with the so far known records (manuscripts and publications) in the years 1763-1776.

Already at the beginning, let us present the records and statements that beekeepers from Gorenjska knew about the bee queen mating with drones in the air before the year 1763. About Glavar's record (1768), Mihelič (1934) writes in the book Anton Janša, Slovenian Beekeeper, on page 23: »... From this brood, the queenless bees will raise a young queen, who will then mate (P.P. Glavar, as well as many other beekeepers in our country in the 1760s and probably even earlier, knew very well that the queen is mated by the drones outside the hive in the air.)« Mihelič (1948): »...that the queens were inseminated by drones outside the hive deserves all recognition. For not only did several trustworthy and experienced beekeepers from Gorenjska confirm this to me, who had seen such mating many times, but I was also completely convinced from my own experience during my 27 years of beekeeping that this previously dubious subject can no longer be disputed... We can conclude from Glavar's article that the bee queen mating was not discovered by him because "experienced beekeepers from Gorenjska" have known this for a long time. Humel (1771): "...I talked about this circumstance with some experienced beekeepers, of whom there are very many in the country. I received a unanimous answer that they had known this for a long time, that they always saw it as a good sign if the queen flew out to the mating so early and came home with a white abdomen." Rihar (1998) writes: "It is a probable "assumption" that Scopoli, a doctor in Idrija, learned about the peculiarities of bee queen mating from some knowledgeable Slovenian beekeeper, since as a member of beekeeping societies he had the opportunity to come into contact with them on several occasions." And he continues: "As can be seen from Mihelič's writings (1934, 1972), in the 18th century in Slovenia many advanced beekeepers knew well that the queen was inseminated by drones outside the hive in the air." What is said is mainly the records of oral testimonies, which generally confirm that the old beekeepers of Gorenjska knew about the mating of the queen.

Many old beekeeping books have been digitized and are freely accessible, which allows for browsing. Thus, among others, the book Bienen=Buch, written by Johann Rudolph Schubarth (1747), was found. The author's biography has not been found online. From various materials, we have learned that he lived in Saxony, was a pastor, and had been involved in beekeeping for a long time (he wrote the book after 25 years of beekeeping).

[2] Gorenjska: Northwestern part of the country Slovenia


Johann Rudolph Schubarts
nützlich und gründliches
Bienen-Buch,
worinnen von denen
emsigen Bienen
gehandelt wird,
besonders
von derselben vortrefflichen Ordnung,
ihrer Wartung, Vermehrung,
und guten Nutzung, ꝛc.
ingleichen
wie man
einen Bienen-Garten anlegen,
gantze Schwärme in denen Stuben ausbecken
und pflegen, auch ihnen zu einem neuen Weiser
verhelffen kan.
Meistens aus eigener Erfahrung
denen Bienen-Liebhabern zum Nutzen
vorgelegt.
Leipzig,
in der Großischen Handlung.
1747.

Johann Rudolph Schubart
Nützlich und gründliches Bienen-Buch (1747)[3]
https://babel.hathitrust.org/cgi/pt?id=wu.89098858483&view=page&seq=15&skin=2021

[3] The book is presented in Neuer Zeitungen von gelehrten Sachen for the Year 1747. First part, pp. 535-536.
https://gdz.sub.uni-goettingen.de/id/PPN729352439?tify={%22pages%22:[589],%22view%22:%22info%22}

Notes in the book:

In the fifth chapter (On the bee queen or queen and the obedience of bees – pp. 23-32) it is written on page 31:

Page 31:

»… After hatching, the young queen stays in the hive for about two days, then comes out at noon, inspects her apartment (the hive) and at the same time also tests whether she can fly. Then, together with the other bees, she flies into the air, as if she never wanted to return to her hive. But after only two minutes, she returns with many bees to the entrance and then happily returns to the hive, where she immediately makes brood. The bees bring honey and wax. This is how this hive is helped."

In the sixth chapter (On the drones or large "Brut=Bienen – pp.32-37) it is written on pages 35 - 36 and 37:

Pages 35-36:

"Just as the great God created a male and a female for all creatures, humans and livestock, small and large beings, so that everything He created could be preserved and multiplied in the future as long as the world exists, so it is with bees. But the fact that we can generally observe the mixing and mating of all creatures at certain times, and that this does not apply to bees in any way, is solely due to their virtue. For when they are outside in front of the hive, we can never observe even a single act of courtship or negotiation; rather, **this always happens inside the hive**. Moreover, the drone is the male."

Page 37:

Brut=Biene[4] does **no other work than to fertilizate the queen** and thus make her fertile and sometimes to serve and inseminate the young bees.

We have examined many old beekeeping books and publications that were published before 1763. But only in the book Bienen-Buch (1747) have we so far found a record of how the young queen somehow two days (depending on the weather) after hatching comes out of the hive onto the alighting board together with the bees (drones are not specifically mentioned), how she looks at the hive and then flies into the air together with the bees. Quickly (after two minutes) she returns to the entrance and hive together with the bees, where she immediately makes a brood. Nothing is written about the purpose of this trip, perhaps something indirect at the end, when it is said that she immediately makes a brood. There is also no mention drones and any signs (say: a white thread on the back) that the queen brings upon her return. The author carefully observed and also recorded the events, but did not understand their purpose. In the sixth chapter (pp. 32-37), when describing drones, he emphasizes in the introduction that God created males and females for all living beings so that everything he created would be preserved and multiplied in the future, and so it is with bees. However, **we**

[4] This is the naming of drones

do not observe mating in them and everything happens in the hive. The author emphasizes that the only function of drones is to fertilize the queen in the hive, so that she becomes fertile.

Thus, Scopoli's record from 1763 remains the first to explain (pp. 303 – 304): **«… she is surrounded by several drones; she flies out, flying in the air and becomes fertile…». This is the first record in the world that a queen is mated by drones in the air.**

It is difficult to predict whether anything more will be discovered. However, it is already true that, in line with the progress of digitalization, which increasingly incorporates artificial intelligence and the more frequent open access to digitized old beekeeping materials, it will be necessary to continuously re-examine studies that seem to have been researched and concluded.

GIOVANNI ANTONIO SCOPOLI

(*Cavalese, June 3, 1723 – +Pavia, Mai 8, 1788)

(Slovenia: Idrija, 1754–1769)

Portrait of Giovani Antonio Scopoli

Scopoli and Gorenjska beekeeping

He was born on June 3, 1723 in Cavalese, a doctor and conservationist. From 1754 to 1769 he was employed as a mine doctor in Idrija. He was elected a member of the Carniolan Agricultural Society in 1769. He was interested in botany and entomology and traveled extensively throughout Carniolan. In 1763 he published the book Entomologia Carniolica in Latin, where he presented the insects of Carniolan, including our honey bee Apis mellifica. He learned about Carniolan beekeeping on his hikes and in conversations with Gorenjska beekeepers. From them he knew about the mating of a queen with drones in the air. In 1770 he published his Dissertatio de Apibus, where he described Carniolan beekeeping in Latin.

The beekeeping society of Oberlausitz (Upper Lusatia) made him an honorary member in 1767.

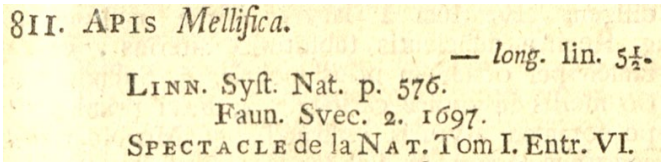
He died on May 8, 1788 in Pavia, where he spent his last 12 years as a professor of chemistry and botany at the university.

Scopoli: First record of the mating of a queen with drones in the air – 1763


IOANNIS ANTONII SCOPOLI
MED. DOCT. S. C. R. ET APOST. MAIEST. MONTANÆ CIVITATIS IDRIÆ PHYSICI
ENTOMOLOGIA
CARNIOLICA
EXHIBENS
INSECTA
CARNIOLIÆ INDIGENA
ET
DISTRIBUTA IN ORDINES, GENERA, SPECIES, VARIETATES
METHODO LINNÆANA.
LABORE ET FAVORE
VINDOBONAE,
TYPIS IOANNIS THOMAE TRATTNER,
CAES. REG. AVLAE TYPOGR. ET BIBLIOP.
MDCCLXIII.

Titel page: Entomologia Carniolica (1763)
http://www.dlib.si/?URN=URN:NBN:SI:DOC-VP8U24VW

Scopoli (1763) described 1,153 species of insects and arthropods that he found in Carniola in his book "Entomologia Carniolica". Among the Hymenoptera, our Apis Mellifica (honey bee) is described on pages 303–304 under number 811.


811. APIS *Mellifica.*

— *long.* lin. 5½.

LINN. Syſt. Nat. p. 576.
Faun. Svec. 2. 1697.
SPECTACLE de la NAT. Tom I. Entr. VI.

Entomologia Carniolica, 1763, page 303

Scopoli wrote about the **queen**: "**She is surrounded by numerous drones; she flies away, while she flies in the air, the drones inseminated her..." This is the first record in the world that drones inseminate the queen during the flight.** Scopoli was not a beekeeper and he learned or realized this from conversations with beekeepers from Gorenjska and based on his own observations, which is described by Rihar (1998) and is already presented in the Introduction.

Appointment of Scopoli as an honorary member of the Beekeeping Society in Upper Lusatia (1767)

Scopoli's work Entomologia Carniolica had a good scientific echo and was received by the "father of taxonomy" Swedish botanist, physician and zoologist Carl Linnaeus, with whom he also corresponded, and elsewhere in Europe. This work was the basis for the Beekeeping Society in Upper Lusatia to appoint Scopoli as an honorary member in 1767 (Abhandlungen…1770).


Neue Mitglieder

a) Ehren-Mitglieder

— Herr D. Johann Anton Scopoli, K. K. Bergrath, und der Arzeneykunſt und der Chymie Profeſſor zu Schemnitz in Ungarn, 1767.

Appointment of G.A.Scopoli as an honorary member.
Abhandlungen und Erfahrungen …, 1770, p. XIII

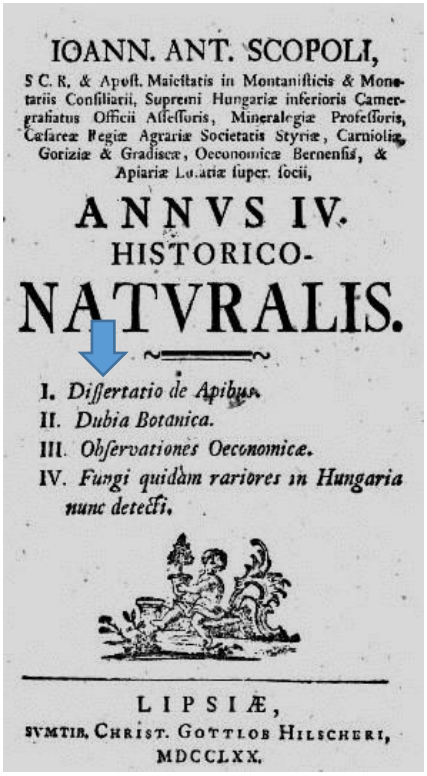
Scopoli member of the Carniolan Agricultural Society

Umek (2006) reports that the Society for Agriculture and Useful Skills (hereinafter: Carniolan Agricultural Society - CAS) was founded in Ljubljana on 26 October 1767, a professional organization for the promotion of agriculture, which also included beekeeping in its program. Among the members was Giovani Antonio Scopoli (probably from 1769).

Scopoli: Dissertatio de Apibus – 1770

http://www.dlib.si/?URN=URN:NBN:SI:DOC-S0MLTISX

In 1770, Scopoli included in the first chapter of the Annus historico naturalis a work called Dissertatio de Apibus (Dissertation on Bees), written in Latin.



IOANN. ANT. SCOPOLI,

S C. R. & Apoſt. Maieſtatis in Montaniſticis & Monetariis Conſiliarii, Supremi Hungariæ inferioris Camergrafiatus Officii Aſſeſſoris, Mineralegiæ Profeſſoris, Cæſareæ Regiæ Agrariæ Societatis Styriæ, Carnioliæ, Goriziæ & Gradiscæ, Oeconomicæ Bernenſis, & Apiariæ Latiæ ſuper. ſocii,

ANNVS IV.
HISTORICO-
NATVRALIS.

I. *Diſſertatio de Apibus.*
II. *Dubia Botanica.*
III. *Obſervationes Oeconomicæ.*
IV. *Fungi quidam rariores in Hungaria nunc detecti.*

LIPSIÆ,
SVMTIB. CHRIST. GOTTLOB HILSCHERI,
MDCCLXX.

Titel page: ANNUS IV (1770)

Scopoli's Treatise on Bees is the first professional presentation of Carniolan beekeeping printed and published in Latin. The introduction presents three species of bees from the genus Apis (bees): Eucera (carob bee), Apis (bee in the narrow sense of the word) and Nomada (migratory bee). He identified the most subspecies - 16 - in the second species, and discusses Apis cerifera (wax-bearing bee) in the most detail. In the introduction, he presents the members of the bee family: the queen, drones and worker bees. He then describes Carniolan beekeeping through 17 observations. Wester (1935) translated the Treatise on Bees together with all footnotes and in the 37th remark on the tenth observation (Measures in the event of a lost queen and signs of fertilization of the queen – white thread on the back) it is written: **some consider the purpose of this degeneration to be breeding, while others claim that asexual bees[5] do not build honeycomb until the queen brings a thin white thread on herself to the hive – Scop.**

Scopoli, first briefly with Entomologia Carniolica (1763) and then with Dissertatio de Apibus (1770), sent a detailed description of Carniolan beekeeping with the Carniolan bee to Europe and the world before Janša, and with it also records of the queen's fertilization with drones in the air.

[5] Worker bees

MATEJ FURLAN

(*Vrhpolje near Vipava, September 15, 1727- +Kamnik, January 8, 1780)

Memorial plaque to Matej Furlan at the elementary school in Vrhpolje (1987)
Photo: Andrej Šalehar

Matej Furlan – Short Biography

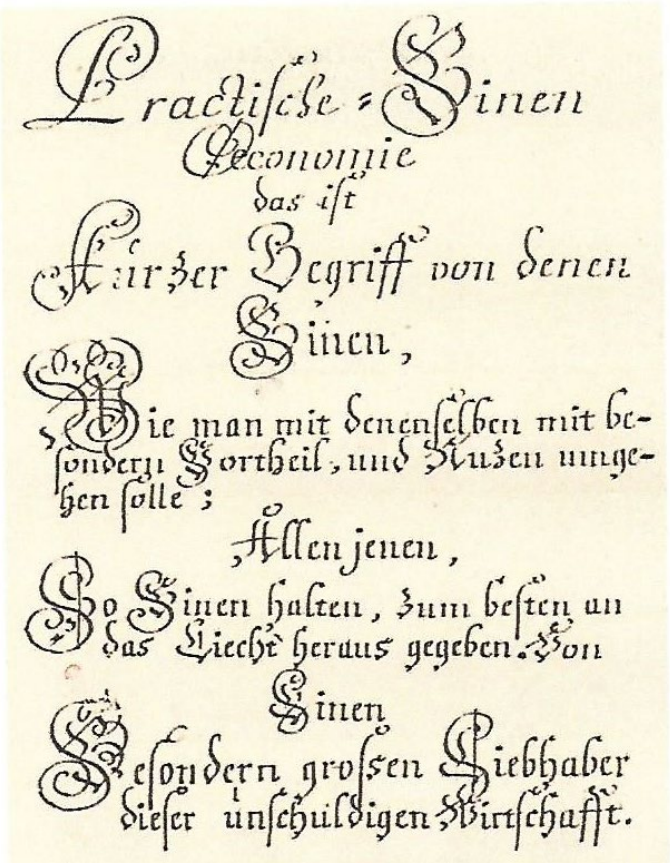
He was born in 1727 in Vrhpolje near Vipava. He attended primary school in Vipava, and completed his theology studies in Gorizia and Udine. Around 1750 he was ordained a priest. Until May 1755 he worked as an auxiliary priest in Velesovo, until 1769 he was a chaplain in Cerklje na Gorenjskem, then he moved to Kamnik and served as a priest in the Poor Clare monastery in Mekinje. He had a house at Šutna No. 6, where he lived with his mother Ana until her death in November 1775.

He was known as a good and knowledgeable beekeeper. He also knew the queen fertilization from drones in the air well and also explained it to Humel (1769). Matej Furlan is the probable author of the beekeeping book Praktično čebelarstvo… (Practical Beekeeping…), which is preserved in manuscript in the Archives of the Republic of Slovenia. It was translated and published in 1976.

He died in Kamnik in January 1780.

Manuscript: Practical Beekeeping…

Matej Furlan was a priest and a famous beekeeper who helped Humel with his explanations of observations of bee queen mating in the air. The Archives of the Republic of Slovenia holds a large manuscript in Gothic and German (65 pages) with beekeeping content – title: "Praktische Binenoeconomie, das ist Kurzer Begriff von denen Binen… (Practical beekeeping or instructions for beekeeping and how bees should be treated to achieve a certain profit and benefit…"). The author of the manuscript is not specified and Furlan, who was also a famous beekeeper, is the most likely author of the manuscript manual. The work is said to have been written in 1768 and 1771 in the Mekinje monastery in Kamnik, where Furlan kept bees and advised on beekeeping. Furlan's manual was first published in 1976, translated by Leopold Debevec, in the book Ob 200-letnici pisane besede o Slovenskem čebelarstvu (On the 200th anniversary of the written word about Slovenian beekeeping).



Cover: Practical Beekeeping or Instructions for Beekeeping and How to Handle Bees to Achieve Certain Profits and Benefits.
Archives of the Republic of Slovenia, Krumpek Estate Fund, SI AS 748, folder 44, 65 pages, written by Matej Furlan (?) in 1768/71 (?)

Translator Leopold Debevec reports that colleagues at the Central State Archives (today the Archives of the Republic of Slovenia) drew his attention to a large (65 pages) manuscript with beekeeping content. The author of the manuscript is not indicated, and Debevec (1976) concluded, based on the phrases and expressions, that the work was written by a Slovenian who was familiar with the centuries-old traditions of Slovenian peasant beekeepers. The likely author was considered to be the famous beekeeper priest Matej Furlan. The work is divided into twenty chapters.

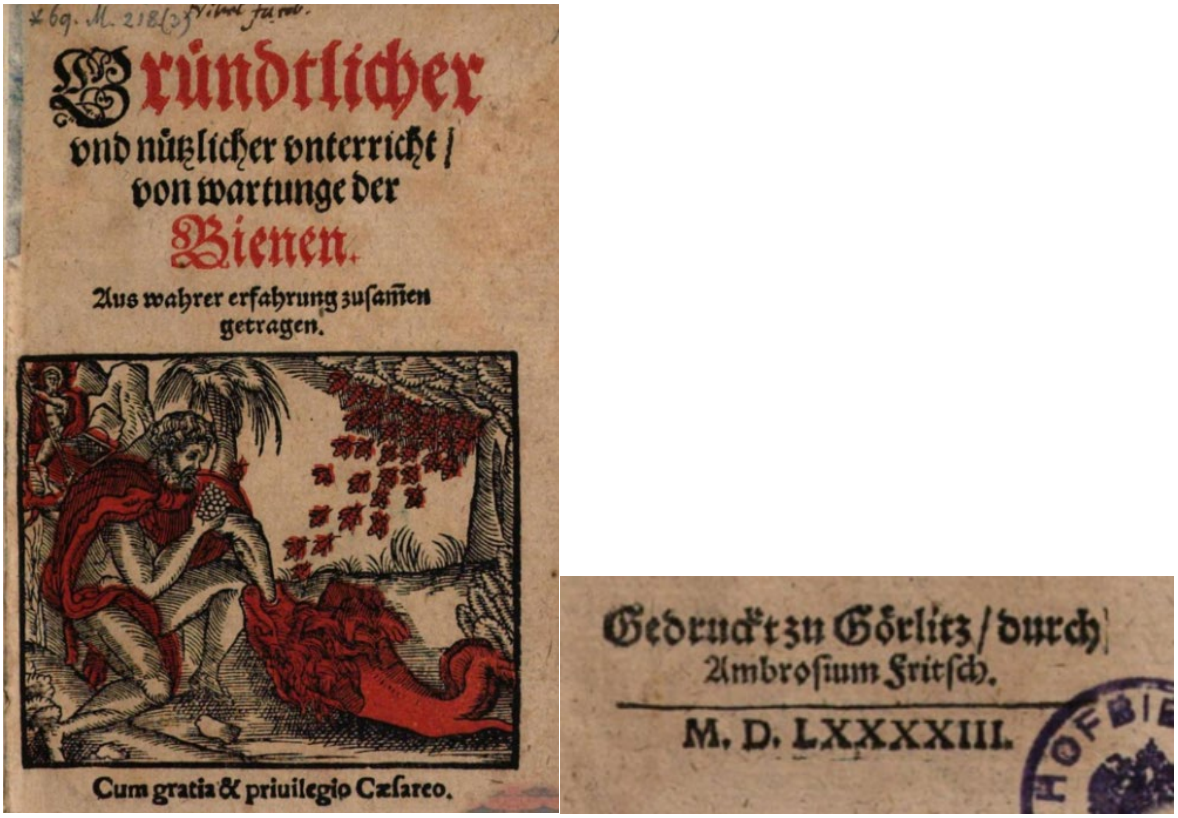
Chapter 6: On the fertilization and reproduction of bees (a ball of drones with a bee queen)

»Here I intend to talk about a bee queen in the second or third swarm, which is not yet fertile and therefore cannot lay eggs. When we put it in a hive with a swarm, such a queen flies out of the hive on the third day, and the drones also fly after her. But when it rises into the air, the drones also rise after it, attack the queen and inseminate her. Due to the mating instinct, a ball (clump) is formed and it often happens that they all fall to the ground together with the bee queen, with the most skillful drone getting the "prey", which I once saw to my great surprise.«

Furlan is the only author who, in this work, describes the mating of the queen and also writes about a ball of drones with the bee queen falling to the ground.

About the fall of a ball of bees with a queen to the ground – a similar description from 1568 (?)

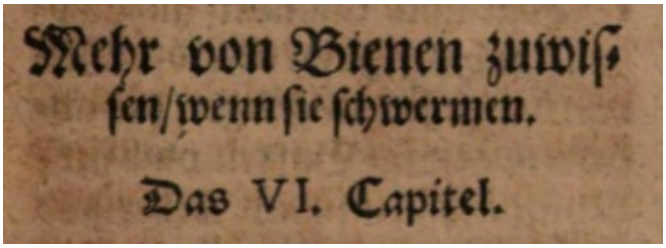
Using the search engine KVK (Karlsruher virtueller Katalog), a beekeeping book was discovered, written in 1568 as the first German book by Nickel Jacob (1505-1576), a beekeeper and writer. A reprint of the book from 1593 is available online: "Gründtlicher und nützlicher Unterricht von wartunge der Bienen. Aus wahrer erfahrung zusammen getragern. (Detailed and useful instructions on beekeeping. Collected from real experience)."



Book cover illustration 1593

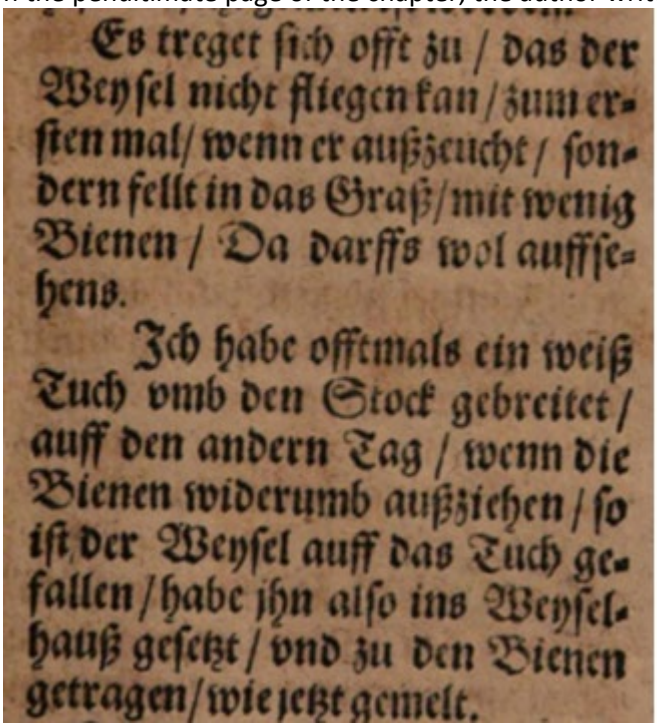
Digitalisierte Sammlungen der Staatsbibliothek zu Berlin Werkansicht: Gründtlicher || vnd nützlicher vnterricht/|| von wartunge der || Bienen.|| Aus wahrer erfahrung zusam̃en || getragen.||(PPN823186458

The book is not numbered, it is divided into 18 chapters, and in the sixth chapter (Learning more about swarming bees) it is written:



Chapter Six: Learn More About Swarming Bees

On the penultimate page of the chapter, the author writes:



Es treget ſich offt zu / das der Weyſel nicht fliegen kan / zum erſten mal / wenn er außzeucht / ſondern fellt in das Graß / mit wenig Bienen / Da darffs wol auffſehens.

Ich habe offtmals ein weiß Tuch vmb den Stock gebreitet / auff den andern Tag / wenn die Bienen widerumb außziehen / ſo iſt der Weyſel auff das Tuch gefallen / habe jhn alſo ins Weyſelhauß geſetzt / vnd zu den Bienen getragen / wie jetzt gemelt.

Translation attempt[6]:
It often happens that the bee queen cannot fly, especially if she is young, but falls into the grass with a few bees. This can of course attract attention.

Several times the next day I spread a white cloth in front of the hive and when the bees flew out, the queen then fell onto the cloth. I put the queen in the hive and the bees accepted her.

It is presented partly similar to Furlan's note on the drones ball with the queen. It is written in Old German and in accordance with the knowledge of bees and beekeeping at that time.

We will also meet the beekeeper Matej Furlan at the presentation of Humel.

[6] I was not able to fully decipher some words and writings; it is old German, and I could not find the words in the dictionary either.

PETER PAVEL GLAVAR

(*Ljubljana, May 2, 1721 - +Lanšprež, January 24, 1784)

Peter Pavel Glavar (2.5.1721- 24.1.1784) – Painting in the chapel at Lanšprež
Photo: Andrej Šalehar

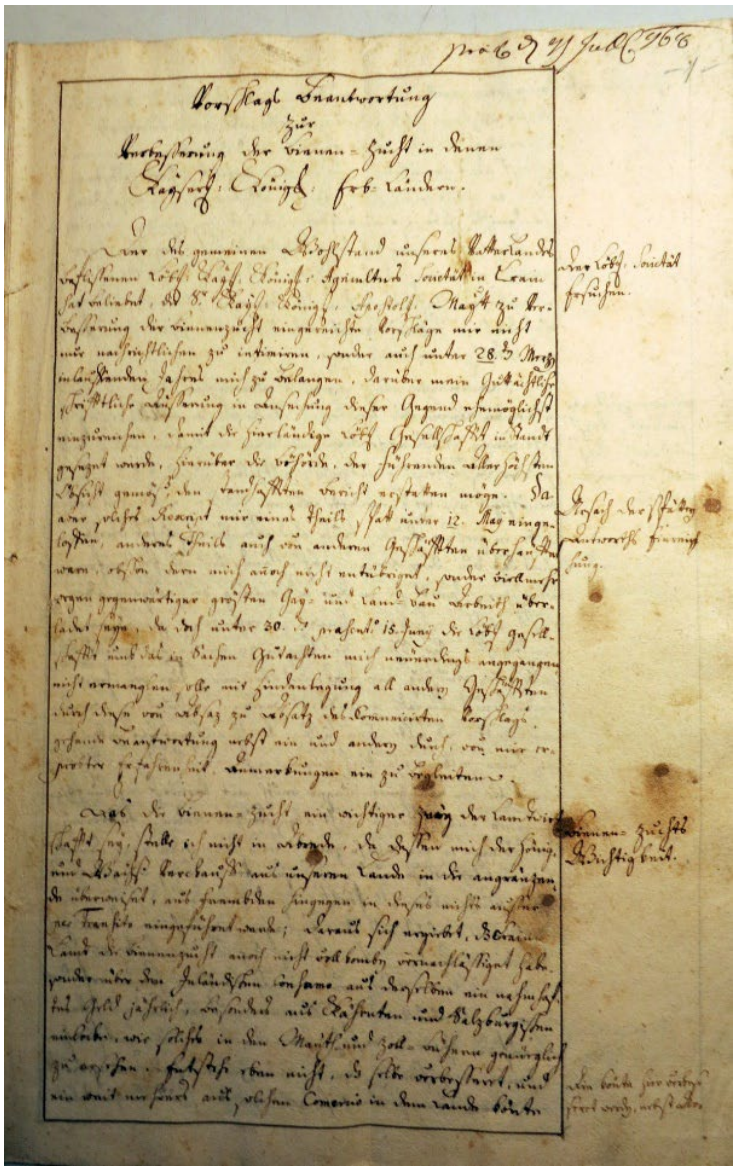
The Glavar Library in Komenda
Photo: Andrej Šalehar

Peter Pavel Glavar - Short Biography

He was born (1721) in Ljubljana, lived in Komenda (1721-1766) and at the Lanšprež manor (1766 - 1784). He was ordained a priest in 1744. He kept bees in Komenda from 1744 to 1766 and in Lanšprež from 1766 to 1784. He acquired basic beekeeping knowledge from beekeepers from Gorenjska, but he also gained a lot from foreign beekeeping books. Three of them are preserved in his library in Komenda – two from 1766 and one from 1769. In 1768 he became a member of the Carniolan Agricultural Society. He was the first to professionally describe Carniolan beekeeping (1768), wrote the first Slovenian beekeeping book Pogovor o čebelnih rojih (Talk about Bee Swarms) – 1776. This is a significantly supplemented and translated book by Janša, Razprava o rojenju čebel (Handling Bee Swarms) - 1771, which remained in manuscript until 1976. He prepared the Rules for the Beekeeping and Gardening School in Lanšprež (1781) and founded the Beekeeping School in Lanšprež (1781), where he taught in the Slovenian language. He helped his subjects with beekeeping, with his knowledge and also materially. The Beekeeping Society in Upper Lusatia appointed him an honorary member in 1772. He died in Lanšprež in 1784, where he rests in the chapel there.

Glavar: The first professional description of Slovenian beekeeping – »Reply« (1768)

On 28 January 1768, the Viennese court office sent the “Vorschläge zur Verbesserung der Bienezucht in den Kaysl. Königl Erbländern (Proposals for the improvement of beekeeping in the imperial-royal hereditary lands)”, prepared by a company from Lower Austria. This document and others related to it are stored in the Archives of the Republic of Slovenia. The Carniolan Agricultural Society also asked its member Peter Pavel Glavar, a priest and owner of the Lanšprež estate, to evaluate it and give his opinion on the matter. Thus, in the same year (7 July 1768), he wrote his famous “Vorschlag Beantwortung zur Verbesserung der Bienezucht in den Kaysl. Königl. Erbländern”, abbreviated as “Antwort” (Proposal-response for the improvement of beekeeping in the imperial-royal hereditary lands, abbreviated as “Reply”) in German (Glavar et al. (2017)), which is the first professional description of beekeeping in Carniola. On the back of the manuscript there is a note “sent on July 30, 1768”, which indicates that the Carniolan Agricultural Society sent a “Reply” to Vienna. The Reply, written by Glavar based on his 24 years of practical experience in beekeeping and reading foreign beekeeping books, describes beekeeping in Carniola in detail and professionally.



Manuscript cover - Peter Pavel Glavar: Vorschlag Beantwortung... Answer (1768).
Manuscript: Archives of the Republic of Slovenia, Fond Mapa 1, no. 2, AS SI 869, Peter Pavel Glavar

He also mentions the mating of queens

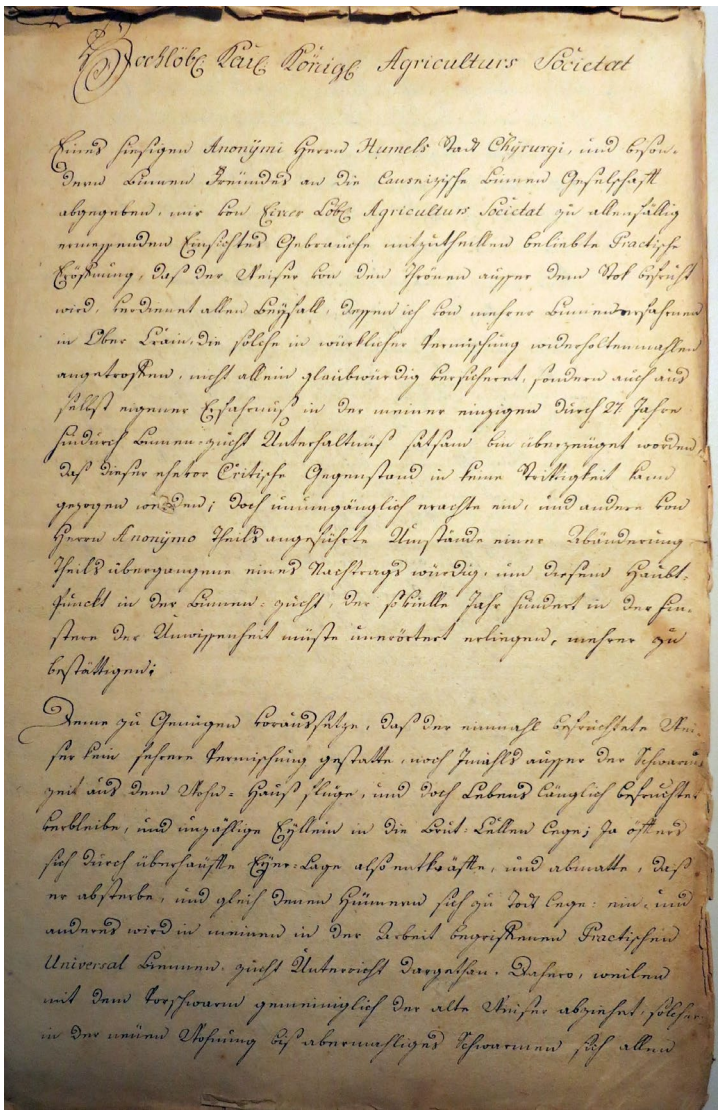
"... From the brood, the queenless bees will raise a young queen, which will then be inseminated. (in sixty years of 18th century and probably even earlier, Glavar and many other beekeepers in Carniola knew very well that queens fertilization is outside the hive, in the air).

It should be noted that **the young queens of those hives, as well as the second and third swarms, fly out to mating after a few days between 12 and 2 pm**."

Glavar's assessment of Humel's letter - 1771

Glavar received Humel's notes on the mating of queens with drones in the air from the Carniolan Agricultural Society in Ljubljana for evaluation. The Archives of the Republic of

Slovenia contain Glavar's response to the Carniolan Agricultural Society dated 25 November 1771, which represents an evaluation of Humel's note on the fertilization of queens.



Manuscript: Glavar's letter to the Carniolan Agricultural Society about Humel's observations of the queen's mating with drones in the air (November 25, 1771)
(AS SI 869 Glavar Peter Pavel, 1751 – 1784)

Glavar's letter to the Carnioln Agricultural Society (1771)[7] – translated by Stane Mihelič (1948)[8]

»The report on the practices of the queen being surrounded by drones outside the hive, sent by a certain anonymous local Mr. Humel[9], a city surgeon and a special friend of bees, to the Lusatian Beekeeping Society and kindly handed over to me by the famous Agricultural Society for review and possible comments, deserves all recognition. For not only have several

[7] Glavar's opinion on Humel's observations of bee queen mating with drones in the air – translation by Stane Mihelič (1948).
[8] The heirs of Prof. Stane Mihelič have kindly allowed the reprints of the translations. Sincere thanks.
[9] Humel is probably a pseudonym (a made-up name); otherwise, Glavar could not have referred to him as an anonymous (without a name, unnamed).

trustworthy and experienced beekeepers from the Gorenjska region confirmed this to me, who have seen such a real union many times, but I myself have also become completely convinced, after my own experience in my 27th year of beekeeping, that this previously dubious subject can no longer be disputed. However, it seems necessary to me to partly change some other circumstances that the unnamed gentleman states, and partly to supplement the omitted ones, in order to confirm this most important point of beekeeping, which has remained unexplained for so many centuries in the darkness of ignorance.

To satisfy this, I assert above all that after fertilization the queen no longer permits union, that she never flies out of her hive except with the swarm. However, she remains fertile throughout her life and lays countless eggs in the cells. By laying too often the egg even weakens and becomes so tired that it dies and, like bumblebees, kills itself by laying eggs. I explain this and other things in my textbook On Practical General Beekeeping, which I am currently writing. Therefore, since the old queen flies away with the first swarm, she refrains from any departure in the new habitat until the next swarm and is so busy with laying eggs that the bees can barely build enough cells, and I have indeed found laid eggs in cells that have just been started. I said this in general because if the weather prevents the first swarm from flying for a few days, or if the old queen is too stubborn for this, this life is hers and she lays the brood with the young, which is recognized by the previous singing; therefore such queens are also called singers and, although these are the first swarms, they must be asked to join the drones to lay eggs, just as in later swarms. All newly born queens, who are supposed to take care of the reproduction of the bee colony, are killed off in a short time, and must be visited by the males for this. We cannot determine the time for this with certainty, but in general it always happens in the first 14 days, if the weather is favorable: for some are so eager that we have seen them fly away from the place where the swarm settled to join. Others are more cold-hearted, so that they go to the mating much later or not at all. In the latter case, the brood decreases daily because there is no increase, and must finally die.

I have observed both this and the other this year, which was very bad for bees. I noticed that in some swarms they only made some brood when the buckwheat flowers, and in two I found. although they had built enough combs and had already collected some honey, when I examined them inside, the queen, but no brood; this is undoubtedly a sign that the queen has not yet been mated: both of these swarms attacked, plundered and killed the families of other hives after two months, when the buckwheat had stopped blooming.

The afternoon mating season in warm, sunny weather without wind between one and three o'clock is the right time for the queen to go on her journey. At the entrance she comes out of the hive very slowly, stops for a short time and looks around her apartment, so that she can find her way more easily on her return, then rises to a height and flies away very quickly. Here the unnamed gentleman mentions a circumstance which I have not noticed, namely that the bees are very agitated when the queen leaves, they run back and forth by the hive and that they mourn and lament because of her departure. To be fair, I have often seen the opposite, that the bees appeared completely calm when the queen leaves, as if they had not even noticed it, but this happens if the queen delays returning at the usual time: because of the suspicion that she is lost, they begin to make strange noises inside the hive. They completely scatter in the hive, running here and there looking for it, they also crawl to the entrance and run around the alighting bord, as if they wanted to swarm. With the only difference that they

do not fly away from there but return inside again. They even fly to the neighboring hive, as if they wanted to leave it, which also happens more than once, but if the queen comes home during this alarm, as soon as she touches the board, they notice it. In an instant, everything is quiet inside and outside the hive, they change their sad murmur into ordinary, to show their joy they stand briskly on their feet with their backs raised upwards and fan their wings happily, which I have admired many times. when I found the queen who had fallen into the grass and placed her in front of the entrance.

On the contrary, if it is delayed longer and if the family does not immediately leave its hive and join the neighboring ones, the alarm certainly lasts for some time, but it gradually fades. During this unrest, after an hour of the loss, when they have completely forgotten the queen, the bees willingly take over a foreign queen, but if this time is ignored, the swarm is lost. The bees no longer acknowledge the foreign queen if we bring her to them later, because in the meantime they have already started to raise a young queen, which will come to nothing, because a drone will hatch from the newly built royal cell. It is different with the breeding bees, if they lose a queen, they find her, if the lost queen has recently laid a legion of eggs. because she was mated. Over 2 or 3 days old larva among them, they raise a young queen from her, and if she hatches happily, flies away to the mating and if she returns healthy, the family of the hive has acquired a new leader.

How long the queen stays outside the hive or how long it takes for her to mating cannot be determined, but is governed by whether she seizes the opportunity to join the drones. Sometimes she returns after a quarter of an hour, if it happened quickly, and sometimes after one, two or even more hours. Sometimes she even returns without having done anything. Therefore, she repeats the trip until she is completely satisfied. Two years ago, I caught another swarm with an extra queen and a swarm of bees and placed it in a glass case with a piece of honeycomb on the window to observe it. The next afternoon I saw the queen fly out. Since she had left 3 pairs of bees, I suspected that they had all escaped. The suspicion was all the more justified because by evening the other bees had also disappeared. But I was wrong, because the queen only flew out to the mating. The next evening I unexpectedly noticed her sitting with a much whiter abdomen above the cupboard, surrounded by two bees, and put her back inside. But on the third day the honey that was there attracted foreign bees and they completely killed the queen, because the few native bees could not defend her.

The described event, which seemed completely foreign to the unnamed gentleman in his beekeeping, led him to consult with some experienced fellow beekeepers, who unanimously told him that this was a sign of fertelisation, if a queen came home with a white abdomen. Also that she did not stop flying until she brought this sign with her and then she did not appear again. This news aroused the gentleman's curiosity in what way and with whom this union of the queen occurs. So he redoubled his research until he noticed on the second and third day of the same year that the queen, after the previous strong buzzing, had come to the hive around two o'clock in the afternoon, and had been climbing on the hive for more than 15 minutes. Finally, she rose high and flew in a circle for some time with her head turned towards the hive, looking at it so as not to miss it on her return. After one hour, she returned home without a sign, that is, without having done anything.

Therefore, the queen had to repeat her trip, which she did on the 3rd:7th[10] day after the cloudy weather had calmed down, in clear, sunny, sultry weather, during the afternoon mating or airing of the bees at one hour, when she again flew away from the alighting board with the ceremonies that she had seen on the previous trip and with flying, still unchanged on her body, and after 28 minutes she came back again, but greatly changed, for her genitalia were white, very raised and expanded; she went completely limp with her wings folded along her alighting board into the hive, where the bees accompanied her with flapping wings to express their joy at the arrival of their leader. This incident did not satisfy the curiosity of the unnamed gentleman either, because he still did not know where the queen had received this sign from, until the priest Matej Furlan from the monastery of virgins in Mekinje, a reliable beekeeper, my former closest neighbor, untied the knot for him after 22 years of beekeeping.

The named priest told the researcher how, in 5 years, he had twice noticed, on hot summer days, that a large clump of drones had fallen to the ground in front of the apiary: he immediately grabbed it and, when he examined it, found the queen in the middle both times, with which, in the manner of butterflies, the drone was always closely united. Therefore, he also added that until the queen is mated, the bees of the second swarm do not come home with the polen load and that such a departure of the queen is also the cause if the hives remain without a queen, because these females in the air are not only exposed to many dangers and bad weather, but also during their rare trips and subsequent returns they can miss their hive and go to a foreign one, and his family welcomes the new member very poorly with prickly and nippy behavior.

The above observations of the unnamed gentleman are almost completely consistent with mine, except for some small incidental circumstances, which in no way refute the main success of his purpose. For example, in the longer or shorter stay of the queen on the trip, which is supposed to be guided by her desire for more joy; or in the fact that I have (seen) several times not only the queen with a white, raised and widened genital mouth, but also the drones with which she had recently mated, that they returned home, partly before the queen, partly after her, and had between the two testicles, as between two outwardly curved horns, which when squeezed by the drone stick out, a protruding, white male organ the thickness of a medium thread, and not longer than a line or 1/12 inch, which is further confirmed by the present object. I know this from absolutely certain experience, because I once saw the queen of another swarm fly out and therefore waited for her return, but in vain, because I saw the drone with the aforementioned signs go to the hive, while the queen did not come for the longest time. Already after that. and even more so because the bees, which had been calm before, began the alarm described, I concluded that the queen must have had an accident after the union, which the bees probably realized by the scent of the drone returning home and were confused. To prevent this evil in time, I took another queen, prepared for such an occasion, and placed her among the bees on her alighting board, after which everything immediately became calm as before.

I must ignore the claim of a spiritual friend (that he saw a clump of drones) because I have never had such luck, although I have been chasing it. But others have told me about it,

[10] *Here P. P. Glavar was mistaken. This date applies to the first trip, the third day of the week. That is July 7, 1769: the second trip was on July 10, which is the sixth day of the week, according to his method, therefore the 6th: 10th day.

especially my friends, who recently confirmed to me that a clump of drones suddenly fell from the air to the ground in front of it, but they did not understand what caused it. I have very often heard drones rustling over the meadows in the afternoon sun, I have often seen them flying here and there, but I have not yet noticed them falling to the ground. The fact that the queen of another swarm has not yet been mated whether a hive has been left without a queen, as soon as the bees on their legs bring pollen either none at all, very rarely and in small quantities, while others, on the contrary, come fully loaded with it, is an indisputable sign. However, if, according to the unnamed person, buckwheat swarms do not thrive because there are few or no more drones at that time, the gentleman is very mistaken, for there are simply too many of them. Many (hives) keep them until Michaelmas and beyond, which is a sure sign that the other mother hive has reared young queens; for they are in the habit of flying in the fall and laying eggs in November, if it is warm enough. On the other hand, as soon as a hive begins to seriously choke drones, we can be assured that its queen has been mated, and the earlier this happens in the autumn, the earlier the swarms promise us for the coming spring.

Finally, I must approve of the unnamed gentleman's curiosity and research efforts and commend him with the wish that many, especially learned beekeepers, may imitate him. For in the darkness of ignorance lie sunk and buried as in a deep sea, very many things concerning bees. The Glorious Society, if it deems it worthy, should communicate this statement of mine to the Lusatian Society, so that it may confirm the discussion of the unnamed gentleman, perhaps modify it in some circumstances, and publish most of it in the file on bees, which goes to print every year. I recommend myself with special humility.

Landpreis manor, September 25, 1771. Peter Pavel Glavar

Summary

… Glavar has been saying from the very beginning that Humel's work deserves all recognition, since experienced beekeepers from Gorenjska have also told him that they have seen the queen flying with drones through the air and that they have observed this many times. Therefore, there can be no more doubt about this. After the brood, the queen no longer allows herself to be united with drones and, except with the swarm, does not fly out of the hive and remains fertile throughout her life. Finally, he concludes with a recommendation to the Carniolan Agricultural Society that, if it deems it worthwhile, it should send this letter to the Beekeeping Society in Upper Lusatia with a recommendation that they publish Humel's note in their beekeeping publication...

Appointment of Peter Pavel Glavar as an honorary member of the Beekeeping Society in Upper Lusatia (1772)

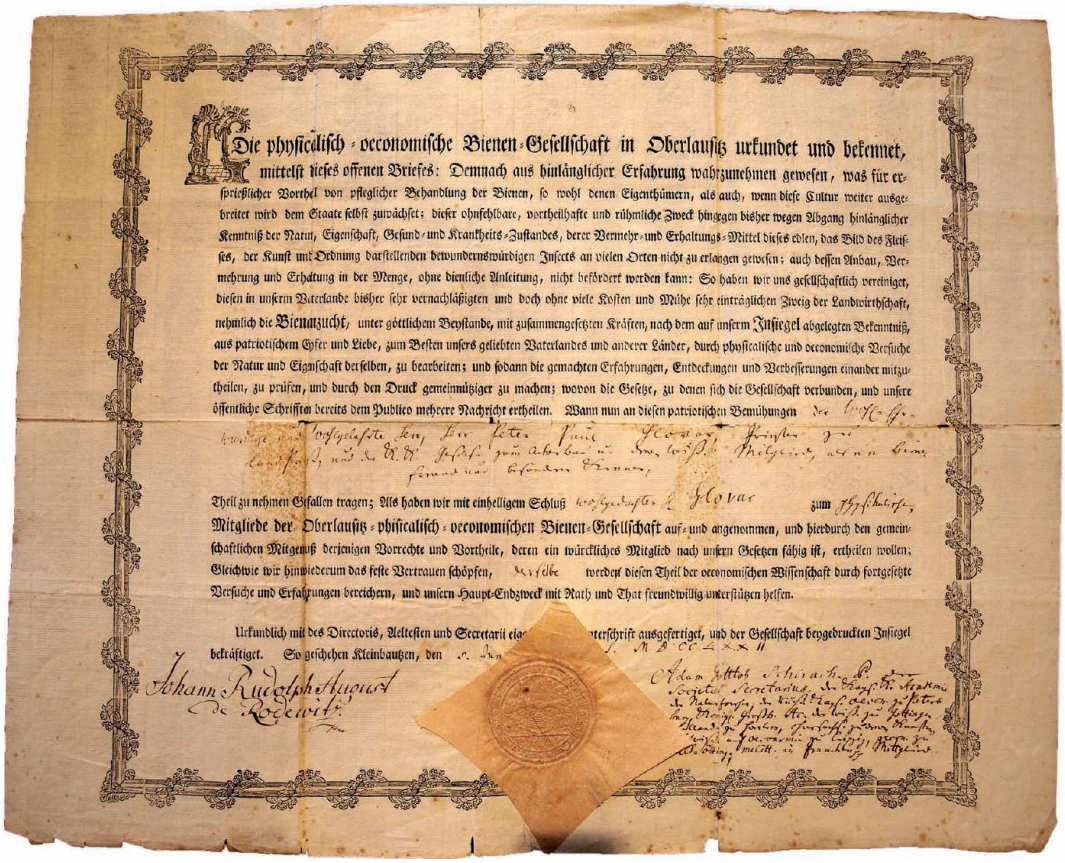
In 1772, the Beekeeping Society in Upper Lusatia appointed Peter Pavel Glavar as an honorary member.

b) Ehren-Mitglieder zur physikalischen Classe.

— Herr Peter Paul Glovar, Priester zu Land-Preiß im Herzogthum Krayn. 1772.

Gemeinnützige Arbeiten…, 1773, page XIV

Deed of the Beekeeping Society in Upper Lusatia for Peter Pavel Glavar dated June 5, 1772.



Die physicalisch-oeconomische Bienen-Gesellschaft in Oberlausitz urkundet und bekennet, mittelst dieses offenen Briefes: Demnach aus hinlänglicher Erfahrung wahrzunehmen gewesen, was für ersprießlicher Vortheil von pflegl[ic]her Behandlung der Bienen, so wohl denen Eigenthümern, als auch, wenn diese Cultur weiter ausgebreitet wird dem Staate selbst zuwächset; dieser ohnfehlbare, vortheilhafte und rühmliche Zweck hinggegen bisher wegen Abgang hinlänglicher Kenntniß der Natur, Eigenschaft, Gesund- und Krankheits-Zustandes, derer Vermehr- und Erhaltungs-Mittel dieses edlen, das Bild des Fleisses, der Kunst und Ordnung darstellenden bewundernswürdigen Insects an vielen Orten nicht zu erlangen gewesen; auch dessen Anbau, Vermehrung und Erhaltung in der Menge, ohne dienliche Anleitung, nicht befördert werden kann: So haben wir uns gesellschaftlich vereiniget, diesen in unserm Vaterlande bisher sehr vernachläßigten und doch ohne viele Kosten und Mühe sehr einträglichen Zweig der Landwirthschaft, nehmlich die Bienenzucht, unter göttlichem Beystande, mit zusammengesetzten Kräften, nach dem auf unserm Insiegel abgelegten Bekenntniß, aus patriotischem Eyfer und Liebe, zum Besten unsers geliebten Vaterlandes und anderer Länder, durch physicalische und oeconomische Versuche der Natur und Eigenschaft derselben, zu bearbeiten; und sodann die gemachten Erfahrungen, Entdeckungen und Verbesserungen einander mitzutheilen, zu prüfen, und durch den Druck gemeinnütziger zu machen; wovon die Gesetze, zu denen sich die Gesellschaft verbunden, und unsere öffentliche Schriften bereits dem Publico mehrere Nachricht ertheilen. Wann nun an diesen patriotischen Bemühungen der [illegible] Theil zu nehmen Gefallen tragen; Als haben wir mit einhelligem Schluß [illegible] zum [illegible] Mitgliede der Oberlausitz-physicalisch-oeconomischen Bienen-Gesellschaft auf- und angenommen, und hierdurch den gemeinschaftlichen Mitgenuß derjenigen Vorrechte und Vortheile, deren ein würckliches Mitglied nach unsern Gesetzen fähig ist, ertheilen wollen; Gleichwie wir hinwiederum das feste Vertrauen schöpfen, [illegible] werdest diesen Theil der oeconomischen Wissenschaft durch fortgesetzte Versuche und Erfahrungen bereichern, und unsern Haupt-Endzweck mit Rath und That freundwillig unterstützen helfen.

Urkundlich mit des Directoris, Aeltesten und Secretarii eig[enhändi]ger Unterschrift ausgefertiget, und der Gesellschaft beygedruckten Insiegel bekräftiget. So geschehen Kleinbautzen, den [illegible]

Johann Rudolph August de Rodewitz

Charter of the Beekeeping Society in Upper Lusatia for Peter Pavel Glavar dated June 5, 1772.
Archive of Glavar's Benefice in Komenda - folder 1/26
Photo: Andrej Šalehar

Peter Pavel Glavar:
Conversation on bee swarms (Landpreis 1776)

Written in German by A. JANŠA, a Viennese beekeeping teacher,
and translated and supplemented into Carniola by a highly respected, venerable, learned priest

PETER PAVEL GLAVAR,

former parish priest of the Commandery of St. Peter,
now the owner of the Landpreis manor.
In 1776
http://www.dlib .si/?URN=URN:NBN:SI:DOC-PMTK8QLN

Glavar: Conversation on Bee Swarms – 1776

Peter Pavel Glavar is the author of the first book on beekeeping in the Slovenian language, which appeared in 1776 with the title »Conversation on Bee Swarms«, but its beginnings extended back to 1768 when Glavar wrote his famous »Reply« and offered to write a book on beekeeping for Slovenian beekeepers in the Slovenian language. He sent it to the Carniolan Agricultural Society to issue in 1779. The Society never published it, probably due to the text in the Slovenian language. Furthermore, the manuscript was supposed to be lost. Archivistin Dr. Marija Verbič noticed about the manuscript, which was found in the central Archive of Slovenia in the years 1950/51. Slovenian Beekeepers' Association in 1976 in the booklet »At the 200 Anniversary of Written Word in Slovenian Beekeeping" published also Conversation on Bee Swarms.

Glavar (1776) writes about the mating of bee queen in XXXI. Chapter.

XXXI. Conversation: About mating of bee queen. Pages 119, 121 and 123, paragraphs 349 - 359

349. Type of conversation

We placed swarms and parent colony, some in the home apiary, others were transferred elsewhere for a while. To commence a new house, we have given them a handsome dowry, or we have given them with the necessary lodging for a few weeks, so that they have no cause to complain over us of want. But now we want to know how these and their parents are treated.

350. What is bee queen mating

After the queen hatches or an unneeded one is added according to the instruction under no. 335, the first task is queen mating. By mating, we mean the pairing or breeding of the queen, or the female, with a drone or with her own mate, from which the received semen makes her fertile, so that by laying eggs she reproduces the bee colony.

351. In what place is the queen breeding

It is to be known, and yet it must be known, that the queen is endowed with the attribute of creation by God, of all things of the Creator, whose mystery and causes of his wonderful works we are not given to know, in creation this quality of never mating with drones in her dwelling place, but always going out and mating when she is desirous of being ennobled. This flight of the queen is called mating fly, and this mating is called breeding.

352.The peculiar property of the bee queen is that it is forever fertile after a single mating

It is also necessary to know the other quality granted by God, that the queen, once received from the males a tribe or seed, from a single mating with a male, becomes fertile throughout her life, and never again goes through the tribe. A quality such as - so far as I know - is not assigned by God to any other thing.

353. Why the bee queen is mated several times and how many times

However, the queen is shown not always to mate with the males in a single mating, and even if they mate, because they force the males one after the other towards her, they push each other away and hinder each other from doing their deed completely, and so she does not take the semen into her vessel completely. So she goes to make her fertile, many and so many times to dusting until she catches it.

354. Time of bee queen mating

The mating time is not always the same, but is faster or later depending on the weather and grazing. If the weather is good and grazing is good, and the bees have already made some two to three finger-long honeycombs, the young queen from the swarm or offspring, which no longer intends to swarm, usually goes to mating on the third or fourth day. However, if there is bad weather and also grazing, it is dusted on the 14th day after hatching and even later.

355. We saw her mating herself immediately after swarming

I don't want to keep quiet to my beekeepers, which is what happened to me with two singers. For at one swarm I saw a queen fly to the mating and return from a branch before the swarm was hived, and at another from the hive, soon after hived. For one, I can't remember which, I know that the rain kept him in the swarming for a few days, and therefore she also hurried to mating, for the other I don't know whether he was restrained or went out of the way earlier after the tribe.

356. How the bee queen is mated

Between nine o'clock in the morning and four o'clock in the afternoon of a sunny day, the bee queen comes out of the hive, accompanied by several bees and drones, walks around on alighting board, spins and looks at the hive in order to get to know it well and not miss it on her return. When she has a good look at it, she flies away, turning back for a while in front of the hive wider and higher, watching the hive until it disappears from sight and that's her mating.

357. How the bee queen behaves

When the queen has flown in the company of some of the bees and the males from the hive, from the hive after another the males descend one after the other, and a few shots far from the beehive fly together over a beautiful plain, and there in the air, no other than in swarming, they fly to and fro amid a great murmur. The males pressed more and more densely against the bee queen, took it in the middle, and clung to it so that they fell to the ground several times in the form of a ball, and the reapers found in the midst of it a queen with its hindquarters open and upwards, and the male under it with a limb thrust into it; so they stuck together.

358. How the bee queen comes off the mating

When the bee queen and the males have sufficiently fulfilled their sexual desire, and the bee queen has achieved what she was looking for, they let each other down, and this married couple, tired from work, flies home again after a short rest, where some of the bees of her family are carefully waiting for the queen in front of the entrance. The queen again flies in front of the apiary in circles, but always narrower, and when she gets to know the hive well and looks at it, she sits on her alighting board. The bees, with antennae and front legs stretching them towards her, and licking or stroking her with their tongues, accept her, flap her wings with joy, have their butts up, and escort her into the home.

359. Sometimes it is not come back until the second day

What are the little bees doing at this time? It also happens – and it happened to me with one bee queen, raised on a window in the small beehive – that she does not return until the next day, because it turned to mating or she was carried away by the wind or detained by the weather conditions. If she does not return on time, the colony becomes sad, mourns for her with sad buzzing, misses her, runs around looking for her, desponds, and disperses to nearby hives. So this little bee escaped from my hive, and I only found the queen with two little bees and one drone the next evening on the ceiling of the hive.

Memorial plaque to Peter Pavel Glavar on the facade of the chapel at Lanšprež – 2015
Photo: Andrej Šalehar

ANTON JANŠA

(*Breznica, May 20, 1734[11] – +Wien, September 13, 1773)

Janša's apiary on Breznica
Photo: Andrej Šalehar

Painted beehive end cap of St. Ambrose, Janša's apiary on Breznica
Photo: Andrej Šalehar

[11] Date of baptism

Anton Janša, the first beekeeping teacher

Empress Maria Theresa founded a beekeeping school in 1769 and on April 6, 1770, she appointed Anton Janša, a simple young man from Carniola, who had attended a copperplate drawing school in Vienna, as the first beekeeping teacher and traveling teacher for beekeeping. The beekeeping school was in Augarten from 1769 to 1775, and from 1775 to 1782 at Belvedere. Anton Janša was born in Breznica in Gorenjska in Slovenia, in an environment where beekeeping was very developed. Janša's beekeeping teachings were based on a good knowledge of bees and the knowledge of Gorenjska beekeepers. He taught that bees should not be killed, he taught how to drive bees to pasture, he refuted the teaching that drones are water carriers and taught that the bee queen is inseminated by drones in the air. This was known to the old beekeepers of Gorenjska as the first in the world, and Scopoli was the first to write about it (1763). He kept bees in wooden beehives from Gorenjska. He is the inventor of beekeeping tools – the swarm trap. The basis of his profitable beekeeping (science) is the control of swarming, the rejuvenation of colonies and not killing bees – in short, in the good treatment of bees. He wrote two beekeeping books in German, which were reprinted and translated into other languages several times and are included in the world's classic beekeeping literature. The beekeeping patent of Maria Theresa (1775) also legislated Janša's principles of beekeeping. In the added decree, the Instructions for Master Beekeepers (1775), Janša's beekeeping teachings are prescribed in beekeeping schools. World Bee Day is celebrated on the birthday (date of baptism) of Anton Janša, May 20.

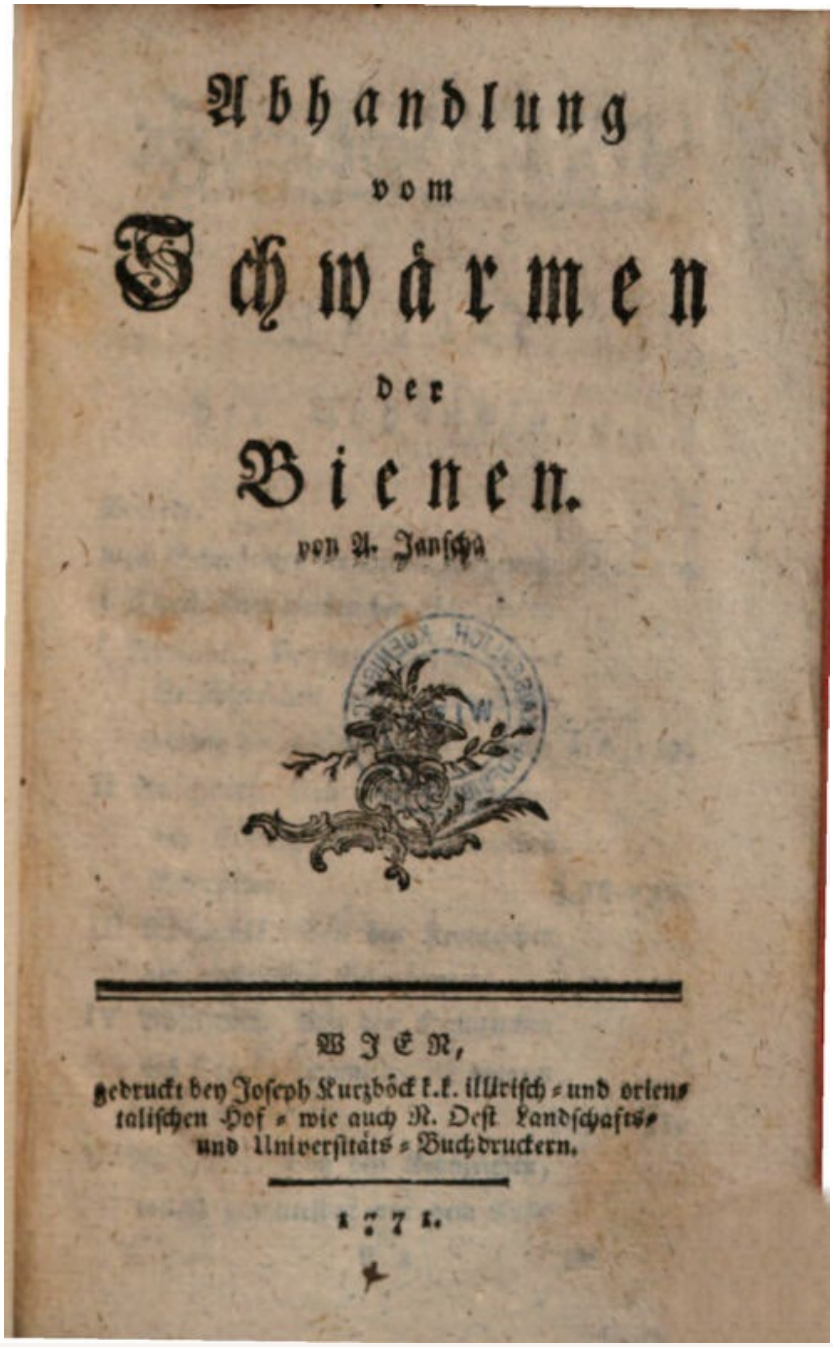
General information about the fertilization of the queen with drones in the air during the time of Anton Janša

In Janša's time, there were still assumptions about the method of the queen fertilization. Most believed that this happened in the hive, but no one had ever seen it. Janša's publication in both books, especially in the first, that the queen is mated with drones in the air, aroused a lot of interest and also opposition among beekeeping experts. Most people incorrectly attributed this discovery to Janša. Even before Janša's first book was published in 1771, in the beekeeping literature where Carniolan (Slovenian) beekeeping is described or presented, this was written in the publications: Scopoli (1763) and (1770), Glavar (1768), Humel (1771) and Furlan (1768-1771 (?)). The signs of fertilization of the queen, which are visible upon her return - a white thread on the back and others, are also described here. Janša's discovery in this regard is that the queen is inseminated in the air by several drones. There is also living oral testimony that the beekeepers of Gorenjska (Carniola) knew, many years before, that drones fertilize the bee queen in the air.

On the mating of the queen with the drones in the air in Janscha's first book – 1771 (§63)

Abhandlung vom Schwärmen der Bienen (Treatise on the swarming of bees) Janscha, Anton, Vienna: Kurzböck, 1771, 140 pages

https://www.digitale-sammlungen.de/de/view/bsb10296195?page=5



Abhandlung
vom
Schwärmen
der
Bienen.
von A. Janscha

WIEN,
gedruckt bey Joseph Kurzböck k.k. illirisch- und orientalischen Hof- wie auch N. Oest. Landschafts- und Universitäts-Buchdruckern.

1771.

Titel page: Abhandlung vom Schwärmen der Bienen. Janscha, Wien, 1771

§63, pages 50-51

“Since we are talking about the queen’s mating, we should also state the time of fertilization and the signs by which we can conclude that the queen has been fertilizated. The time of the queen’s flight to mate depends on the weather and the pasture supply. If the weather is fine and the pasture is so good that the bee colony has managed to build a few combs, then the queen flies away on the third or fourth day after hatching. In the case of poor pasture or bad weather, the flight to mate is postponed for 14 days or more.

On a fine day, between nine o’clock in the morning and three or four o’clock in the afternoon, the bee queen comes out of the hive in a large company of bees and drones. She looks around in all directions on her alighting board for a while, to remember the hive so that she can find it when it gets higher and higher. When she returns from mating, she does not go straight to the hive, but flies ahead of it for some time. On this occasion, we must pay attention to the following signs by which we know that the queen has been inseminated. If the queen's back is open, where the bees have their sting, or if something white, like a thin thread, hangs from the back, so that it looks as if the back is broken or torn, then the queen has definitely been mated. In five or six days she will begin to lay eggs. If she does not be mated during this flight, she must go to the mating again, either this time or immediately the next. Sometimes she even flies several times until she is fertilized.

Anyone who has not observed the queen when she returns from the mating, can also tell by the bees if the bee queen has been fertilized. Namely, the bees:

1. They fly out or come straight up and apply the strong legs that they need to feed the brood. From this alone we can conclude that the queen has been mated.

2. After fertilization, they start driving out the drones, because they have become unnecessary; they bite them and push them out of the comb into some corner of the hive so that they cannot reach the honey.

3. They become even more irritable than before, because they are worried about the safety of the bee queen who is laying eggs.

4. They sit close together to warm the young brood.

5. They fill the cracks and crevices of the hive to protect the brood from drafts and other enemies.

6. The most reliable way to recognize a hive with a inseminated queen is by the eggs that are in the cells. We can see them if we look at the comb from the side.

After the fertilization period, the queen does not leave the hive until she swarms again. ”

Mihelič (1934) on Janša's note (§ 63)

Mihelič (1934) enthusiastically welcomed Janša's note (§ 63) on the mating of the bee queen with drones in the air and wrote: “In a few sentences, Anton Janša said everything that others, from Reaumur to Schirach, had guessed in entire books. Janša writes: **The queen is fertilized in the air outside the hive. She is fertilized by drones. Fertilization occurs only once for each bee queen and is sufficient for the queen's entire life.[12]”**

Janša's beekeeping lessons in the Augarten park in Vienna
Ilustriran Slovenec, 1(1925)39, p.2

Linguistic update:
"I do not kill bees to get honey and wax, but I keep them strong and healthy so that they will collect honey for me again next year.
(text from § 174. – Janša, Anton: Vollständige Lehre von der Bienenzucht - 1775)."

[12] From the book: Stane Mihelič, Anton Janša, Slovenian Beekeeper, … . 1934, page 123.

Vollständige Lehre von der Bienenzucht (1775)

Janscha Anton, Münzberg, Joseph, Wien 1775, 204 strani

https://www.dlib.si/stream/URN:NBN:SI:DOC-NTDERK2I/e677ff0e-1700-453d-98c0-9988b56d7719/PDF

Title page: Vollständige Lehre von der Bienenzucht, Janša Anton, Vienna 1775

In his translation (1906) Rojina wrote:

Chapter II. On the sex and reproduction of bees. § 7 - 13, pages 13 – 16

§ 8: Drones, page 13

"Drones are male; their sole function is to inseminate the bee queen. At the time of swarming, on a fine, warm day, each unfertilized bee queen, accompanied by many drones and bees, flies into the air, where the drones pollinate her. Then the bee queen begins to lay eggs and lays them throughout her life. A fertilized bee queen that is capable of laying eggs is called a

visited or inseminated queen, and one that has not yet been fertilized is called an unvisited or uninseminated queen."

Chapter IX. On the queen's mating § 51-55; pages 39 - 42.

§ 51. Time of mating; page 39

A young queen does not lay any brood before she has been fertilized (§ 8.). Fertilzation, however, takes place only in the air (§ 8.). A young virgin swarming queen (§ 40., 43.) does not pollinate immediately, but on the third or fourth day after, if the weather and pasture are favorable. In bad weather and scanty pasture, even after 14 or more days. The same thing happens with the degenerate after the departure of the last swarm. The newly hatched bee queen goes to fertilization on the fifth or sixth day, if the weather permits. Mating in general depends on the trip, and this in turn depends on the weather and pasture.

§ 52. Fertilization; page 40

On such a day, go to such a hive on the side, wait from 9 o'clock in the morning until 3 or 4 o'clock in the afternoon and look at the entrance. Here comes the queen, accompanied by a large company of bees and drones. She turns around several times to remember the hive and can find it on her way back, and finally rises into the air. She flies around the hive for a while, observing it, and gradually rises higher and higher. Do not let her out of your sight, and you will see how they rush towards her drones at a certain speed; this is, so to speak, breeding. After a few minutes she returns home again. Where the hive is isolated, this observation is quite easy. If she has not been fertilized the first time, she will go either the same day or another day, or sometimes several times more to pollinate.

§ 53. Signs of fertilization; pages 40-41

Before the queen goes into the hive, she flies around it for a while. Now watch for the following signs:

1. If the pointed back part of the body, where the sting is, is open and something white, similar to a thin thread, hangs down, as if something had been wounded or torn, then it has already been properly fertilized.

2. Anyone who does not notice this may conclude that the queen has been inseminated, from the fact that the bees fly freely and inward, and that they carry a polen load (§ 20.) for feeding the brood.

3. If the bees are stiff and become more irritable when we approach the hive, or want to open it, and are ready to sting earlier than usual, this is from concern for the safety of the queen and the brood.

4. If the bees sit close together to warm the brood.

5. If they work and glue the cracks and crevices of the hive to keep it warm.

6. If there are eggs and brood in the hive. This can be seen by looking at the side of the comb obliquely towards the bottom of the cells.

7. If they chase the drones out of the parent colony, it is also a sign of a inseminated queen, because from now on they are unnecessary. They would enjoy the honey for free, but do not collect it (§ 5.), so the bees begin to chase them, chase them into the corners of the hives, pinch them and finally kill them.

§ 54. The benefit of this knowledge; page 41

A lot depends on knowing whether the bee queen is fertilizated or not, because if you give a bee queen in case of need, the bees will only willingly accept the one they had before. If they had a inseminated queen before, they demand a inseminated one again, and so on in the opposite case. This also applies to the bees themselves. Those who have had the same bee queen like to unite, but those from hives with different queens attack and slaughter each other.

§ 55. Age of the Bee Queen for the breed; pages 41-42

Experience has taught me that a six-week-old bee queen no longer inseminated, many of them even do not fly out to the open field if they have been kept there for only three weeks by bad weather, and then they remain useless. Such a queen, unable to be inseminated due to age, causes just as much destruction to the hives as queenlessness (§ 7.).

Summary

Mating always takes place only in the air (§ 8). In general, mating is based on a trip, which depends on the weather and the pasture. On such a day, between 9 o'clock in the morning and 3 or 4 o'clock in the afternoon, the bee queen arrives, accompanied by a large company of bees and drones; she circles a few times to remember the hive and can find it on her return, and then finally rises into the air. She flies around the hive for a while, observing it, slowly rising higher and higher. Do not let her out of your sight, and you will see the drones rushing towards her at a certain speed; this is fertilization. In a few minutes she returns home. Before the queen enters the hive, she flies around it for a little while.

Now pay attention to the following sign: If the serrated back of the bee queen, where the sting usually is, is open and something white, like a thin thread, hangs from it, as if something had been wounded or torn off, then she has already been properly inseminated. Experience has taught me that six-week-old queens no longer perform the mating period, many do not fly to the fertilization at all if bad weather has kept them there for only three weeks and they are then useless.

ANTON HUMEL[13], (LJUBLJANA)

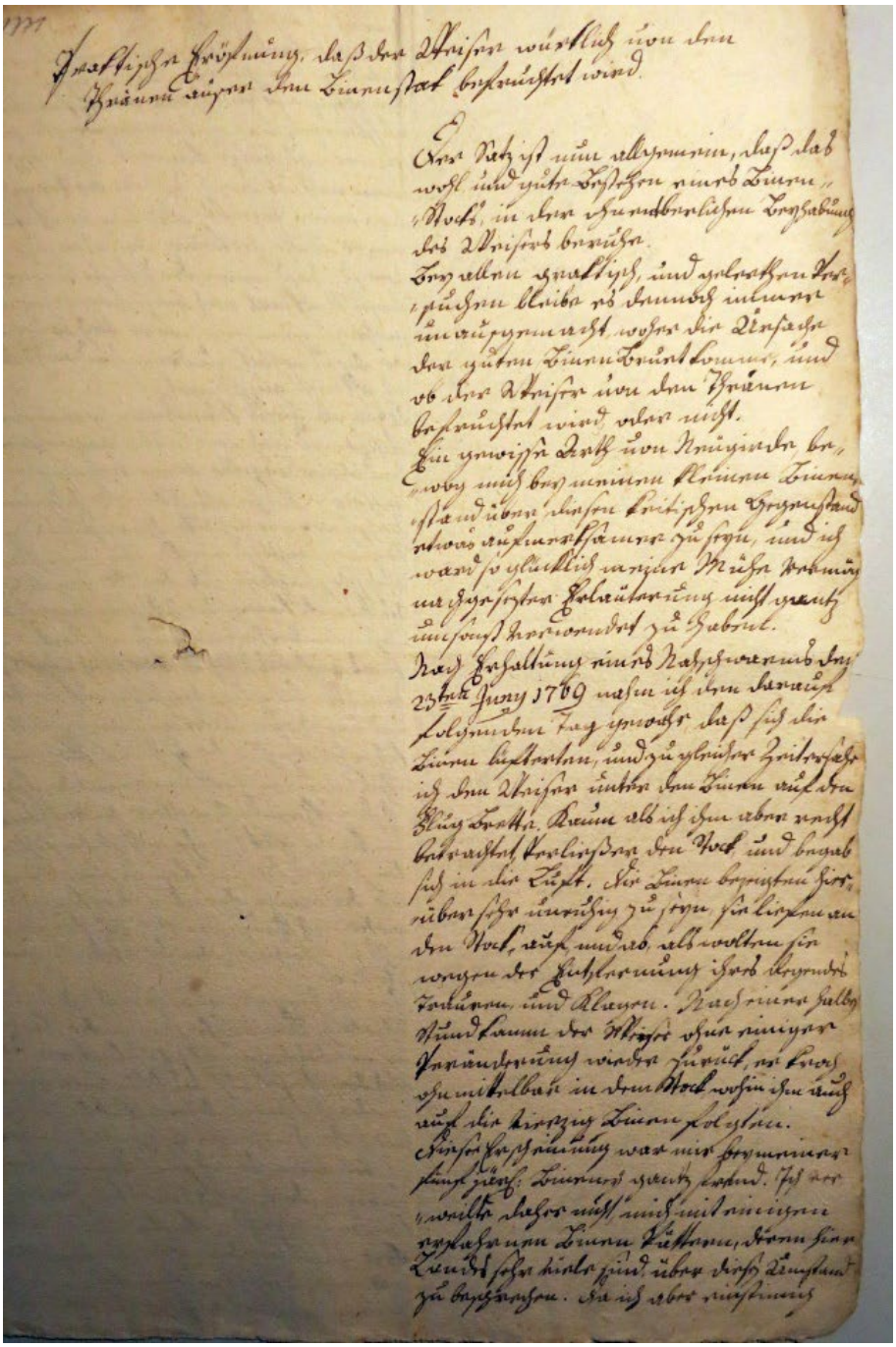
Introduction

Biographical information about Anton Humel is unknown. He worked as a city surgeon in Ljubljana and was an amateur beekeeper. In 1769, he observed the bee queen mating and Matej Furlan explained it to him. In 1771, he informed the Carniolan Agricultural Society of his observations in a letter. She latter asked Matej Furlan and Peter Pavel Glavar to evaluate Humel's observations, which they rated positively. The Carniolan Agricultural Society sent both evaluations and Humel's letter to the Beekeeping Society in Upper Lusatia, which also published Humel's observations in 1773. This is one of the first publications in the world about the queen mating with drones in the air.

[13] Unknown biographical data

Humel: Record of observation of mating of a bee queen with drones in the air in 1769 – letter to the Carniolan Agricultural Society dated September 9, 1771

The Archives of the Republic of Slovenia contain a letter by Humel dated September 9, 1771 (folder 1, no. 2b-1 in AS SI 869 Peter Pavel Glavar) entitled: Praktische Eröffnung dass der Weiser wirklich von den Thränen ausser den Bienenstock befruchtet wird (Practical discovery that drones outside the hive actually fertilize the queen).



Humel's letter (title page) to the Carniolan Agricultural Society
dated September 9, 1771
(folder 1, no. 2 in AS SI 869 Glavar Peter Pavel)

Summary

Humel, a city surgeon from Ljubljana, explains in the introduction that it has not yet been definitively clarified whether the bee queen is visited by drones at all. For this reason, he paid particular attention to this in his apiary. In June 1769, he noticed in the second swarm that the bees were pollinating, that the bee queen was on her alighting board and then flew into the air. She returned within half an hour and immediately climbed into the hive, where she was accompanied by about 40 bees. He saw this for the first time after five years of beekeeping, and he asked experienced beekeepers, of which there are many here. They told him that they had known this for a long time, and that it was always a good sign for them if the queen flew out so early and returned home with a white abdomen. Humel noticed this in a new second swarm and several times in subsequent swarms in the following years. This was explained to him in more detail by the priest Matej Furlan, who was an experienced and well-known beekeeper. He said that his findings were nothing new, as he had observed them many times in his twenty-two years of beekeeping. He also related that he had twice seen a clump of drones fall to the ground in front of the apiary, and when he examined it, he always found the bee queen in the middle, united with the drone. Humel concludes that it is now clear that queen fertilization is carried out by drones in the air, and he encourages other beekeepers to be careful to see for themselves. Especially for those who doubt it.

Publications of Humel's observation of bee queen fertlization in 1769

First abridged publication in 1772

The Upper Lusatian Beekeeping Society first reported on Humel's observation of bee queen in 1772.
Geschichte … Bienengesellschaft…, 1772, no. 7, pages 5 – 6.

http://digitale.bibliothek.uni-halle.de/vd18p/periodical/structure/12822322

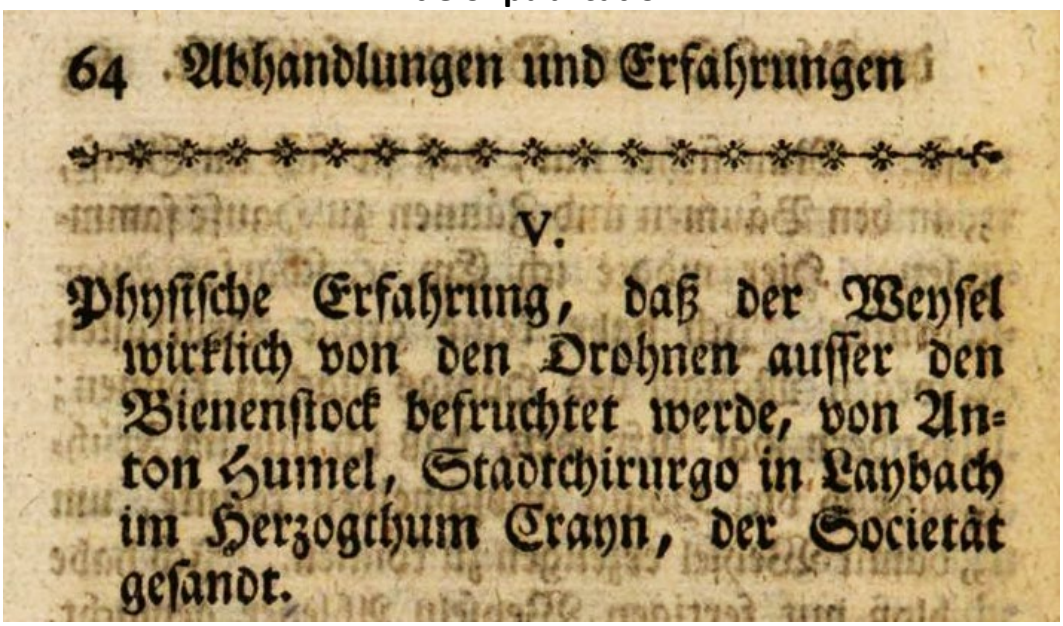
Summary

Although there is no longer any doubt that the fertility of young bee queens is related to the mating from drones. Nevertheless, due to their internal structure, the bee queens, which are fertilized at a certain time, are naturally fertile throughout the year, even for up to three generations. How and when this happens remains a mystery. Swamnerdam and Réaumur never claimed that this fertilization occurs in the hive, but assumed it on the basis of certain contacts of drones with the bee queen. But now three experienced Austrian bee experts (from Slovenia) claim that fertilization occurs by mating with the sperm of drones outside the hive, a few days after hatching, which was clearly seen by Mr. Anton Humel, the city surgeon in Ljubljana, about which he first informed the society. The Carniolan Agricultural Society followed suit, sending this to our beekeeping society along with the opinions of two gentlemen, namely Mr. Peter Pavel Glavar from Lanšprež and Mr. Matej Furlan from the monastery in Mekinje, who, based on their many years of experience, confirmed Humel's findings. This usually happens from the second to the twelfth day after the formation of the swarm during the mating period, when the bee queen flies away and is left to be fertilized,

and returns with a white thread hanging from her back. We ask all bee lovers to pay attention to this and take the time and patience to observe.

Complete publication (1773) of Humel's observations in 1769.

Title of publication


64 Abhandlungen und Erfahrungen

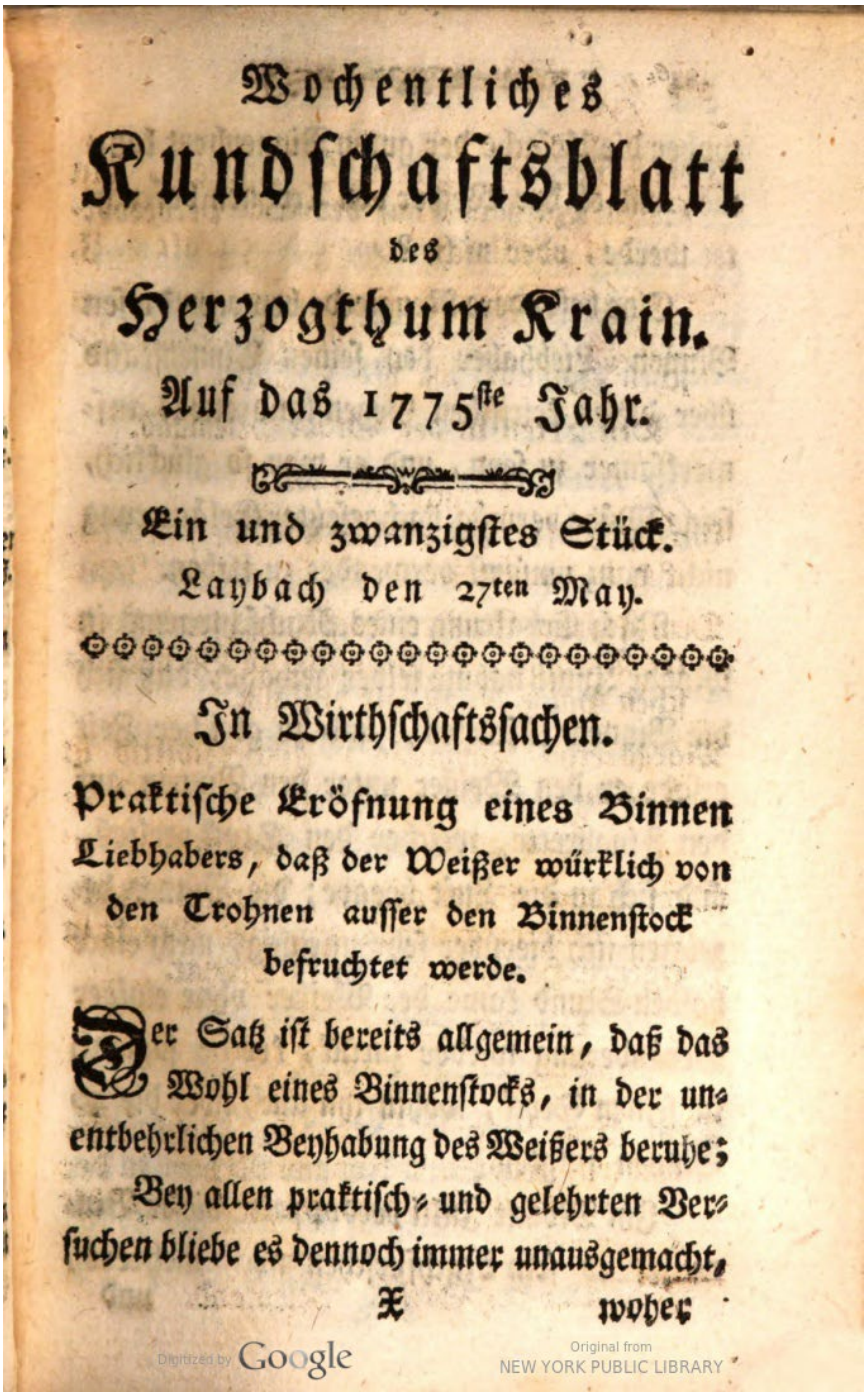
V.

Physische Erfahrung, daß der Weysel wirklich von den Drohnen ausser den Bienenstock befruchtet werde, von Anton Humel, Stadtchirurgo in Laybach im Herzogthum Crayn, der Societät gesandt.

Article title
Gemeinnützige Arbeiten …, 1773, pages 64
http://reader.digitale-sammlungen.de/resolve/display/bsb10293787.html

Translation of title:
A physical experience that drones actually mated the queen outside the hive, by Anton Humel, state surgeon in Ljubljana, Carniola, who sent it to the society.

This was also published with the same title in the Wochentliches Kundschaftsblatt der Herzogthum Krain (1775). The composition was translated into Slovenian by Stane Mihelič and published in Slovenski čebelar (1948).



Wochentliches
Kundschaftsblatt
des
Herzogthum Krain.
Auf das 1775ste Jahr.

Ein und zwanzigstes Stück.
Laybach den 27ten May.

In Wirthschaftssachen.

Praktische Eröfnung eines Binnen Liebhabers, daß der Weißer würklich von den Trohnen ausser den Binnenstock befruchtet werde.

Der Satz ist bereits allgemein, daß das Wohl eines Binnenstocks, in der unentbehrlichen Beyhabung des Weißers beruhe; Bey allen praktisch- und gelehrten Versuchen bliebe es dennoch immer unausgemacht,

X woher

Wochentliches Kundschaftsblatt der Herzogthum Krain (1775).
About Queen Mating With Drones in the air. 1775, p. 321
https://babel.hathitrust.org/cgi/pt?id=nyp.33433013584010&view=1up&seq=328

A message from practice, that the queen is mated by drones outside the hive (translated by Stane Mihelič - 1948)

"It is now generally known that the bee queen is absolutely necessary for the prosperity and success of the hive; however, in all practical and scholarly experiments, it always remains

unresolved where the correct bee brood comes from, and whether the bee queen is mated by drones or not.

A kind of curiosity prompted me to pay more attention to this controversial subject in my small apiary, and I became so happy that my efforts, as the following explanation shows, were not in vain.

When I received another one on June 25, 1769, the next day I noticed that the bees were fanning, and at the same time I saw the bee queen on her alighting board. But I had hardly looked at her properly when she left the hive and flew into the air. The bees were very restless, running back and forth along the hive, as if they wanted to mourn and lament the departure of their bee queen. Half an hour later, the bee queen came back again, without any change being noticeable in her; she immediately return into the hive, where about 40 bees followed her. This phenomenon was completely foreign to me, despite my five years of beekeeping. Therefore, I did not hesitate to talk about this circumstance with some experienced beekeepers, of whom there are many in this country. And I received a unanimous answer that they had known this for a long time, that they always saw it as a good sign if the bee queen flew out to the field so early and came home with a white abdomen. However, it is not known whether this sign of union comes from some insect or from the influence of some flower, but it is certain that if the bee queen brings this sign home, she does not appear again, although before she got it she had flown out up to three times or often more.

When I heard all of this, my curiosity was even more aroused, and I doubled my research with even greater effort when I got a new swarm on July 5th. On the first and second days, nothing was noticeable; the bees flew out very timidly. On the 3rd day, which was the 7th of the month, the bee queen came around 2 o'clock after a preceding strong buzzing on the alighting board, crawling over it for more than 15 minutes, from there to the hive and back onto the alighting board, finally rising into the air and flying for a while in a circle around, with her head turned toward it, as if she wanted to watch the hive so as not to miss it upon return. Then she flew away and came back an hour later, as she had been before, that is, without any sign, once again returning home. On the 8th and 9th nothing was observed, as the weather was very cloudy.

On the 10th, on the contrary, it became very clear, sunny and sultry. At 1 o'clock the bees began to pollinate as last time: the bee queen also came to the comb, performed the previous ceremonies again and flew away. Here I had several occasions to observe her closely and found her still unchanged; in 25 minutes she came back again, but completely different from when she flew away, for her genitals were white, very raised and spread out, and she also walked completely inertly with her wings folded along the honeycomb of the hive, where she was followed by a great many bees, all of whom were flapping their wings. As if they wanted to show their joy at the arrival of their queen.

And so, after this time and in the past years, I have mostly noticed the same thing many times, except that sometimes the side circumstances differed.

Amid all this, it still remained unknown to me where the bee queen obtains that sign of mating, until the honorable priest at the monastery of high nobility in Mekinje, Matej Furlani, who

became very famous through his long practice in true beekeeping, unraveled the knot through recounting his observations in this matter. My aforementioned observation, he said, was nothing new to him, because he knew that during his 22 years of beekeeping, he had seen it more than 40 times, and that one could always observe that bees from the second and third swarm do not return home with pollen until the bee queen has mated; as for where the sign of mating comes from, it is explained by this. He had observed, over five years during hot summers, twice that a large lump of drones brood had fallen to the ground in front of the apiary. He picked up this lump and, upon examining it, found on both occasions a bee queen in the center, which was always closely associated with the drone brood in a butterfly-like manner.

From this revelation it will now perhaps not be difficult for some learned researchers of bees to conclude many things, to which my limited science cannot yet penetrate. Only this I may be permitted to suppose, after having again seen for myself how the bee queen goes to waste in every second swarm and that after the revelation of the above-named friend the drones do indeed bypass her outside the hive. This is also largely the reason why hives are often left without a bee queen. Who does not know to what various accidents this deliccate female is exposed in the air and weather? And how she can miss her own hive on her return and be killed on the other side.

It can also happen that if a colony swarms during the buckwheat flowering season, that is, at the end of August or the beginning of September, the mother hive usually does not progress because there are few or no drones left at that time.

That should be enough for me for now, then when I have found out above from my own and other experiences that the drones mated the bee queen, and only outside the hive.

Now finally I would like to ask every researching friend of bees not to stop trying if the experiment does not immediately succeed as desired the first time, and to those who still completely or partially refuse to ask the bee queen for drones. I recommend this experiment very especially. And since they will convince themselves that it is different, I hope for their justice that they will not doubt in the future; how much people were wrong in the experiments in which the bee queen was always forbidden to fly to the mating.

Discussion and conclusions

It is already explained in the introduction and later supplemented several times in the following chapters that the old beekeepers in Gorenjska knew about queen mating. In addition to living oral testimony, this is confirmed by Scopoli (1763) in the book Entomologia Carniolica, where he described our honey bee (pp. 303-304) and, as the first in the world, also the queen mating with the words: **... it is surrounded by several drones, it flies out, and in the air it is mated ...**

We have examined many old beekeeping books and publications that were published before 1763 and are digitized and accessible, in order to confirm Scopoli's primacy. When reviewing the book **Bienen-Buch (1747)**, written by Johann Rudolph Schubart, we found a description of how a young bee queen, about two days (depending on the weather) after hatching, arrives on the alighting board of the hive together with the bees (the drones are not specifically mentioned) and flies off into the air together with them. She quickly (after two minutes) returns together with the bees and goes to the hive, where she immediately lays the brood. The author carefully observed and also recorded the events, but did not understand their purpose, because he further writes that in bees: **… It is supposed to be the mating of bee queens with drones in the hive.**

Matej Furlan, who is the probable author of the beekeeping book »Practische binen oeconomie… (Practical bees economy…)« (1768/1771 (?)), writes in the chapter On the fertilization and multiplication of bees: »…here I intend to talk about a bee queen in the second or third swarm, which is not yet mated and therefore cannot lay eggs. When placed she in a hive with a swarm, such a bee queen flies out of the hive on the third day, and the drones also fly after her. But when she rises into the air, the drones also rise after her, attack the bee queen and fertilize her. **Due to the mating instinct, a ball (lump) of drones is formed and it often happens that they all fall to the ground together with the bee queen, with the most skillful drone getting the "prey", which i once saw to my great surprise."** Furlan is the only author, in this work, who saw a ball of drones with the queen fall to the ground. When examining old beekeeping records, we found the following in a reprint (1593) of the book Gruendtlicher und nuetzlicher Unterricht von wartunge der Bienen, written in 1568 by Nickel Jacob: **It often happens that the queen cannot fly, especially if she is young, but falls into the grass together with a few bees.** This is similar to the note by Furlan and indicates that it is possible that the bee ball was known as early as the 16th century.

Interestingly, the above note also states that the drones attack the bee queen and fertilize her. There are several opinions on how many drones fertilize the queen. According to Glavar, this is one drone, while Janša (1771) claims that the queen is fertilized by several drones. Rihar (1988) confirms this opinion and cites Janša's note: **... we see that the drones rush into her at high speed, which is, so to speak, breeding...**

Frideric Eggers de Villepin (2024) published the book A history of the discoveries about the sexuality of the honey bee, where in the fourth chapter "How are babies made? Coda" based on the publication "Šalehar and Šivic (2021). Records (manuscripts and publications) on the mating of the queen with drones in the air in the years 1763-1776 from Slovenia" reports on Scopoli's record on the mating of the queen with drones in the air. He also mentions that all

Slovenian proponents of this discussion write about this **'air fertilization of the queen bee.'** This is the latest confirmation that mating the queen bee with drones in the air is an original Slovenian discovery. Let us also add the fact that the author published the book in the American Bee Journal (2024-2025).

Based on the records found so far, it is undeniable that Slovenian beekeepers were the first to know about the mating of the bee queen with drones in the air. It is interesting that after Scopoli's record in 1763, all subsequent writers (Furlan, Glavar, Janša, Humel) until 1776 unanimously write that the mating of the bee queen takes place outside the hive in the air with drones. It is unlikely that everyone would be familiar with Scopoli's 1763 paper. Peter Pavel Glavar wrote about it in particular detail and at length in his 1776 work Pogovor o čebeljih rojev **(Conversation on bee swarms)**.

Fontana (2020) critically examined the manuscript Trattato sule api (Discourse on bees) by Uldarico Fantelli (1780) and wrote, among other things: **"...THE DISCOVERY OF THE SECRET OF BEE QUEEN FERTILIZATION MUST BE ATTRIBUTED ENTIRELY TO SLOVENIAN BEEKEEPING. THESE WERE THE EXPERIENCES, THE UNWRITTEN KNOWLEDGE, OF THE OLD GORENJSKA BEEKEEPERS AND THE FIRST IN THE WORLD TO PUBLISH THIS IN CARNIOLAN ENTOMOLOGY IN 1763 WAS SCOPOLI."**

THIS NOTE IS ALSO OUR CONCLUSION TO THIS DISCUSSION.

SOURCES

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