General characteristics of papillary pattern of dog's nasal speculum

Svetlana Spotkai[1], *Kuban* Arbaev, *Baktybek* Azhybekov, *Marasulbek* Amirakulov, *Nurbek* Myrzakanov, *Kamil* Tokoev, *Rasida* Karabaeva, *Svetlana* Ishenbaeva, *Lyudmila* Lykhina, *Anvar* Matiev

Kyrgyz National Agrarian University (KNAU) named after K.I. Skryabin, Bishkek, Kyrgyz Republic

Abstract. The establishment of the possibility of using pattern of dog's nasal speculum for individual biometric identification has prompted further research in this area. This research was aimed at studying and searching general characteristics of papillary pattern details of dog's nasal speculum in order to use it in practice of forensic veterinary identification of individuals of this species. In the furtherance of this goal, we examined nose prints of 266 dogs of different species, ages and housing conditions. In the course of the research, we took into account, recorded and classified characteristics that are observed in all species of the *canis familiaris* family. Thus, it was found that nose prints contain information on the severity of nose's symmetry line, its form, the presence of symmetry line branches of the nose and fine lines, as well as density of the print by papillary pattern and shape of the print. Experimentally, it has been established that the nose symmetry line can be well and weakly expressed; 8 types of lines of symmetry of the nose were determined: straight, fusiform, wedge-shaped, straight round-ended, round-ended wedge, V-type form, disrupted and complex; the impression may be present or absent branches of the nose symmetry line; the impression may be unspotted, weakly spotted or heavily spotted with fine lines; 2 basic impressions were found and it was revealed that impressions may have different density of papillary pattern.
Keywords: Dog identification, forensic veterinary identification, nasal speculum, papillary pattern, crest skin.

1.   Introduction

The dog is currently an object of private and state ownership and the question of a reliable and inexpensive method is still open. The value of a dog is determined by its use in various sectors of the national economy: for search, rescue and other services, as an assistant in hunting, a mount, for the protection and grazing of herds of domestic animals, for the purpose of purebred breeding, as a companion; there are medical dogs that notify owners of an upcoming attack of hypoglycemia or heart problems. There are many ways to identify dogs, but not all of them are cheap and reliable enough.

[1] Corresponding author: svetavet@mail.ru

A large number of sources describe that it is possible to use prints of papillary patterns to identify dogs [1-15].

This statement was confirmed by previous studies that revealed that the crest skin of dogs' nasal speculum has the properties of individuality, relative immutability and recoverability, which make it possible to use the crest skin and its display in forensic veterinary identification [16].

According to N. Mailis [17], when performing identification on the basis of a comparative study, the identity of an object or person is established by a set of general and particular characteristics. This statement prompted our research team to search for signs of the papillary pattern in the available set of identification cards with prints of dog's nasal speculum of different breeds.

2.   Materials and Method

The materials for the research were 266 prints of dogs of different breeds and ages, and housing conditions made on specially designed forms with information about the dog and its owner, as well as the date of selection of the print. Impressions were taken exclusively from clinically healthy animals at dog shows, from specialized departmental kennels for working dogs, from the "Right to Life" NGO and from private owners. The resulting forms were digitized using Canon 3010 multifunction device and studied both in native form, using a magnifying glass x 10, and using the CorelDRAW 2017-2019 graphics editor.

3.   Results and discussions

A detailed analysis of the structure of the papillary pattern of the nasal speculum of dogs' nose prints, carried out by our research group, showed that they can be divided into groups consisting of subtypes of common features.

Common features can be divided into direct signs of papillary patterns and form of nose prints.

The direct signs of papillary patterns include: the presence of nose's symmetry line, the form of nose's symmetry line, the presence or absence of nose's symmetry line branches and the availability of prints by lines [18-19] (Fig. 1).
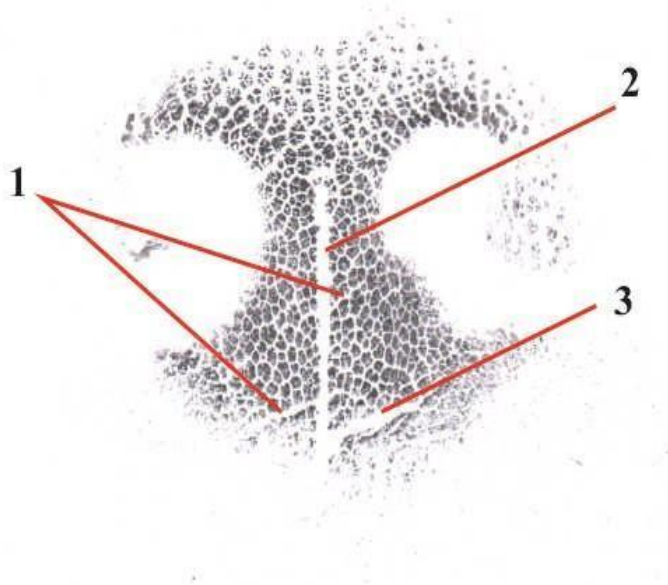
Fig. 1. General characteristics of papillary pattern. 1 – small lines, 2 – nose's symmetry line, 3 – symmetry line branch. Compiled by the authors.

Figure 1 shows how small lines, nose's symmetry line and symmetry line branch looks on the print. The skin of the nasal speculum of dogs is a hairless area covered with ridges that have a unique relationship.

Upon receipt of the impression, during coloring, the dye remains on the protruding parts of the nasal speculum, that is, papillary ridges are mainly colored. When ink transferred to the paper form, the pattern, or papillary pattern, is completed from the separately arranged elements of the papillary pattern created by these ridges and similar to a mosaic. Mosaic elements are arranged randomly, they have different shapes and individual patterns.

On the print, nose's symmetry line is formed by a sagittal furrow, skin cover on which is not colored due to concavity [20] (Fig. 2).
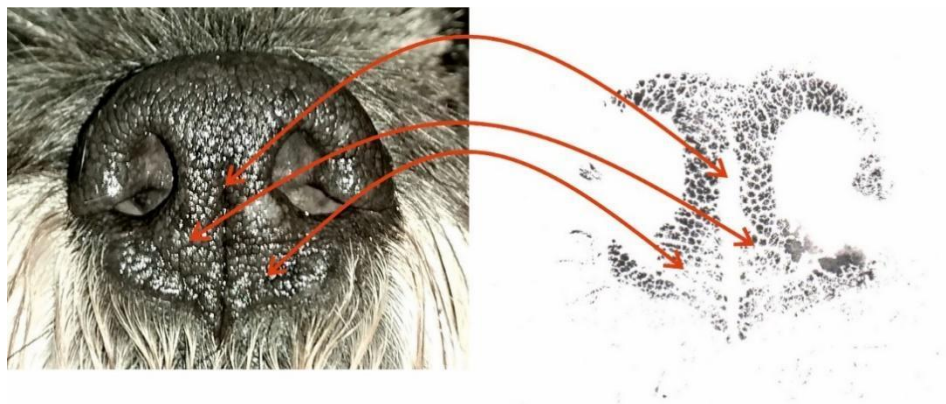
Fig. 2. Mechanism of formation of a colored nose print. Compiled by the authors.

The expression and shape of the line is determined by the depth and shape of the sagittal furrow. According to the results of the research, in most of the studied animals (251 heads), the line of symmetry of the nose is well expressed, and only in a small number of dogs (15 heads), the line of symmetry of the nose is weakly expressed. So, on the studied 266 prints, our research team identified 8 types of nose symmetry lines: straight, fusiform, wedge-shaped, straight round-ended, round-ended wedge, V-type form, disrupted and complex from (Fig. 3). The names were given to them in accordance with their geometric structure.
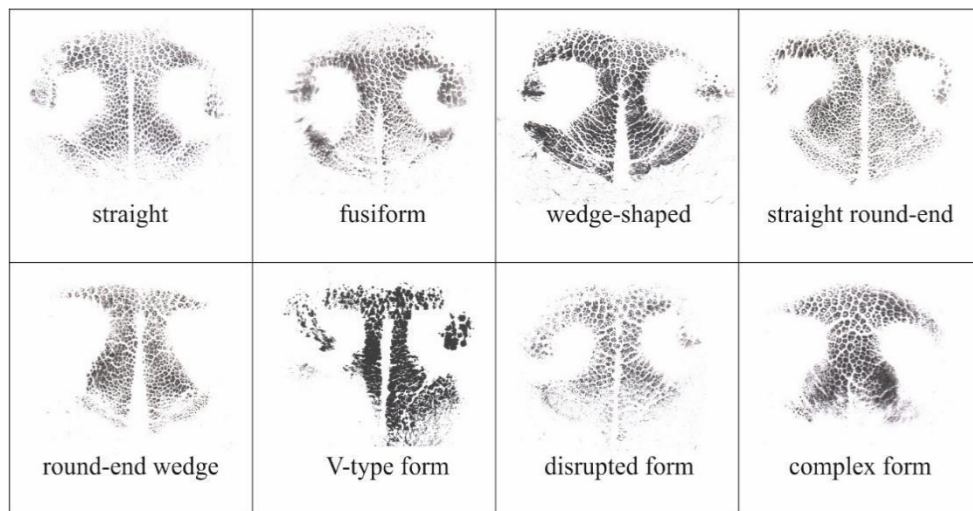
**Fig. 3.** Forms of nose's symmetry line. Compiled by the authors.

The straight line of nose's symmetry has the form of a segment and can be of different widths, which is determined by breed and individual characteristics. The fusiform line of symmetry is an uncolored segment of the print that tapers at the ends and widens towards the center. The wedge-shaped line of symmetry has the form of a triangle with two equal sides with a short base. A straight round-end and round-end wedge are distinguished by the presence of a round or oval end at the top, which occur on the print due to the presence of a depression on the skin. V-type form is extremely rare and has the form of an inverted triangle with two equal sides. Broken line of symmetry is formed due to the presence of interceptions or protruding groups of papillary ridges on the sagittal furrow. The complex type of symmetry line includes those that have complex geometric forms and their exact definition is not possible, and it is impractical to separate them into separate types. The frequency of occurrence of different forms of nose symmetry lines among these were: straight (23.3%), fusiform (7.52%), wedge-shaped (22.56%), straight round-ended (22.18%), round-ended wedge (8.65%), V-type form (0.75%), disrupted (8.27%) and complex (6.77%).

According to the results of our scientific observations, it was found that in the lower part of the nasal speculum, the sagittal furrow can be separated by furrows that differ from the other inter-crest furrows in their depth, or the ridges located in this area have some sloping. On the print, they are displayed as nose's symmetry line branches. From the analysis of the available prints, it was found that some of the prints do not have a line of symmetry of the nose, the rest of them can be from one to three (Fig. 4.). The mechanism of their display on the print is shown in Figure 2.
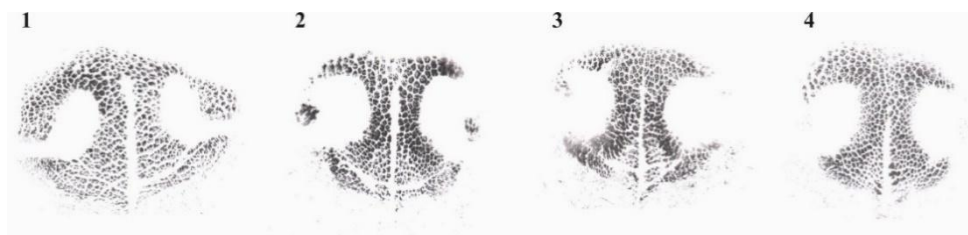
Fig. 4. Nose's symmetry line branches. 1 – one, 2 – two, 3 – three, 4 – no branches. Compiled by the authors.

The skin of the nasal speculum, regardless of age, may be covered with wrinkles and deeper furrows. In some cases, the streaked lines are of a pedigree nature. On prints, they are visualized as lines of different thickness smaller than the symmetry line and its branches. Thus, depending on whether there are uncolored lines on the imprint of the nasal speculum or not, we singled out the feature of the imprint streaked with lines into a separate subgroup. According to the results obtained, we have identified 3 types of impressions: no lines, when other uncolored lines, in addition to the line of symmetry of the nose and branches of the symmetry line, are absent on the impression; slightly lines - on which we can observe up to 3 lines and strongly liny - an impression on which more than 3 lines are visualized (Fig.5.).
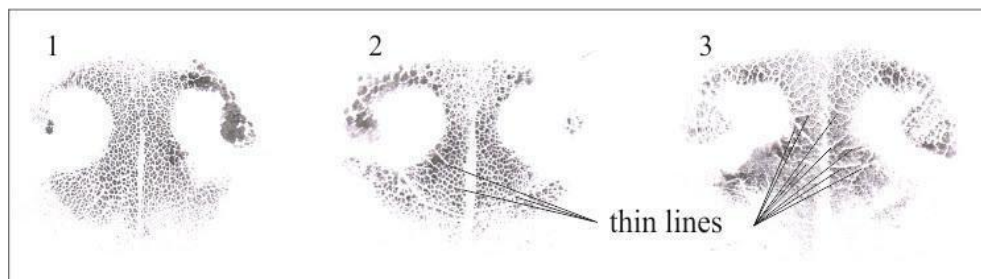
Fig. 5. Availability of lines. 1 – no lines, 2 – slightly lines, 3 – strongly liny. Compiled by the authors.

In the examined material 73 weakly available, 156 heavily available and 37 available prints were identified. The interposition of these lines and their number is an important diagnostic factor for identification.

After studying forms of the nose prints, we identified two main subtypes: horizontally elongated oval and an oval with obtuse angle at the bottom (Fig. 6). In our opinion, the shape of the nasal speculum depends on the phenotypic structure of the dog's muzzle and breed characteristics.
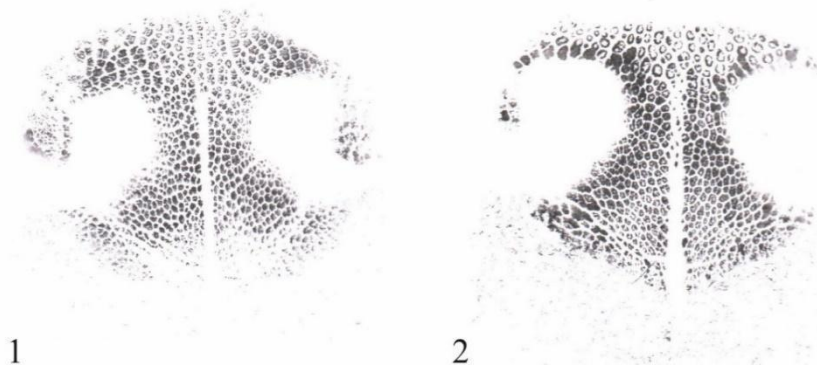
Fig. 6. Forms of nose's pattern. 1 – horizontally elongated oval; 2 - horizontally elongated oval with obtuse angle at the bottom. Compiled by the authors.

During the research, it was noted that the number of pattern elements creating an individual pattern elements that create an individual pattern on each impression varies (Fig. 7). We noticed that some of the impressions differ in that the papillary pattern on them seems to be sparse. In Figure 7 of the print, it is noticeable that there are not many individual elements of the pattern on the first print, and they are quite large, and the spaces between them are wide. Such filling of the print with a pattern we called loose. The second impression in the above figure contains many compactly arranged elements of the papillary pattern, which makes the pattern dense. Such densely patterned prints are more common. The highest density of the papillary pattern is found in the Kyrgyz Taigan breed.

Fig. 7. Density of the papillary pattern. 1 - loose; 2 - dense.

4.   Conclusion

The results of these researches allow the conclusion that nasal speculum of dogs have common features of the papillary pattern. So, in the mandatory comparison, when establishing the identity, such general features as the severity of the line of symmetry of the nose, the shape of the line of symmetry of the nose, the presence or absence of branches of the line of symmetry of the nose, the speckling of lines, the density of the papillary pattern and the shape of the imprint will be taken into account. General features of the papillary pattern, together with particular features, can be used to establish individual identification. Since the papillary pattern of the nasal planum is relatively stable, individual and has the ability to recover, this will allow for reliable biometric identification of dogs in the

conditions of large departmental service and working dog kennels, as well as inventory of the livestock owned by private owners. It is also possible to use this biometric identification method for dog life insurance. Using the common features of the papillary pattern, it is possible to systematize and catalog identification cards with imprints of the nasal speculum.

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