Royal jelly production revisited

Mitsuo Matsuka
Japan Royal Jelly Fair Trade Council
Apimondia, Apitherapy Commission

Jun Nakamura
Honeybee Science Research Center,
Tamagawa University

43Apimondia@Kiev,1310
Royal Jelly Production

Royal jelly (RJ) is produced by beekeeping, which is a branch of livestock industry or animal husbandry.

It should be produced by well managed, healthy bee colonies.

1. Production by a bee

2. Production by a beekeeper
Characteristics of Royal Jelly
By International Honey Commission

- Moisture: 60 – 70 %
- Crude protein: 9 – 18 %
- Fat: 1 – 10 %
- Sugar: 7 – 18 %
- Mineral: 0.8 – 3.0 %
- Others: Vitamins, Biopterin, Nucleotides, etc.
1. Production by a bee

- “The Hive and the Honey Bee” states as “Royal jelly is the hypopharyngeal glandular secretion of young workers”.

- But this description is insufficient.

- Royal Jelly is a mixture of honey and secretions from Hypopharyngeal glands and Mandibular glands of honey bee workers.
Glands of a worker bee

- Hypopharyngeal gland
- Mandibular gland
- Honey sac
- Wax glands
- Nasanov gland
- Venom gland
General composition of RJ

Protein ← Hypopharyngeal gland

Fats ← Mandibular gland

Sugar ← Honey

Minerals, Vitamins, etc.
"The Biology of the Honey Bee" (Winston) quotes Jung-Hoffman (1967) as “queen larvae receive white and clear food from young workers.”

- The white food is the secretion from Mandibular glands and the clear one is the Hypopharyngeal glands secretion, mainly composed of protein. Honey (may be immature) is added as “energy source and phagostimulative material.”
2. Production by a beekeeper

- Only one queen exists in a colony, and during a reproductive season, a few queen bees would be produced.

- A beekeeper would produce royal jelly using plastic queen cups in a row. When one transfers a young worker bee larva into a cup, young nurse bees feed the larva a plenty (ca. 350 mg) of royal jelly, causing the worker larva into a queen.
Production of royal jelly

with artificial (plastic) queen cups
Queen differentiation and Royal jelly

- Egg → Larva
  - JH → Brain → Queen
    - big body, developed ovary, 2000 eggs per day, long life
  - Brain → Worker
    - small body size, shrunk ovary, specialized mouth, legs, sting parts, lived short
Production by a beekeeper

- A beekeeper would collect royal jelly 2 to 3 days after grafting, producing ca. 20 g of royal jelly at a time in a colony.

- Good production would be affected by:
  - Genotypes of bees
  - Colony condition
  - Season
  - Queen-less/right
  - Availability of food
  - Pollen/pollen substitutes
  - Honey/sugar syrup
  - Etc.
<table>
<thead>
<tr>
<th>Quality standard by JRJFTC (Fresh Royal Jelly)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water contents</strong></td>
</tr>
<tr>
<td><strong>Crude protein</strong></td>
</tr>
<tr>
<td><strong>10-OH-decanoic acid</strong></td>
</tr>
<tr>
<td><strong>Acidity</strong></td>
</tr>
<tr>
<td><strong>Bacterial number</strong></td>
</tr>
<tr>
<td><strong>Eschericia</strong></td>
</tr>
</tbody>
</table>
ISO Standardization

• In 2007, China proposed to fix the World Standardization through ISO, and it was adopted to make a Working Group as TC34/WG13.

• It is composed of members from 7 countries (Argentine, Barbados, China, France, India, Italy, and Japan), and Thailand and U.S.A. gave opinions on the draft.

• This working group restarted in 2013 and we will propose a draft soon.
ISO Standardization

Royal jelly are divided into two types:

**Type I Royal jelly:**
Produced by the bees kept with only bee’s natural foods (pollen and nectar)

**Type II Royal jelly:**
Produced by the bees kept with bee’s natural food and other nutrients (proteins, carbohydrates, etc.)
<table>
<thead>
<tr>
<th>Component</th>
<th>Japan</th>
<th>ISO Standardization (tentative draft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>62.5% - 68.5%</td>
<td>62.0% - 68.5%</td>
</tr>
<tr>
<td>Crude protein</td>
<td>12.0% - 15.0%</td>
<td>11.0% - 18.0%</td>
</tr>
<tr>
<td>10-HDA</td>
<td>more than 1.40%</td>
<td>min 1.4%</td>
</tr>
<tr>
<td>Acidity</td>
<td>32.0 mL - 53.0 mL</td>
<td>30.0 mL - 53.0 mL, receive(mol/L alkali per 100 g)</td>
</tr>
<tr>
<td>Total sugar</td>
<td>--</td>
<td>7.0% - 18.0%</td>
</tr>
<tr>
<td>Total lipid</td>
<td>--</td>
<td>2.0% - 8.0%</td>
</tr>
</tbody>
</table>

* see the other table (for sugar)
## ISO Standardization (tentative draft)

<table>
<thead>
<tr>
<th></th>
<th>Type I</th>
<th>Type II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total sugar</strong></td>
<td>7.0 - 18.0g% colony, 7.0 - 18.0%</td>
<td>7.0 - 18.0%</td>
</tr>
<tr>
<td><strong>Fructose</strong></td>
<td>2.0 - 9.0%</td>
<td>2.0 - 9.0%</td>
</tr>
<tr>
<td><strong>Glucose</strong></td>
<td>2.0 - 9.0%</td>
<td>2.0 - 9.0%</td>
</tr>
<tr>
<td><strong>Maltose</strong></td>
<td>1.5%</td>
<td>Na *</td>
</tr>
<tr>
<td><strong>Maltotriose</strong></td>
<td>0.5%</td>
<td>Na *</td>
</tr>
</tbody>
</table>

* Na : not applicable
ISO Standardization

C13/C12 Isotopic ratio (δ‰)

Type I Royal jelly: –29 to –20

Type II Royal jelly: –29 to –14
Thank you for your attention

Contact to:

mmat.tamagawa@gmail.com
Japan Royal Jelly Fair Trade Council

Activities

• Quality standardization and monitoring
• Technical promotions with Chinese organizations
• Issue of Seal (Fair Trade Mark, not obligate)
• Public communication (Leaflets, Press releases, Lectures, etc.)
• Treatments to Claims
• Research Promotion (Funds for Research Institutes)