Study on Current Situation of Guide Dog Training and Molecular Genetic Analysis

Summary

   Guide dogs provide helpful support to visually impaired people to expand their participation in social activities, but the number of guide dogs being trained and certified in Japan at present is about 150 annually and this number is considerably small for the number of disabled people who desire to have a guide dog. Until today, for about 50 years since the assistance dog service was launched, guide dogs have always been in short supply.

   The guide dog service was regulated by the Road Traffic Act for a long time, but since the enactment of the Law Concerning Assistance Dogs for the Disabled in 2002, the social awareness regarding the role of guide dogs has been raised and the social participation of guide dogs has been increasingly allowed. The revisions of the Law Concerning Assistance Dogs for the Disabled in 2007 led to setting up service counters in the offices of prefectural governments, government ordinance cities and core cities to receive complaints and inquiries from assistance dog users and those who deal with such disabled people. This Law also obligates private enterprises to employ the assistance dog users and to accept the use of an assistance dog by disabled workers who have been already employed by them. It is expected that the enforcement of this Law will further promote the independence of those disabled people and facilitate them to be more active in their social participation.

   The certification of guide dogs is determined by the overall assessment of each of the steps in the guide dog training process, namely, breeding, consignment to puppy walkers and performance at the training centers. In Japan, about 150 guide dogs are certified annually, and the certification rate is about 30%, remarkably lower figures than those of the United Kingdom (where about 800 guide dogs are certified annually at the certification rate of 70%). Some of the reasons for such a large difference are; the history of guide dog training, issues related to dog breeds, differences in lifestyle, training conducted in a household (by puppy walkers) and general lack of recognition of guide dogs in Japan.

   Therefore, we carried out a survey on the guide dog training provided by puppy walkers and also conducted genetic analysis of the dog characters for the

purpose of implementing early-stage aptitude analysis of guide dogs subject to training. We reasoned that we would be able to improve the guide dog training and certification rate and also reduce the economic load of the training by conducting objective assessment in the early stage in order to increase the number of certified guide dogs.

The following are the summaries of each chapter:
1. Survey Study on Guide Dog Training Provided by Puppy Walkers (Chapter 2)

We carried out a questionnaire survey on puppy walkers in recognition that the training provided by puppy walkers as a step in the overall guide dog training has bearing on the successful certification of guide dogs.

The certification rate of guide dogs in the above survey session up until now (October 31) was 11.8% (14 dogs certified out of 119). The survey will need to be continued for the remaining 23 dogs for which the certification results have not been given yet. The ratio of certification failure due to the dog characters was 77.5% (55 dogs out of 71), and this figure was similar to other reports on the studies dealing with this topic. Following that, the failure ratio of 22.5% was due to diseases (16 dogs out of 71). The diseases include hip dysplasia, cataract, retinal atrophy, and optic nerve atrophy. These diseases are hereditary in many cases, and therefore it will be necessary to be considerably cautious when selecting breeding dogs.

Next, based on the survey results, we examined the criteria which are relevant to the certification of guide dogs.
(1) Physical environment factors

As for the family structure of the puppy walkers, the successfully certified dogs were trained in families consisting of more members than that of the failed dogs. (An average number of 4.57 family members for the certified dogs, whereas 3.21 for the failed dogs). The certification rate tended to be higher with two-generation families than that of one generation, likewise three-generation families than two-generation. This result seems to be related to the instinctive habit of dogs to live in groups, and thus the involvement with more people may have been a factor for helping those dogs to be more sociable.

The area of residence, traffic situation, and type of houses did not have influence on the certification rate.

(2) Training condition

The response of puppies upon seeing a strange dog as categorized in three levels had relevance to the certification rate, that is, "always mild (always friendly) (78.6%, χ=4.200, p<0.05)," "displaying competitive attitude (100%, χ=6.198, p<0.05)," and "indifferent (showing no interest in most cases) (92.9%, χ=4.070, p<0.05)." This result seems to be a reflection of the inborn character of exceptional mildness that the breed of Labrador retriever has.

The leading factor of certification failure was the pulling behavior during a walk. Those dogs which demonstrate the pulling behavior during their puppy period would eventually disqualify them. The three reasons of their pulling behavior, "pulling out of fear or anxiety (32.7%, χ=5.581, p<0.05)," "pulling out of excitement (72.7%, χ = 6.739, p<0.05)," "interested in other dogs or cats (81.8%, χ=11.887, p<0.05)" are associated with the inborn nature of dogs, and it may not have been corrected in this training session.

The use of staircases was also examined, and the rate of certification failure was higher among those dogs which used staircases almost daily.

The criteria which did not have influence on the rate of certification were as follows:

(1) Gender of dogs trained, (2) coat color of dogs trained, (3) sickness during the consignment, (4) location of excretion, (5) number of walking sessions, (6) duration of walking sessions (7) number of house sitting sessions, (8) duration of house sitting sessions, (9) feelings of discomfort (evasive attitude) or hostility (threatening or attacking gestures) upon seeing a strange dog, (10) timings of barking or snarling, (11) such experiences encountered during the period of consignment as seeing strangers, unfamiliar children, dogs, cats, birds, horses, sheep, cattle, lightning and thunder, discomforting and loud noise, sound of running cars, large trucks, car horns, trains, crowds, slippery floors, iron grids, riding in a car, elevators, and escalators.

In this chapter, the following factors were indicated as having relevance to the certification rate of guide dogs; the number of family members, the number of generations in the family, puppies' response to other dogs, namely, "always mild (always friendly)," "displaying competitive attitude," and "indifferent (showing no interest in most cases)," the pulling behavior during a walk, or more specifically "pulling out of fear or anxiety," "pulling out of excitement," and "interested in other dogs or cats," and the use of staircases.

2. Molecular Genetic Analysis Regarding Guide Dog Training (Chapter 3)

The factors that govern dogs' characters are presumably the environment and genetics. Among other things, especially the hostile and active characters are considered to be strongly influenced by the hereditary factor. The characters of dogs under training are one of the most important elements that influence the results of guide dog training, having strong relevance to the aptitude of guide dogs.

In this chapter, from the genetic point of view for accumulating useful knowledge involved in the training of guide dogs, a series of analyses were conducted by using the dog genome samples bred and managed by Kyushu Guide Dog Association: (1) catecholamine-o-methyltrans-ferase (*COMT*) genetic polymorphism analysis, (2) search for unknown genome regions related to guide dog training through genome wide association analysis, and (3) genetic diversity analysis by means of mitochondrial DNA analysis.

(1) The G216A genotypic analysis of *COMT* genetics on 146 dog genome samples specified the genotypes of GG for 138 samples, GA for four samples, and AA for four samples. The GA type was found in three samples from the failed dogs after the training and in one sample from the breeding dogs. Moreover, the four samples identified as AA type were all from the failed dogs which underwent the training. The frequencies of G216A genetic polymorphism were compared between 39 guide dog samples (dogs certified after the training, currently in service and retired) and 58 dogs which were disqualified after the training, and there were significant differences in both groups.

The 39 samples from guide dogs were all GG genotype. The result seems to suggest that the differences in *COMT* (catecholamine-o-methyltrans-ferase) on an individual level have influence on the certification rate of guide dogs based on their characters. This genotype, however, is patented to be used for selecting dogs well-suited to be guide dogs, and therefore Kyushu Guide Dog Association needs to consult the patent holder in case it actually uses the genotype for the purpose of selecting the breeding dogs. It will be possible to gain more useful information for training guide dogs by conducting analyses on other genetic polymorphism.

(2) For the purpose of searching for genome regions useful for training guide

dogs, illumina CanineHD BeadChip (provided by Illumina, Inc. in San Diego, USA) was used to analyze the genome DNA of 26 samples consisting of 13 samples from guide dogs and 13 samples from non-guide dogs to identify the genotype of 173,649 SNPs that cover the entire chromosomes of the dog species.

As a result, top three SNPs were identified which exhibit high significant difference particularly in Chromosome 18 and Chromosome 14. It will be necessary to continue to refine the new genetic regions related to characters by fine mapping of the identified regions in the future.

For the purpose of examining the genetic diversity of the analyzed groups, we identified the base sequence of mtDNA HV1 region (660 bp) of 68 Labrador retriever samples (34 male samples and 34 female samples). The genetic diversity thereof was compared with the analytic data of the same breed reported by Sugiyama et al.

As a result, in the analyzed groups, NVLU033 accounted for about 70%, and the genetic diversity rate was 0.499, a lower value than the results of the same breed reported by Sugiyama et al.

As shown above, the dog characters can be one key factor that has influence on the certification rate of trained dogs as indicated by the questionnaire survey on the puppy walkers and molecular genetic analyses. It is deemed necessary to carry out future selection of breeding dogs and training of guide dogs while taking into consideration the genetic background of such dogs.

It is thought that this study is expected to be used to avoid time and economic loss in training guide dogs and to contribute to aptitude assessment in the early stage with a view to increasing the number of certified trained dogs.