The Swedish Armed Forces breeding program for German Shepherd Dogs – the next step

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IWDC 2017
Outline

1. The Swedish Armed Forces breeding program for German Shepherd Dogs has been successful…

2. …but improvements are possible: Planned development

3. Challenges
Why breeding???

Genetic improvements are accumulated, because every round of selection starts from the level obtained by previous selection!

(Also, better guarantee for access to high quality dogs)
The Swedish Armed Forces Breeding Program

• The goal is to provide the Armed Forces with its full need of dogs (~30/year), and half of the need of the Swedish Police (~40/year). Norway, Denmark, Finland…

• Started in 2004, first litter 2005

• Germans Shepherds only

• Until now, 2000 puppies. Today >200 dogs born annually

• (Almost) closed breeding colony, 70-80 females and 15 males
Production of Military Working Dogs

- Bitch arrive to breeding station 3 weeks prior to whelping
- Puppy born

- Training of dog at DTC for 1 year, or selected for breeding (bitches)
- Training of dog together with future handler at DTC for 16 weeks
- Service (some males used for breeding)
- Retirement

Production of Military Working Dogs
Production of Military Working Dogs

1. Bitch arrive to breeding station 3 weeks prior to whelping
2. Puppy born
3. 8 weeks old - puppy to foster home
4. Foster home support program
5. 12 months old – hip and elbow X-ray
6. 15-18 months old – temperament test and veterinary examination
7. Training of dog at DTC for 1 year, or selected for breeding (bitches)
8. Training of dog together with future handler at DTC for 16 weeks
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The proportion of dogs rejected for training or breeding at test (15–18 months old) has decreased.
Outline

1. The Swedish Armed Forces breeding program for German Shepherd Dogs has been successful…

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Principles of a breeding program

DEFINITION OF BREEDING GOAL

RECORDING

GENETIC EVALUATION

SELECTION OF BREEDING ANIMALS

MATING SYSTEM

GENETIC IMPROVEMENT

Which traits are important?
Development

- Better definition of breeding goal (e.g., improved definition of suitable temperament; investigate reasons for vet. treatments, retirement, and genetic correlations btw traits; include robustness and longevity...)
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Which traits are important?

How to measure?
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- Better definition of breeding goal (e.g., improved definition of suitable temperament; investigate reasons for vet. treatments, retirement, and genetic correlations btw traits; include robustness and longevity…)

- Earlier/better temperament assessment
Earlier/better temperament assessment

- Development of temperament test (sociability, variation, standardization, age, validation…)
Measured traits...
...goal traits?
Earlier/better temperament assessment

• Development of temperament test (sociability, variation, standardization, age, validation…)

• Questionnaires (to foster homes or to foster home consultants?)
Principles of a breeding program

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Which traits are important?

How to measure?

No genetic progress will happen unless the recordings are utilized!
Development

• Better definition of breeding goal (e.g., improved definition of suitable temperament; investigate reasons for vet. treatments, retirement, and genetic correlations btw traits; include robustness and longevity…)

• Earlier/better temperament assessment

• Develop Estimated Breeding Values (EBVs) and start using these for selection
Why EBVs? Selecting the \textit{genetically} best animals enhances genetic improvement!
Why EBVs? Selecting the *genetically* best animals enhances genetic improvement!
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• International collaboration
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Challenges…example 1:

Logistical issues and lack of demand makes it difficult to keep production high enough to recruiting breeding animals from own production and at the same time avoiding inbreeding-related problems

Solution = international collaboration?
• Sharing genetic material -> possibilities for lower inbreeding rate and higher selection intensity -> faster genetic progress
• Increased demand by selling dogs abroad (primarily to other Scandinavian countries)

✓ Bonus = each program less vulnerable…
Challenges...example 2:

Dogs who consume many foster homes have a higher success rate in training.
Challenges...example 2:

- Dogs with a desired temperament for MWD/Police dogs are more likely to be discarded by host families.
- Breeders of companion dogs are not likely to select for traits desired in MWD/Police dogs.
- Improving temperament have to be combined with adapting methods of raising and training the dogs.
Questions, suggestions...

Aim for the Cat
The Swedish Armed Forces
Dog Training Center – HISTORY

1911: First dogs in training for military use

1936: The Army established the first dog unit

Since 1952: Patrol dogs, Mine Detection Dogs and Explosives Detection Dogs have served in Gaza, Sinai, Lebanon, Bosnia, Kuwait, Cambodia, Kosovo, Laos and Afghanistan

1980: The Air Force established today’s Dog Training Center

Since 2004: (New) breeding program

>100 years of dog service!
The Swedish Armed Forces
Dog Training Center – TASKS

- Administration of all Military Working Dogs within the Armed Forces
- Supplying the Armed Forces - and the Police - with capable dogs
- Training and educating personnel in dog service
- Development of the dog service
- Collaboration with other countries and governmental organisations
- Breeding of dogs (German Shepherd)
Patrol dogs

Detecting, searching and tracking people. Used over wide areas and in buildings, on or off leash. Used within all branches of the fighting service.
Explosives detection dogs

Detecting firearms, and commercial, military and home-made explosives
From puppy to breeder

- Puppies born
  - 5% rejected prior to weaning
  - 40% rejected as breeders for medical reasons (individual or litter). Considered for training.
  - 45% rejected as breeders for temperament reasons (individual or litter). Considered for training.

- 7% of males and 14% of females recruited as breeders (of which 10% rejected due to, for example, infertility)
Temperament test

15-18 months old – temperament test and veterinary examination

The ratings made during the test can be aggregated into three composite traits

Engagement and Confidence predict training outcome, Aggression does not

**Characteristics of dogs with high/low levels of Engagement and Confidence**

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Confidence</strong></td>
<td>Fearful, insecure, dependent, sensitive, easy to train in obedience tasks, easy to control</td>
<td>Courageous, stable, independent, insensitive</td>
</tr>
<tr>
<td><strong>Engagement</strong></td>
<td>Phlegmatic, no desire to play or to chase objects/prey</td>
<td>Lively, energetic, responsive, needs to be activated</td>
</tr>
</tbody>
</table>
Test results for Engagement and Confidence have improved

Period
A. Breeding dogs from Sweden
B. Breeding dogs recruited among European sport dogs
C. Breeding dogs from SAF breeding program
Development

- Create better structure regarding how information is recorded, stored and utilized. **Develop database!**

…otherwise nothing else will work smoothly.
Why EBVs?

Purpose of breeding = genetic improvement, which requires selecting the genetically best animals as parents.

But: A phenotypically good dog is not necessarily genetically good (and vice versa)!

EBVs are effective – the most objective way to rank animals based on their genetic qualities:

- Phenotype adjusted for environmental factors
- Information from relatives taken into account
Factors affecting the rate of genetic progress

- Heritability
- Number of records per dog
- Tested relatives
- Pedigree structure
- Correlation with breeding goal
- Measurement method
- Inbreeding
- Number of tested dogs
- Relevant traits
- Age of breeding animals
- Accuracy of selection
- Selection intensity
- Genetic variation (SD)

Annual genetic progress = Generation interval
Factors affecting the rate of genetic progress

Method for genetic evaluation

Annual genetic progress = Accuracy of selection × Selection intensity × Genetic variation (SD)

Generation interval

Method for genetic evaluation
Temperament test

- 12 sub-tests
- Approximately 40 minutes per dog
- 24 behaviour ratings during the test (BR score sheet)
- 14 traits subjectively rated after the test (SR score sheet)

1. Affability
2. Competetiveness
3. Hunting drive
4. Environmental sureness
5. Courage
6. Nerve stability
7. Hardness
8. Liveliness
9. Sharpness
10. Defense drive
11. Cooperativeness
12. Prey drive
13. Curiosity
14. Gun shyness
# Behaviour ratings (BR)

<table>
<thead>
<tr>
<th>Sub-test</th>
<th>Rating</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual startle</td>
<td>Flight distance</td>
<td>Escapes &gt;5 m</td>
<td>Escapes 2-5 m</td>
<td>Escapes 1-2 m</td>
<td>Jerks without escaping</td>
<td>No fear response</td>
</tr>
<tr>
<td>Visual startle</td>
<td>Aggression</td>
<td>No sign of aggr.</td>
<td>Some signs of aggr.</td>
<td>Several signs of aggr.</td>
<td>Several signs of aggr. and attack</td>
<td>Aggr., attacks, bites</td>
</tr>
</tbody>
</table>

# Subjective ratings (SR)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Definition</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courage</td>
<td>&quot;The absence of fearful behaviour toward real or imagined danger…”</td>
<td>Insignificant</td>
<td>Weak</td>
<td>Some</td>
<td>Strong</td>
<td>Very strong</td>
</tr>
</tbody>
</table>


## Heritabilities

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td>0.22 0.28</td>
</tr>
<tr>
<td>Confidence</td>
<td>0.23 0.19</td>
</tr>
<tr>
<td>Aggression</td>
<td>0.18 0.12</td>
</tr>
</tbody>
</table>
Temperament profiles of different categories of dogs

- Breeding
- SAF Patrol
- SAF Search
- Other WD
- Police
- Reject/Temperament
- Euth/behavioral

- Aggression
- Confidence
- Engagement
101 questions on frequency or intensity of a dog’s typical behaviour. Can be condensed into 15 composite traits.

Thinking back over the recent past, please indicate how often your dog has chased or would chase squirrels, rabbits and other small animals given the opportunity:

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Please indicate your own dog’s recent tendency to display fearful behavior in response to sudden or loud noises (e.g. vacuum cleaner, car backfire, road drills, objects being dropped, etc.):

<table>
<thead>
<tr>
<th>No fear/anxiety: No visible signs of fear</th>
<th>Mild—Moderate fear/anxiety</th>
<th>Extreme fear: cowards; retreats or hides, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
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</table>
Development

• Better definition of breeding goal (e.g., improved definition of suitable temperament; investigate reasons for vet. treatments, retirement, and genetic correlations btw traits; include robustness and longevity…)

• Earlier/better temperament assessment

• Develop Estimated Breeding Values (EBVs) and start using these for selection

• International collaboration

• Genomic selection? Optimal Contribution Selection?
Puppy born

8 weeks old - puppy to foster home

15-18 months old – temperament test and veterinary examination

Rejected (sold to private home)

Selected (sold) for service outside SAF; bitches “lost” for breeding

Selected for training/breeding within SAF

Prior to test: OCS to identify females of particular value from a coancestry perspective

OCS all dogs still available for breeding, including EBVs

Selected for service within SAF; bitches “lost” for breeding

Selected for breeding (among service dogs only males available)

(Only males)

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Challenges...example 2:

Some dogs "consume" lots of foster homes

<table>
<thead>
<tr>
<th>Number of host families</th>
<th>Number of dogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1046</td>
</tr>
<tr>
<td>2</td>
<td>326</td>
</tr>
<tr>
<td>3</td>
<td>94</td>
</tr>
<tr>
<td>4-5</td>
<td>34</td>
</tr>
</tbody>
</table>

(Mean = 1.41 families/dog)

Challenge = Dogs who consume many foster homes to a higher degree pass the temperament test
Engagement and Confidence related to number of host families consumed