Evaluation of the Behavior of Some Native Dogs in Vietnam to Determine Their Suitability as Detector Dogs

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Abstract—In dogs of native breeds (”Hmong,” “Phu Quoc,” and “Zang Soi”), the features of behavior pre-adapted to interaction with humans and formed in the process of directional selection have been revealed. Behavioral characteristics (contactiveness, activity, playfulness, reaction to the unexpected appearance of an unfamiliar object, and abrupt sounds) were used to evaluate the dogs’ suitability for training for use as service detector dogs. It was shown that native dogs even without directional selection can show high indices of activity and contact with a human, similar to those found by the authors earlier for European breeds. Indicators of playfulness and reaction to unfamiliar objects and sharp sounds are formed only in the process of directional selection. The “Zang Soi” dog recommended for breeding and use as detection dogs turned out to be the closest to the European breeds in terms of activity and contactiveness indices.

Keywords: native breeds, personality, evaluation of behavior, detector dogs

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INTRODUCTION

The history of domestication of the dog Canis lupus familiaris is ~30000 years old (Thalmann et al., 2013). During this time, many breeds have been developed that are used by humans for various purposes. The issues of the centers of origin and settlement of the domestic dog are actively under discussion. Some authors (Pang et al., 2009; Wang et al., 2016;) suggest that the dispersal of the dog came from Southeast Asia; others, that the center of origin of dogs was in Europe (Thalmann et al., 2013) or the Middle East (von Holdt et al., 2010).

In this regard, the presence of more than ten aboriginal breeds and breed groups in such a small country as Vietnam is of absolute scientific interest. The population of Vietnam is ethnically diverse, inhabiting various geographic regions, some of which have their own dog breeds (Fig. 1). They are the result of folk selection and, as a rule, have the names of the peoples who created them (for example, “Hmong,” “Bakha”), or areas where dogs have been isolated for quite a long time, for example, on the island of Phu Quoc. Sometimes breeds are named according to the similarity of the exterior, for example, with a wolf (“zang soi,” a wolf-like dog, “vietdingo,” etc.). Basically, these breeds are used for the protection of homes and hunting. According to the classification proposed by M.N. Sotskaya, primitive or aboriginal dog breeds are actually natural endemic populations in which purposeful artificial selection is completely absent and human influence can be considered as one of the factors of natural selection (Sotskaya, 2004). Indigenous Vietnamese breeds, in particular, the Hmong bobtail (hereinafter, Hmong) and Phu Quoc dog (hereinafter, Phu Quoc) selected for research, are transitional according to this classification, since in the last decade, directed breeding work has been carried out with them, but at the same time there is no selection for working qualities (hunting and home guarding). The breed group of wolf-like dogs (“Zang Soi”) is a unique material for research, since until recently it was not subjected to active selection regarding user qualities (hunting and guarding), in contrast to European service breeds. The breeds “Hmong” and “Phu Quoc” are currently registered as national in the Vietnamese Cynological Association and have recently been bred with selection for the exterior; for them breed standards have been developed and approved by the Vietnam Cynological Association (breed standards 001 and 002 VN, VKA, 2009). The breed group “Zang Soi” has not yet been registered, but a standard for this breed, which will allow the start of breeding, is under development. Other aboriginal breeds and groups are threatened with extinction due to hybridization with...
European dogs imported in large quantities from other countries. Due to the fact that the attitude of the peoples of Southeast Asia to the dog is fundamentally different from the European one (until recently it was not considered a companion, but was mainly a food item or was used for hunting or guarding homes), Vietnamese dogs in practice have much less contact with humans. Aboriginal dogs exist next to a person autonomously, free-range or in cages; they are not trained.

In the last decade, the behavior of dogs of European selection has been actively studied, and particularly great attention has been paid to the relationship of domestic dogs with humans in the context of animal understanding of human gestures and postures (Agnetta et al., 2000). It has been shown that dogs of European breeds correctly assess the gestures and facial expressions of a person, focusing on his emotional state (Muller et al., 2015). Such communication features are especially important in the context of training and using dogs for service purposes (Ganitskaya et al., 2020).

The outstanding olfactory ability of dogs is widely used around the world to identify the sources of odors of various chemical and biological substances. Dog-
detectors can reveal the location of explosives, flammable substances, and various gases, can detect pathological conditions of a person by smell, and can find rare species of animals leading a secretive lifestyle (Hughes, 2019; Arnesen, 2020). To improve the working qualities of dogs in all countries, the targeted selection of individuals is carried out. An example is the working breeding of the German and Belgian Shepherd in Germany and Belgium, the Labrador in England, and some others. In such breeding, dogs are assessed for certain behavioral characteristics necessary for the job, and in the absence of such characteristics, they are not allowed to breed.

Much attention is also paid to the study of factors affecting the effectiveness and speed of the search for various substances by detector dogs (Jezierski, 2014). Such factors also include the breed of the dog. However, many authors are of the opinion that the performance of detection dogs is influenced more by the individual characteristics of behavior than the breed itself (Goddard and Beilharz, 1986; Serpell and Hsu, 2001).

Previously we have shown that individual behavioral characteristics, such as contact, activity, and play, are most closely associated with successful search work (Ganitskaya et al., 2020). We applied similar studies of the behavioral characteristics in work with indigenous dogs of Vietnam. The use of aboriginal dogs for official purposes is due to the fact that, unlike European breeds, they are better adapted to the hot and humid climate of the country. Dogs of European breeds in local conditions reduce their performance and often get sick.

Thus, the fundamental task of this work is to identify behavioral features associated with relationships with humans in aboriginal dogs. The practical task of this work is to assess the behavioral characteristics of local Vietnamese dogs to identify the breed or breed group most suitable for experimental training as detector dogs.

MATERIALS AND METHODS

This work was carried out on the basis of the Russian–Vietnamese Scientific Research and Technological Tropical Center in 2015–2019. There were tested 150 dogs of two indigenous breeds (“Hmong,” “Phu Quoc”) and one breed group (“Zang Soi”) of 50 dogs. Only males were used in the study. The animals were between 2.5 years old and 7.5 years old. The dogs were physically healthy and were kept under the same conditions during the study period. Testing was carried out in the summer months (from 10:00 to 11:00), in typical weather conditions for dogs (temperature 28–30°C, air humidity 75–80%), in a familiar territory for the dogs, in the area of Hanoi.

To assess individual behavior characteristics, we used the same techniques as when testing European breeds, which was described in detail by us earlier (Ganitskaya et al., 2020). The dog’s reaction when tested (Table 1) was assessed on a five-point scale: the minimum manifestation of the reaction was assessed at 1, and the maximum, at 5 points. Each test (a total of 750 tests was carried out) was recorded on video. While watching it, three independent experts gave assessment in points, by which its average value was determined.

Statistical analysis was performed in the statistical environment R v. 3.4.3 (R Core Team, 2017). The “psych” v 1.7.8 package was used to construct the correlation matrices.

RESULTS

In the test “Contact,” the most pronounced sociability with a stranger was shown by dogs of the “Zang Soi” breed group. They differed significantly from the “Phu Quoc” and “Hmong” breeds. When comparing the two breeds “Phu Quoc” and “Hmong,” “Phu Quoc” proved to be significantly more contactable (Table 2, Fig. 2).

Dogs of the “Zang Soi” breed were significantly more active than “Phu Quoc,” but did not differ in this indicator from the “Hmong” (Table 3, Fig. 2).

In terms of their inclination to play, “Zang Soi” does not differ reliably from “Phu Quoc,” but they are more inclined to play than “Hmong” (Table 4, Fig. 2).

All aboriginal dogs demonstrate similar results in the test “Responses to a sharp sound” (Table 5, Fig. 2).

In the test “Reaction to the unexpected appearance of an unfamiliar object,” the results of the “Zang Soi” and “Phu Quoc” dogs did not differ from each other, and the Hmong dogs showed greater fear and aggression (Table 6, Fig. 2).

DISCUSSION

We have tested for the first time dogs of two indigenous Vietnamese breeds “Hmong” and “Phu Quoc” and the breed group “Zang Soi.” Studies have shown that indigenous dogs of Vietnam, living in completely different conditions (including social) than European breeds, nevertheless, already in the first generation raised in close contact with humans, demonstrate qualities similar in terms of contact and activity to those of European dogs.

This is especially true of the “Zang Soi” breed group. When compared with European breeds, which showed the best results when working on odor detection, the test results of which we obtained earlier (Ganitskaya et al., 2020), “Zang Soi” did not differ from Labradors in contact, and German Shepherds showed an even significantly lower the level of this indicator (Table 2). At the same time, dogs of this breed group are reliably more active than European Labradors and shepherds (Table 3). However, both Labradors and Sheepdogs are reliably more playful.
than dogs of the “Zang Soi” breed group (Table 4). In addition, “Zang Soi” are more afraid of harsh sounds than European dogs (Table 5). In the test “Reaction to the unexpected appearance of an unfamiliar object” “Zang Soi” in their results do not differ significantly from European dogs (Table 6).

“Hmong” dogs turned out to be the least contactable. This can be explained by the national charac-

| Test name                          | Appointment                                                                 | Estimate                                                                                                                                     |
|------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Contact                            | Testing the dog’s ability to make contact with a stranger and attitude towards physical contact with him (assessment of behavior at the beginning of contact, interaction with a person and attitude towards physical contact) | 1 point for lack of contact or fear, 5 points for active, benevolent interaction with the stranger conducting the test |
| Activity                           | Assessment of the behavior of a dog on a free leash next to a calmly standing owner | 1 point when the dog remained close to the owner and did not show further activity, 5 points when the dog moved a long distance from the owner with constant movement |
| Reaction to the unexpected appearance of an unfamiliar object | Assessment of the dog’s reaction (fear, aggression, curiosity, and residual fear) on a human-shaped object suddenly raised in front of the dog with outstretched arms (specially prepared overalls) | 1 point in the absence of fear and aggression, 5 points in case of refusal to approach the overalls, panic fear, or aggression |
| The game                           | Assessment of the dog’s desire to play, lifting an object from the ground, pulling a toy | 1 point in case of refusal to play, unwillingness to pick up an object from the ground, 5 points in case of active play with the test person, willingly picking up an object from the ground and pulling a toy |
| Reaction to a harsh sound          | Assessment of the dog’s reaction (fear, curiosity, and residual fear) to the harsh noise produced by objects stretched along a corrugated sheet masked at 2 m | 1 point in the absence of fear, 5 points in case of pronounced panic behavior |

| Test name                          | Appointment                                                                 | Estimate                                                                                                                                     |
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| Contact                            | Testing the dog’s ability to make contact with a stranger and attitude towards physical contact with him (assessment of behavior at the beginning of contact, interaction with a person and attitude towards physical contact) | 1 point for lack of contact or fear, 5 points for active, benevolent interaction with the stranger conducting the test |
| Activity                           | Assessment of the behavior of a dog on a free leash next to a calmly standing owner | 1 point when the dog remained close to the owner and did not show further activity, 5 points when the dog moved a long distance from the owner with constant movement |
| Reaction to the unexpected appearance of an unfamiliar object | Assessment of the dog’s reaction (fear, aggression, curiosity, and residual fear) on a human-shaped object suddenly raised in front of the dog with outstretched arms (specially prepared overalls) | 1 point in the absence of fear and aggression, 5 points in case of refusal to approach the overalls, panic fear, or aggression |
| The game                           | Assessment of the dog’s desire to play, lifting an object from the ground, pulling a toy | 1 point in case of refusal to play, unwillingness to pick up an object from the ground, 5 points in case of active play with the test person, willingly picking up an object from the ground and pulling a toy |
| Reaction to a harsh sound          | Assessment of the dog’s reaction (fear, curiosity, and residual fear) to the harsh noise produced by objects stretched along a corrugated sheet masked at 2 m | 1 point in the absence of fear, 5 points in case of pronounced panic behavior |

Table 2. Significance of differences (Mann–Whitney test) in behavioral characteristics of aboriginal breeds and breed group of Vietnamese dogs in comparison with European breeds: in the test for activity

| Breed                  | Labrador | Sheepdog | Hmong | Phu Quoc | Zang Soi |
|------------------------|----------|----------|-------|----------|---------|
| Labrador Sheepdog      |          | 0.0001   |       |          |         |
| Hmong                  | 0.0001   |          | 0.0133|          |         |
| Phu Quoc               | 0.001    | 0.2389   |       | 0.0007   |         |
| Zang Soi               | 0.3883   | 0.0001   | 0.0001| 0.0056   |         |

Table 3. Significance of differences (Mann–Whitney test) in behavioral characteristics of indigenous breeds and breed group of Vietnamese dogs in comparison with European breeds: in the test for activity

| Breed                  | Labrador | Sheepdogs | Hmong | Phu Quoc | Zang Soi |
|------------------------|----------|-----------|-------|----------|---------|
| Labrador Sheepdog      |          | 0.0016    |       | 0.0001   |         |
| Hmong                  | 0.0704   | 0.0009    |       | 0.2442   |         |
| Phu Quoc               | 0.5302   | 0.0475    | 0.103 | 0.0101   |         |
| Zang Soi               |          | 0.0475    | 0.103 | 0.0101   |         |
teristics of the Hmong mountain people, who created this breed. According to colleagues from Vietnam, this ethnic group is uncommunicative. It is precisely contact and activity that are, in our opinion, the necessary behavioral characteristics for the successful work of dog-detectors. These qualities, most likely, arose in the process of domestication in aboriginal dogs. Thus, in studies on Indian pariah dogs (animals that use only human food resources, but do not come into direct contact with humans), it was shown that one of the important manifestations of interspecies communication is the perception of nonverbal human signals by dogs, for example, the direction of gaze or poses (Bhattacharjee et al., 2017a, 2017b). The same conclusions were reached by researchers studying the social behavior of stray dogs in urban populations of Rome (Italy) and Concepción (Chile). These dogs also understand the nonverbal cues of a stranger and can use them to adapt to an urban environment, for example, learning to cross the road with a person, relying on his assessment of the safety of the crossing (Bonanni and Cafazzo, 2014; Miternique and Gaunet, 2020). Dogs understand human gestures and tone of voice and are good at distinguishing between threatening and positive behavior and react accordingly. Contact is manifested even in dogs that are practically unrelated to humans and are not subject to targeted selection.

If the Vietnamese aboriginal dogs show high indicators of activity and contact, then a quality such as the ability to play is poorly developed in them. In Vietnam, it is generally not customary to play with dogs and interacting with a person in this way is a completely new experience for them. However, when the authors carried out experimental breeding and training of aboriginal dogs of the “Zang Soi” breed group, it was noted that already in the second or third generation, the descendants of dogs taken from the population begin to show interest in games and can even get and bring various objects out of the water, offering play themselves. It should be noted that bathing and swimming is also not typical for Vietnamese dogs, but when trained, puppies of the second generation already swim well and willingly go into the water, unlike their parents. The ability to play develops quite easily in

**Figure 2.** Features of the manifestation of different forms of behavior (in points from 1 to 5) when testing dogs of European breeds (1, Labradors; 2, Shepherds), aboriginal breeds (3, Hmong; 4, Phu Quoc) and a breed group (5, Zang Soi).

**Table 4.** Significance of differences (Mann–Whitney test) in behavioral characteristics of indigenous breeds and breed group of Vietnamese dogs in comparison with European breeds: in the test for play

| Breed Group     | Labradors | Sheepdogs | Hmong | Phu Quoc | Zang Soi |
|-----------------|-----------|-----------|-------|----------|---------|
| Labradors       |           |           |       |          |         |
| Sheepdogs       | 0.5521    |           |       |          |         |
| Hmong           | 0.0001    | 0.0001    |       |          |         |
| Phu Quoc        | 0.0001    | 0.0001    | 0.0001|          |         |
| Zang Soi        | 0.0002    | 0.0001    | 0.0001| 0.1215   |         |
conditions of frequent contact with a person and does not manifest itself in their absence.

As for the reaction to the “Sharp sound,” the great alertness of aboriginal dogs in comparison with European ones is quite understandable, since the selection of European breeds for a long time was carried out for the absence of fear when a gun was fired such as in Labradors on a hunt, or in shepherds while herding (Regulation NKP-RKF “About Breeding Selection (kerung) of German Shepherd Dogs,” 2020). In Vietnamese dogs, directional selection for this characteristic was not carried out. Thus, it can be assumed that these behavioral features of dogs are associated precisely with selection. Vietnamese aboriginal dogs exhibit a number of behavioral traits necessary for successful performance as detection dogs, and these qualities are not the result of deliberate selection. In contrast, the demonstration of behavioral features such as playing with a person or the lack of a fear reaction to loud sounds and the unexpected appearance of unfamiliar objects is formed in dogs, apparently, only in the process of directed selection.

The practical result of our testing was the identification of the aboriginal breed group “Zang Soi,” which in its characteristics is closest to European dogs and demonstrates the best human contact and activity among Vietnamese dogs. We believe that it is this breed group that is most suitable for use in the experiment on training dog-detectors for service purposes. Subsequently, ten trained dogs of this particular breed group have successfully passed the tests for suitability for detecting explosives and ammunition on the territory of Vietnam.

### Table 5. Significance of differences (Mann–Whitney test) in behavioral characteristics of aboriginal breeds and a breed group of Vietnamese dogs in comparison with European breeds: in the test for reaction to harsh sounds

| Breed Group | Labrador | Sheepdog | Hmong | Phu Quoc | Zang Soi |
|-------------|----------|----------|-------|----------|---------|
| Labrador    |          |          |       |          |         |
| Sheepdog    | 0.2945   |          |       |          |         |
| Hmong       | 0.0347   | 0.2302   |       |          |         |
| Phu Quoc    | 0.0078   | 0.0567   | 0.3349|          |         |
| Zang Soi    | 0.0042   | 0.0221   | 0.1216| 0.5481   |         |

### Table 6. Significance of differences (Mann–Whitney test) in behavioral characteristics of aboriginal breeds and breed group of Vietnamese dogs in comparison with European breeds: in the test for the reaction to an unexpected appearance of an unfamiliar object

| Breed Group | Labrador | Sheepdogs | Hmong | Phu Quoc | Zang Soi |
|-------------|----------|-----------|-------|----------|---------|
| Labrador    |          |           |       |          |         |
| Sheepdog    |          |           |       |          |         |
| Hmong       | 0.0263   |           | 0.0005|          |         |
| Phu Quoc    | 0.0163   | 0.6161    | 0.0046|          |         |
| Zang Soi    | 0.0554   | 0.6065    | 0.0001| 0.333    |         |

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### COMPLIANCE WITH ETHICAL STANDARDS

**Conflict of interest.** The author declares that he has no conflicts of interest.

**Statement on the welfare of animals.** All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

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