Effect of bees’ welfare on the development and productive qualities of honeybee colonies of various breeds in the Republic of Ingushetia

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Abstract. In 2019, a further study is under way to evaluate morphological and economically viable traits of planned bee subspecies native to the Republic of Ingushetia. The following subspecies were studied, namely: Mountain Grey Caucasian, Carniolan Troiseck-F-1, Buckfast F-1. Mountain Grey Caucasian bees possess high genetic and adaptive potential to local environmental conditions, have quite high melliferous capacity, and in this regard are good genetic material for breeding and crossbreeding with highly productive domestic and foreign breeds.

1. Introduction
Beekeeping plays an important role in the economy of the Republic of Ingushetia. In its quest for development, beekeeping went through all stages from wild-hive beekeeping to the spread of modern beekeeping. Beekeeping traditionally develops in three areas: honey, pollinating and breeding, i.e. the main purpose of bee breeding for most beekeepers is the production of honey, as well as the pollination activity of bees or the production of queen bees. In addition, it provides very important products used in alternative medicine, such as royal jelly, bee bread, propolis, pollen, heparin, etc. [1, 2, 4, 7]. Besides this, the role of bees in pollination of entomophilous crops is great, as an effective means of increasing yields and improving the quality of seeds and fruits of a number of valuable cereals, legumes, industrial and forage crops, thereby advancing their productivity by 30–50%. About 150 species of entomophilous crops cultivated in Russia require cross-pollination by insects. Honey bees are still viewed as the only reliable pollinators of entomophilous cultivars. Their pollination efficiency increases every year along with advances in crop culture and improvements of the production technology for seeds and fruits. Indirect income from beekeeping, which can be obtained through the optimal use of honey bees to increase productivity and improve the quality of seeds and fruits of entomophilous crops, is 10–15 times higher than that from direct beekeeping products [3, 5, 6].

The main distribution range of beekeeping in the Republic of Ingushetia is spread over the foothill and forest-steppe zones, where there are a lot of areas occupied by wild honey plants and forests. A honey base is made up of alpine and steppe forbs, lindens, acacias, fruit and berry crops, buckwheat, sunflower, burdock, etc.

2. Objects of the study
Objects of study involve the main bee subspecies bred in the Republic of Ingushetia, specifically Mountain Grey Caucasian F-1, Buckfast F-1, Carniolan (Troisek) F-1.
3. **Purpose of the study**
The study aims to develop the technology for maintaining and breeding bees based on the assessment of their morphological and economically viable traits in the conditions of the Republic of Ingushetia.

4. **Objectives of the study**
- to examine the state of the beekeeping industry in Ingushetia;
- to assess the morphological and economically viable traits of the main breeds of bees native to Ingushetia;
- to assess the food supply for beekeeping in the Republic of Ingushetia;
- to study the effect of various types of hives on the development and production qualities of bees.

5. **Material and methods**
The study aimed at the productivity of planned bee subspecies was based on the Apis mellifera identification method.

The paper relied on a comprehensive approach for assessing breed-bound Apis mellifera characters. The approach combines two methods for breed identification:

1. A standard morphometric method for evaluating worker bees with Microsoft Office Excel, 2007;
2. A modified European morphometric method for drone estimation with computer data analysis (Microsoft Office Excel, 2007).

Statistical processing. Statistica 6.1., Copyright E9 StatSoft, Inc. 1984–2004 and Microsoft Office Excel 2007 were used to analyze the metric data on honeybees. The results were compared in line with accepted European standards from literary sources (Krivtsov NI, 1998; Ruttner F., 2006) referred to in the paper.

6. **Scientific novelty of the study**
For the first time in Ingushetia, a set of activities is underway to develop the technology for maintaining and breeding bees based on an assessment of their morphological and economically viable traits.

7. **Practical implications**
The research findings will be used to develop a framework for improving crossbreeding of local bee breeds with new highly productive breeds to obtain offspring with high production and adaptability to local weather conditions.

8. **Research methods**
**Factor 1.** A study of the anatomical and morpho-physiological properties and productive qualities of various bee subspecies:

1.1. Mountain Grey Caucasian;
1.2. Carniolan Troiseck;
1.3. Buckfast.

**Factor 2.** A study of bees welfare in various types of hives to affect the development, behaviors and melliferous capacity of different subspecies:

2.1. Vertical two-storey Dadant hives with 18 frames;
2.2. Horizontal Dadant long-idea hives with 20 frames.

The experiments involved the first generation crossbreeds, F1, and colonies of the same strength and brood. Bee colonies are specially prepared according to the strength of a colony, the number of broods, nutrition similar for evaluating bee colonies in terms of development, nectar flow, and resistance to Nosema disease, foulbrood, varroatoasis. It is also important to consider susceptibility of queen bees of different subspecies to acaricidal preparations, toxicity and tolerance. Melliferous capacity was assessed based on an acacia – linden – forbs triple, following a Stavropol-Chechnya-
Alkun-Galashi route. A general annual assessment and progress of melliferous capacity of bees by breeds were taken into account. Anti-mite (Varroa and Acarapis) Fluvalides strips were suspended inside the hives – 2 strips per a colony.

9. Results and discussion
One of the most significant issues to consider for establishing a new apiary is the choice of a bee species and type of hive design. The choice of a breed determines how adapted the bees will be in these specific conditions, how high the honey production will be, how good these bees will be at processing honey flows from honey plants and resisting pests and diseases. The authors studied three subspecies: Mountain Grey Caucasian, Buckfast and Carniolan (Troisek). A brief description of the subspecies is provided below.

The Mountain Grey Caucasian is moderately aggressive, has the longest proboscis, ranging from 6.7 mm to 7.2 mm, low body weight – 90 mg, more developed wax-producing glands, slightly prone to swarming. Chitin color is dark Grey, comb capping is wet, sensitive to wax foundation quality (paraffin admixture is undesirable). A good use of nectar flow collected at forbs makes up an average of 10 kg. The average production depending on honey plants is: acacia – 18–20 kg/ha, linden 23–25 kg/ha, gross yield for a season is 40–45 kg. The queen lays 1200–1600 eggs per day. Comb-blanketing capacity amounts to 6–8 combs in spring, 20–24 combs – in summer, 10–12 frames – in autumn, the ball of bees in winter blankets 4–6 combs. The Mountain Grey Caucasian bee is quite winter-hardy, good at producing propolis. It starts floral visitations earlier compared to other breeds. In the Republic of Ingushetia it flies in winter thaws. It is fairly affected by varroatosis, acarapidosis, Nosema disease, ascospherosis, and foulbrood.

The Buckfast, a British subspecies bred by crossing a dark British bee with an Italian bee. This is a very highly productive breed. In addition, it is absolutely peaceful and not prone to swarming. It makes good use of nectar flow, particularly, acacia – up to 35 kg/ha, linden – 25–30 kg/ha. A gross yield of a bee colony reaches 55–60 kg for a season. It starts floral visitations late in spring. Comb-blanketing capacity amounts to 20–24 combs in summer, 12–14 combs – in autumn, and 6–8 combs in winter. The breed has poor frost tolerance. It is well resistant to foulbrood and acarapidosis, but affected by ascospherosis.

The Carniolan (Troisek) is the oldest German breeding line. Bees are very peaceful, clean, non-swarming, and capable of good honey foraging. They have good comb coverage ability. A colony develops gradually, with a peak in June and early July. Colonies are large in size and can occupy up to three blocks. A honeybee queen lays more than 2,000 eggs per day. In the conditions of the republic egg-laying continues until mid-December (temperature is about 0 °C for more than three days), when the temperature rises above 5 °C, even during winter thaws, the queen starts laying eggs again. A proboscis is 6.8 mm. Foraging efficiency at acacia is 22–30 kg/ha, and linden 15–18 kg/ha. On average for a season in the Republic of Ingushetia, the breed brings up to 45–50 kg. Comb-blanketing capacity amounts to 6–8 combs in spring, up to 28 combs – in summer, 5–7 – in autumn, winter ball of bees – 4–5 combs. Overwinter well, early spring development. They are affected by varroatosis, ascospherosis, Nosema disease, and are resistant to foulbroods. When crossed with other breeds, quality characteristics deteriorate; crossing is only possible between Troisek lines.

In turn, the productivity of a bee colony, the number of brood, etc. directly depends on the type of hives. Large-sized hives are not always justified. Thus, in a cool climate or season, colonies do not always have enough time to develop and fill useful space of a hive. In addition, provided that intensive care for bee colonies lasts for six months on average throughout the year, honey production will depend on the design of the selected bee hives. Multistory structures are heavier, more difficult to disassemble for inspecting the nests. Therefore, when using Dadant beehives with one or two honey supers, beekeepers often complain about the difficulty in managing them. Even harder it is to cope with conventional vertical hives with 4–5 full-fledged boxes that are very bulky and heavy.

Hence, any hive design has its advantages and disadvantages that a beekeeper must be reckoned with. For example, a 12-frame Dadant hive is difficult to inspect and rear a strong colony due to
inevitable swarms related to the limited volume with little room for a strong nest. In its turn, a 16-frame Dadant design is usually equipped with one removable super, is more convenient to use and the hive itself is more spacious. It is likely to establish an average colony, although this will not prevent it from swarming.

The two-storey 12-frame Dadant hive is convenient for roaming, especially if it is equipped with a shortened Dadant framework and a second box to facilitate beekeeper’s work associated with frequent hive inspections. With proper care, it is possible to reduce a swarming behavior.

Beekeepers use such a trick as employing narrow, but high frames for two types of hives, two-storey or single-storey with a single super, which in turn replaces multistory hives, since they have increased volumes and enable to build strong colonies with a simultaneous reduction in swarming. The use of such frames allows bees to better tolerate wintering and in spring, colonies wake up stronger than in Dadant hives.

The horizontal long-idea hives are equipped with fifteen or more honeycombs, with a selective barrier (excluder), in the fall in accordance with the strength of the colony. The design is optimal for the Republic of Ingushetia and becomes even more effective when supers are added during the foraging activity. Such hives are very bulky, mainly intended for stationary apiaries. It is possible to make combs parallel to beehive entrance, thus enabling to use them for transportations, facilitating beekeeper’s work and ensuring rational use during transportation. Supers can be put onto a hive. With careful management, beekeepers can avoid swarming even in strong colonies. In addition, in such constructions, even with a very modest nectar flow, it is really possible to gain good melliferous capacity.

With all of the above in mind, a conclusion is possible that it is not entirely correct to compare these two types of hive designs. Each has its own pros and cons, but the main factors affecting the choice encompass climatic conditions, the capacity of the land, nomadic or stationary type of apiary and technology for keeping and caring for bees. Still a brief description of horizontal and vertical hives is provided below.

1. Horizontal long-idea hives are convenient. Frames can be easily removed and put back. They are warmer for spring brood. It is possible to form two nests in one hive and support two colonies by placing a queen excluder to create a two-queen family in one hive. However, due to the large size and weight, it is possible to use it only in stationary apiaries as it is difficult to install anti-mite nets or oil-coated paper, which increases the risk of infection with varroatosis and reduces honey production.

2. Vertical two- or multi-storey hives are suitable. In nomadic beekeeping during transportation they are very compact. Keeping bees is as close as possible to natural conditions, where the bees live in hollows of trees, providing good honey yields. The disadvantage of such designs is the complexity of hive inspections, due to the fact that strong bee colonies occupy up to 3–4 boxes, which, together with the stands and the roof, is about 170–180 cm high, and due to the fact that they are quite heavy during honey collection. An assistant is needed to remove and install the boxes.

In the Republic of Ingushetia, the following types of hives are most widely used: horizontal long-idea Dadant hive with a number of honeycombs from 15 to 18 pieces and vertical two-storey Dadant hive with up to 20 honeycombs with and without superframes. These types were examined in the study.

The target bee breeds were overseen in spring, which showed that earlier than others on February 20–22 (the time when hazel buds are upspringing), Mountain Grey Caucasian bees begin to fly around and seal broods before the end of March. The amount of capped brood is on average 1.5–2 frames. Almost at the same time, Carniolan (Troisek) bees, with a slight delay, also fly out. As of the end of March the amount of capped brood is 1–1.5 frames. The spring development of Buckfast bees starts late. Foraging and egg-laying begin in the foothill zone of the Republic of Ingushetia in the third decade of March.

In late April, comb-blanketing capacity and amount of capped brood for all target breeds increase and reach the following, namely: Mountain Grey Caucasian comb-blanketing capacity – 10 frames, capped brood – 6–7 frames; Carniolan (Troisek) – 9 and 5, respectively; Buckfast – 8 and 3–3.5. At this stage, there was no difference in the development of bees housed in different types of hives,
except for the Buckfast breed, where the average amount of capped brood for 10 hives was 0.5 frames more in the two-storey Dadant hives (Table 1).

| Time Index | Bee breed | Comb-blanketing, pcs. frames |
|------------|-----------|------------------------------|
| 30.04      | Mountain Grey Caucasian F1 | 6, 10, 16 |
|            | Dadant long-idea hive, 18 frames | 7, 9, 17 |
|            | Two-storey Dadant hive, 20 frames | 5, 7, 18 |
| 30.05      | Carniolan (Troisek) – F1 | 7, 18 |
|            | Dadant long-idea hive, 18 frames | 8, 11 |
|            | Two-storey Dadant hive, 20 frames | 6, 13 |
| 30.06      | Buckfast F1 | 3, 8 |
|            | Dadant long-idea hive, 18 frames | 3.5, 13 |
|            | Two-storey Dadant hive, 20 frames | 8, 14 |

With a rise in average daily temperature and the mass blooming of honey plants, the development of bees intensifies. Thus, in late May, comb-blanketing capacity and amount of capped brood averaged 10 hives for each breed.

The Mountain Grey Caucasian: Dadant long-idea hives – 18 frames, the amount of capped brood – 7 frames with a swarming status and 8–9 with a non-swarming status, comb-blanketing capacity – 15 frames; two-storey Dadant hives – 20 frames, the amount of capped brood – 10–11 frames, comb-blanketing capacity – 20 frames.

The Carniolan (Troisek): Dadant long-idea hives – 18 frames, the amount of capped brood – 7 frames, comb-blanketing capacity – 18 frames; two-storey Dadant hives – 20 frames, the amount of capped brood – 8 frames, comb-blanketing capacity – 20 frames.

The Buckfast: Dadant long-idea hives – 18 frames, the amount of capped brood – 4 frames, comb-blanketing capacity – 13 frames; two-storey Dadant hives – 20 frames, the amount of capped brood – 5 frames, comb-blanketing capacity – 14 frames.

The conclusion drawn on the spring development of different bee colonies is that in the spring, Mountain Grey Caucasian bees developed better. Carniolan (Troisek) bees were slightly inferior, but in early summer (May-June) the breed surpassed the Grey Caucasian breed in the amount of capped brood that reached 8–9 frames. This is due to the fact that the breed is not swarming-prone. The Buckfast breed developed most poorly in spring among all target bee breeds.

Due to an inherent strong swarming instinct of the Grey Caucasian breed, it is obligatory to split off a nucleus colony in the amount of 4 frames when the bees blanket 15–18 frames, with a view to preventing swarms. This nuc is kept separately and can be subsequently put into the donor colony after brood reduction due to overloading caused by a heavy honey flow or the creation of a further bee colony. It is also necessary for the Grey Mountain Caucasian breed to use queen excluders to isolate the queen on 6 frames in the long-idea hives or between the boxes in the frame hives. High-quality honey-producing queens were noticed to appear from coarse, rough-tuberculous thick-walled brood chambers. Requeening occurred in Grey Caucasian bees in case of a failing or missing queen. Beneficial use of queens is possible up to 4 years.
The main assessed indicator of bee effectiveness is melliferous capacity that in turn depends on the strength of honey plants, weather conditions, the number of foraging trips, etc. The most appropriate honey dates and routes across Ingushetia go with the rapid flowering of honey plants in various regions of the Republic of Ingushetia (RI) and the Chechen Republic (CR). They are presented in Table 2.

The most effective native honey areas for Ingush beekeepers are:
1. The Nadterechny District of the Chechen Republic, where acacia daily productivity of the Mountain Grey Caucasian control hive is in the range of 4–4.5 kg, the Carniolan (Troisek) – 5–5.3 kg, the Buckfast – 3–3.2 kg.
2. The Republic of Ingushetia, Sunzhensky District, Muzhichi – Alkun – Dzheyrakhsky District, Khyakhk, where daily linden productivity of the Mountain Grey Caucasus is 5.7–6 kg, the Carniolan (Troisek) – 7.2–7.7 kg, the Buckfast – 4–4.3 kg (Table 3).

The bee efficiency evidence suggests that, once reared in the Dadant long-idea hives, the Carniolan (Troisek) bee was the most effective. The average annual honey productivity of the breed was 56 kg by the yield of commercial honey: acacia – 22 kg, linden – 30 kg; forbs are used mainly for autumn development – 4kg. The Mountain Grey Caucasian bee was slightly less efficient with 54kg: acacia – 20kg, linden – 24kg, and forbs – 10.3 kg. The Buckfast bee’s honey productivity was the lowest and amounted to 28.5 kg: acacia – 10 kg, linden – 15 kg, and forbs – 3.5 kg.

Table 2. Optimal honey routes and calendar flowering periods of honey plants in the Republic of Ingushetia and neighboring republics (2017–2019)

| No. | Honey route | Calendar periods | Honey plant | Products |
|-----|-------------|------------------|-------------|----------|
| 1   | RI, Galashki, Alkhasy, Muzhichi, Nesterovskoe | February 20–March 10 | Hazel, alder, willow | Pollen |
| 2   | CR, Nadterechny, Stavropol Territory, Kursk Region | 10.05–15.05, 25.05–10.06 | Acacia, euphorbia, elaeagnus | Honey |
| 3   | RI, Sunzhensky District, Nesterovskoe, Yandare | May 20–30 | Horse chestnut | Honey |
| 4   | RI, Sunzhensky District, Arshty; CR, Achkhoy-Martan District, Bamut | June 25–27 | Acacia | Honey |
| 5   | RI, Sunzhensky District, Arshty; CR, Achkhoy-Martan District, Bamut | June 20–27 | Linden | Honey |
| 6   | RI, Sunzhensky District, Muzhichi, Alkoon | 25.06–15.07 | Linden | Honey |
| 7   | RI, Dzheyrakhsky District, Khyakhki | July 18–30 | Linden | Honey |
| 8   | RI, Sunzhensky and Nazranovsky Districts (foothill zone) | 20.06–20.08, 20.08–10.09 | Forbs, burdock | Honey |

Similar results were obtained for bees reared in the two-storey Dadant hives, where productivity indicators are higher for all target breeds, with the difference being in the range of 7–9 %. Thus, the yield of commercial honey produced by the Carniolan (Troisek) was 59.7 kg, the Mountain Grey Caucasian – 59.3 kg, the Buckfast – 30.7 kg.

Besides evaluating honey productivity, the authors examined the possibility to obtain beekeeping by-products including bee bread, royal jelly, propolis, and pollen. It was found that a low swarming threshold in the Carniolan (Troisek) and Buckfast breeds leaves virtually no chance for beekeepers to obtain royal jelly. The Mountain Grey Caucasian breed can provide up to 80–90g of royal jelly without detriment to the colony. The Carniolan (Troisek) bee is the most efficient in terms of pollen foraging, as well as bee bread and propolis collection. The Mountain Grey Caucasian bee is only slightly less efficient, while the Buckfast bee is the least effective. Subject to a hive design, the productivity of bees does not vary significantly across all the breeds studied. Once reared in the Dadant hives, the indicators are not significantly higher. Regarding the foraging locations, the most effective for pollen flow is the foothill zone of the republic or rape and mustard crops. The mountain
zone with conifers is most suitable for propolis production. Royal jelly is obtained from the Mountain Grey Caucasian in brood cells in stationary conditions.

Table 3. Average efficiency of the target bee breeds subject to a hive design and a honey plant (2017–2019)

| Honey plant | Products | Bee breed          | Dadant long-idea hive, 18 frames | Two-storey Dadant hive, 20 frames | Dadant long-idea hive, 18 frames | Two-storey Dadant hive, 20 frames |
|-------------|----------|--------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Acacia      | Honey, kg| Mountain Grey Caucasian F1 | 20                               | 21                               | 22                               | 23                               |
|             | Pollen, kg| Carniolan (Troisek) – F1 Buckfast | 1.3                              | 1.4                              | 1.5                              | 1.5                              |
|             | Propolis, g|                      | 40                               | 40                               | 53                               | 55                               |
|             | Bee bread, kg|                    | 1.6                              | 1.8                              | 2.0                              | 2.2                              |
|             | Royal jelly, g|                   | 30                               | 35                               | –                                | –                                |
| Linden      | Honey, kg| Mountain Grey Caucasian F1 | 24                               | 25.5                              | 30                               | 32.4                             |
|             | Pollen, kg| Carniolan (Troisek) – F1 Buckfast | 1.4                              | 1.4                              | 1.5                              | 1.6                              |
|             | Propolis, g|                      | 45                               | 45                               | 55                               | 60                               |
|             | Bee bread, kg|                    | 2.2                              | 2.3                              | 2.3                              | 2.3                              |
|             | Royal jelly, g|                   | 30                               | 30                               | –                                | –                                |
| Forbs       | Honey, kg| Mountain Grey Caucasian F1 | 10.3                             | 12.8                              | 4                                | 4.3                              |
|             | Pollen, kg| Carniolan (Troisek) – F1 Buckfast | 0.8                              | 0.9                              | 1.1                              | 1.2                              |
|             | Propolis, g|                      | 20                               | 25                               | 28                               | 28                               |
|             | Bee bread, kg|                    | 2.0                              | 2.2                              | 1.5                              | 1.8                              |
|             | Royal jelly, g|                   | 20                               | 25                               | –                                | –                                |

10. Recommendations

1. The Mountain Grey Caucasian breed was found to harvest pollen and nectar more effectively on acacia, linden and forbs. It is prone to swarming, it leaves the state of swarming with a nectar flow of 500 g per day or improved ventilation, expansion of nests, use of new wax foundtions for honeycombs.

2. The Carniolan (Troisek) is suitable for keeping in the Republic of Ingushetia, but hives need to be thoroughly insulated in winter. It is sensitive to the quality of winter food. It is unacceptable to use honeydew for winter feeding. Hence, it is better to feed sugar syrup at a concentration of 1.5 kg of sugar per 1 liter of water. In view of the colony fewness, winter feeding should be less than that of the Mountain Grey Caucasian breed. When breeding the Carniolan (Troisek), the F2 queens are unproductive and should be replaced with F1 queens.

3. Due to its late development, the Buckfast uses well the main flow solely – linden. Only purebreeding is advisable, since crossbreeding attempts have not given good results so far. It is resistant to acarapidosis (tracheal mite) and Nosema disease. It tolerates anti-Varroa treatment. The use of amitraz is undesirable in the evening, better in the morning.

4. Treatments for diseases and mites following a honey flow: in late August – 2 Fluvalides strips per hive (essential oils), 12 % Bipin T spraying (amitraz) 1 ml/2 liters of water, 100 grams per hive; in September – Aqua Flo (Fluvalinate) 1 ml/1 liter of water, 100 grams per 1 hive – spraying or sublimation (steam).

5. Based on the studies, it is advisable to crossbreed the Mountain Grey Caucasian adapted to local conditions with highly productive but less adapted breeds. In order to create the most productive breed, morphological and economically viable traits of bee subspecies should be taken into account. Due to the fact that the republic lacks bee no-fly zones, artificial or instrumental crossbreeding is advisable. In order to eradicate the import of unproductive bees that do not meet production requirements, both in terms of honey production and disease content transmitted through the queens brought from foulbrood- and parasitic-unfavorable regions, it is necessary to create a breeding and
It should create lines to possess all necessary genetic and economically viable traits, adaptation to local environmental conditions and high melliferous capacity in line with the prevailing honey plants to ensure a chief honey flow. Excluding the import of queens and related diseases, there will be no particular need to use a number of oxytetracycline drugs, which in turn will improve the antibiotic quality of commercial honey.

6. Some desirable crossbreeding options might involve: 1. Carniolan (Troisek) queen X Mountain Grey Caucasian drone; 2. Carniolan (Troisek) drone X Mountain Grey Caucasian queen. Bees selected for crossbreeding must have good honey productivity, low swarming, not aggressive behavior, with good guard of nests.

7. Requeening
7.1. The queen is introduced on the 2nd day to a Mountain Grey Caucasian nucleus colony without brood, being placed under a push-in cage inaccessible to bees. Two days later the bees get used to the pheromone of a new queen. In a week period two brood frames from other hives are added. Thus, the queen of any other breed can be introduced to Mountain Grey Caucasian bees.

7.2. Carniolan (Troisek) queens does not accept Mountain Grey Caucasian nucleus colonies, only in a hopeless situation when there are no larvae and eggs. To do this, place the queen under the push-in cage, transfer a nucleus colony, give 1:1 sugar syrup, and after two days open the bees access to the queen through the passage.

7.3. When introducing the Carpathian queen bee to Mountain Grey Caucasian bees, the acceptability is up to 60 %. It is necessary to make up a nucleus colony from young bees on 6 frames, two of which should be with 3–5-day larvae. Give water to the outer frame and 1 liter of 1:1 sugar syrup, insulate, and introduce the queen with worker bee attendants under the cage for two days. After two days pierce the passage under the cage so that the bees can get access to the queen.

11. Conclusions
1. The Mountain Grey Caucasian breed proves to be the most adapted and quite productive breed in the Republic of Ingushetia. This is a good breeding material for perfective crossbreeding efforts involving highly productive breeds, in particular Carniolan (Troisek).

2. The Carniolan (Troisek) and Buckfast breeds have high honey productivity at good honey plants. At weak honey plants such as forbs, a nectar flow is almost insignificant. They are not swarming; spring development is weak, although in early June Carniolan (Troisek) overtakes the Mountain Grey Caucasus that, due to swarming, reduces its comb-blanketing capacity. Due to peacefulness, they can be used as pollinators in greenhouses. They are good genetic material as local breed improvers.

3. The most suitable type of bee hives for use in nomadic beekeeping, both in terms of the convenience for the beekeeper and for the development and productivity of bees, are the two-storey Dadant hives. For stationary apiaries, the Dadant long-idea hives are more suitable, since they are easy to use, but inferior to two-storey hives in productivity and development of the colonies.

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