OPINION

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ABOUT: Dissertation work on the topic **"DOG LANGUAGE IN SOUNDGRAMS IN DIFFERENT BEHAVIORAL REACTIONS",** authored by a Ph. D student in a free form of education, magister Pavlina Ivanova Hristova, for the award of the educational and scientific degree "Ph. D" in the scientific specialty "Physiology of animals and man", field of higher education 6. "Agrarian sciences and veterinary medicine", professional direction 6.4. Veterinary medicine with scientific consultant Assoc. prof. Violeta Gerasimova Alexandrova, Ph. D.

The dissertation work of PhD student Pavlina Ivanova Hristova examines a current and significant issue in connection with the analysis of the dog's language, depending on various physiological characteristics and specific behavioral reactions, manifested alone or in a group with other dogs.

The direction of the dissertation on the knowledge and correct analysis of dog barking will improve the approach of veterinary specialists in their work with this type of animals, will support a better orientation of the vets in the diagnostic and treatment work with them, as well as in solving problems that have arisen. negative behavioral reactions, which makes this work valuable in a practical-applied attitude.

There is a lack of sufficient research on dog language decoding by sound wave graph, spectrogram and soundgrams. The simultaneous reading of the recordings by the three methods most fully reflects the characteristics of the sound made by the dog and allows a detailed analysis of each of its individual parts.

All the presented facts define the topic of the dissertation was scientifically relevant and practically necessary and justified regarding the research conducted and the results obtained in a very difficult and very specific part of animal physiology for research, such as the higher nervous activity and the ethology of the dog.

The dissertation work is constructed according to the requirements for this category of scientific works and is presented in a very good literary and professional language. The text is included in 154 pages (Contents - 2 pages, Abbreviations used - 1 page, Literature review - 42 pages, Aim and tasks - 1 page, Material and methods - 8 pages, Results and discussion - 70 pages. , Conclusions - 2 pages, Contributions - 1 page, Recommendations for practice - 1 page,

bibliography - 23 pages), excellent illustrated with 72 figures and 9 tables, and contains all the main sections.

The introduction presents a brief analysis of the actuality of the problem and argues that the use of soundgrams in the reading of dog language is the most appropriate method of graphical representation. Through it, emphasis is placed on the need for the additional research and methods carried out in the dissertation, in order to clarify it in more detail. The introduction is also presented in English.

The literature review is comprehensive and laid out in 42 pages. It is divided into 6 sections, each section focusing on a different topic - anatomical features of the larynx in the dog, other canids and the cat, mechanism of sound formation, sound phonetics, characteristics of sound signals, sound signals in other canids and representatives of the cat family and audio decoding. It reflects the in-depth awareness of various aspects on the part of the PhD student, thus emphasizing the relationship between device, function and parts of speech (barking) in the dog. Clarifying and detailing the known allows for a smooth transition to the necessity and identification of the unknown, which will determine the directions of the current studies in the dissertation.

Everything said above makes the literature review richly informative, analytical and shaping the problem posed for the study of the amplitude-frequency coding of vocal signals in the dog, according to the physiological signs - breed, sex, age, behavioral reactions and form of expression.

The purpose of the dissertation work is clearly formulated and fully corresponds to the given title. In order to achieve the set goal, 5 tasks have been set, which are correctly directed and formulated to the analysis, decoding and reading of the language in the dog alone and in a group in different behavioral reactions separated by physiological signs. Precisely set tasks point to categorical evidentiary material reflected in the huge number of figures and tables used in the dissertation work.

In the **"Materials and methods"** section, 24 domestic socialized dogs of different breeds were used as material, correctly divided into three groups according to the size of the breed - large (>25 kg), medium (10-25 kg) and small and (< 10 kg), and the size division of the breed is according to the nomenclature of the International Cynological Federation (FCI), the age of the selected dogs is between 1 and 13 years, and four representatives of the female and male sex were selected reliably for each of the three groups. A solid number of 1,200 soundgrams from the specified breed groups have been extracted. Dog barking in different behavioral contexts was recorded, divided by categories as follows: 1. Play behavior – alone and in a group with other dogs; 2. Agonistic behavior (aggression, guarding territory and/or master) - alone and in a group; 3. Eating behavior - independently; 4. Anxiety behavior (fear of object, sadness due to lack of owner) - independently. In Table 1, the Ph. D student presents an overview of the dogs used according to the physiological characteristics of breed, age and sex. The recordings were recorded with an Olympus Digital Voice Recorder with a built-in microphone, and when recording the recordings, the permissible distance of 1 to 3 m from the animals was absolutely correctly observed, and that each individual bark was independently recorded and processed. Only the clean recordings, those without background noise and human speech, have been carefully used. Acoustic analysis of the sounds was performed

faithfully using Raven Pro, a specialized bioacoustic signal visualization, measurement, and analysis software developed by the K. Lisa Yang Center.

The decoding of the dog's language was carried out by the simultaneous interweaving of three methods: 1. By graphs of the two-phase waves, which quantitatively depict the molecular motion of the air, expressed by the amplitude; 2. Through spectrograms showing frequency density of sound over time; 3. Through soundgrams presenting frequency and amplitude characteristics and the dependence between them, revealing the signal modulation and code. Emphasis is placed on the detailed study of the soundgram, which shows the experience and competence of both the scientific consultant and the accumulated knowledge in previous similar studies, publications and works in the department, with which the doctoral student can focus on the decoding and analysis of the received 1200 soundgrams. It very properly uses and includes statistical analysis performed using IBM SPSS Statistics and specialized software, which is the most widely used and most effective way of analyzing data in the field of social sciences. Without statistical analysis, the claims obtained from the processing of this large number of soundgrams would not be supported and would not be credible. Used *in vivo* methods are completely harmless and do not have an adverse effect on dogs, which makes them absolutely easy and problem-free to use in veterinary practice.

The obtained **results** are described in a clear and synthesized form, emphasizing their good visual presentation with 72 figures and 9 tables, which gives advantage, visualizes and facilitates the interpretation of the obtained results. The figures are well structured, consisting of three recordings obtained by waveform, spectrogram and soundogram of the same dog barking under different behavioral responses and physiological characteristics. The obtained scientific results of the present dissertation work are fundamental in reading the language of the dog in various behavioral reactions, which is its most essential contribution. It is emphasized that the presentation of sound signals in soundograms is a suitable choice, which gives opportunities to detail the dog's language in different behavioral responses in a group or alone, as well as in animals with different physiological characteristics, which is important for the guidance of future sound researchers to the animalsWavelet and spectral analysis were found to be suitable for visualizing and recording sequential dog barking, again guiding their use in future studies. It was observed by the Ph. D student that the values for the frequency and amplitude of the sound signal in large and medium breeds of dogs are similar in values for the behavioral reactions related to play, aggression and feeding, and significantly the highest values for the amplitude were registered in the large breeds at anxiety, as well as for the frequency of the four behavioral groups in the representatives of small breeds. It has been registered that, in terms of the physiological characteristic of sex, in large breeds, higher values for the amplitude (dB) of the recordings in female animals during aggression, feeding and anxiety, and the same tendency is also found in small breeds, but in male representatives. In medium breeds, higher values for the amplitude of the recording are registered in male animals during play, aggression and feeding. The PhD student noted that, compared to the frequency indicator (Hz) in the sex division, in male dogs, for large breeds, higher values were recorded for the four behavioral reactions, for medium breeds during play, and for small breeds - during play and anxiety. Regarding the amplitude index of the recordings in the dogs, divided by age, the values are higher in the representatives over 7 years of age for large breeds in play,

aggression and anxiety, and for medium breeds in aggression, feeding and anxiety. In terms of frequency, older large and medium breeds showed higher scores on feeding behavior and anxiety compared to juveniles in the same breed groups. In the group of small breeds, the values of the amplitude indicator are in favor of the young up to 7 years of age - in aggression, feeding and anxiety, and higher values for the frequency in adult dogs (over 7 years) in play, aggression and feeding. The results obtained by the Ph. D student regarding the amplitude of the sound signals of the animals, expressed in individual or group form during play and agonistic behavior, are extremely interesting, where medium breeds show higher values for both behavioral reactions in a group, and small breeds - alone. What is practically important is what was found regarding the frequency of the sound signal, the representatives of the three categories of breeds have higher values for game behavior in a group and for aggression shown individually.

It should also be noted that the results obtained are a consequence of the extremely good choice and the introduction of well-known working methods, and the obtained results fully and analytically correspond to the set goal and tasks. The use of complementary methodologies gives us more complete information about the decoding of language in the dog through soundgrams, which is purposefully used to illustrate them in the dissertation.

The discussion is presented together with the results, which I find appropriate for this type of dissertation, which would lead to repetition of many facts in such a separate section. In this way, the result supplemented with an analysis of what has been established so far becomes clear and stands out. Thus, the reader simultaneously with what is read in the text immediately and analytically visualizes the corresponding structure of the figures and can evaluate the obtained result.

The obtained experimental results are summarized in 8 correctly and concretely formulated **conclusions.**

The dissertation has contributions presented in a separate section - **3 original and 2 of a confirmatory nature.** I fully agree and support the contributions of the present study proposed by the Ph. D student.

I fully support the mentioned recommendations for practice, as they would help both practicing veterinarians and owners to track and know the sound made by the dog during various behavioral reactions with a view to deciphering it or recognizing a negative behavioral reaction.

The literary index is rich (from 214 authors - only 8 in Cyrillic (Bulgarian) and 206 in Latin (English), including a large number of sources from the last decade.

The 3 articles have been published on the topic of the dissertation work, all of which are in collaboration with the scientific consultant, with the dissertation student being the first author. All three articles were published in the journal of the Faculty of Veterinary Medicine at University Of Forestry - TRADITION AND MODERNITY IN VETERINARY MEDICINE.

The abstract fully corresponds to the dissertation, where the most important of the achieved results are reflected.

I must note that the Ph. D student complied with almost all the remarks and constructive criticisms given by the members of the expanded SC during the preliminary discussion, which are reflected in the dissertation work and immeasurably increases its quality. It is necessary to note that the dissertation has strictly complied with the latest editions of the **anatomical (NAV, 2017 - 6 ed.),** which is due to the built style of her teaching activity in the disciplines "Physiology of domestic animals" and "Ethology, protection and animal welfare'.

Critical notes.

1. The literature review is presented more comprehensively and in detail than necessary, and the data on the larynx and sound production for the cat are not superfluous, but there are no studies on them in the dissertation.

2. A list of publications on the dissertation is missing, both in the content and at the end, where they are traditionally described and noted.

Recommendations:

1. To study the language of the cat in different behavioral reactions on soundograms, which would have significant scientific and practical interest in veterinary practice.

2. To publish similar research in other Bulgarian and foreign journals with an impact rank and in those with an impact factor.

Conclusion: The dissertation of the Ph. D student in an independent form of study magister Pavlina Ivanova Hristova on the topic **"THE LANGUAGE OF THE DOG IN SOUNDGRAMS IN DIFFERENT BEHAVIORAL REACTIONS"** for awarding the educational and scientific degree "Ph. D" in the scientific specialty "Physiology of animals and humans", is current, significant, undeniable in its originality and very well illustrated , which reveals aspects and future directions of the search for answers about language decoding not only in the dog, but also in the cat and other domestic animals.

Despite some technical, spelling and stylistic errors, as well as the critical remarks and recommendations noted by me, all this **does not reduce the** high value of the dissertation work.

The dissertation of magister Pavlina Ivanova Hristova meets the set of criteria, indicators and scientometric data of the minimum national requirements for the acquisition of the relevant degree according to the ZRASRB, the Rules for its implementation and the Internal rules for the development of the academic staff of University of Forestry from 2019.

No plagiarism was found in the dissertation submitted to me for evaluation, and the literary sources used were correctly cited. In support of this and from my personal observations, I can point out that the dissertation work is a personal work of the Ph. D student, carried out in close collaboration with the scientific consultant Assoc. prof. Violeta Alexandrova.

Based on all of the above, I propose to the respected members of the Scientific Jury to support the dissertation of the Ph. D student magister Pavlina Ivanova Hristova and to award her the educational and scientific degree "Ph. D" in scientific specialty "Physiology of animals and

man", field of higher education 6. "Agrarian sciences and veterinary medicine", professional direction 6.4. Veterinary Medicine.

5. 12. 2023

Prepared the opinion:

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(Assoc. prof. Georgi Ivanov Georgiev, PhD)