

Chromosome damage: a cause of small litters in swine

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Summary— A study of parity-specific production values for 68 North American swine breeding herds revealed that nearly 10% of litters had less than 7 piglets.¹ In a recent Minnesota study of swine production on 84 farms, over 18% of the boars culled were removed for unspecified reproductive difficulties.² No examination of their chromosomes was made.

The most common chromosomal abnormalities in swine are chromosome reciprocal translocations (CRT). They result from chromosomal breakage and faulty rearrangement during sperm and egg formation. They have been shown in Europe to be an important inherited cause of small litters.³ It is estimated that 50% of boars that sire an average of fewer than 8 liveborn piglets per litter are hypoprolific because of inherited CRT's. There are 33 different CRT's known worldwide which, on the average, reduce litter size 30%-50%. These boars have sperm with normal structure and motility.

Recently we surveyed PigCHAMP® data from 8203 boars, of which 4412 had six or more monospermic-mated litters.⁴ Of these, 165 (3.7%) were found to be hypoprolific. This is 25 times higher than the estimated rate of hypoprolificacy found in France, where programs for chromosome testing of breeding stock have been used for approximately 20 years. In another study, the prolificacy of 15 boars that had at least six monospermic matings was determined.⁴ Among them we identified one boar with an average of 7.1 liveborn piglets from single boar/single service matings. When the same sows were bred with the other 14 boars (cytogenetically normal) the average litter size increased to 10.8 piglets (Table 1). The affected boar had a 1/14 CRT; a large portion of chromosome 14 was added to chromosome 1 (Fig 1). This same 1/14 CRT condition was inherited by four of 15 offspring examined from three litters sired by the affected boar.

Chromosomal analyses were carried out on heparinized blood (5 mL Vacutainer® tube) within 48 hours of collection and kept at room temperature.

Conclusion

- Swine specialists and producers must become aware that chromosomal abnormalities cause

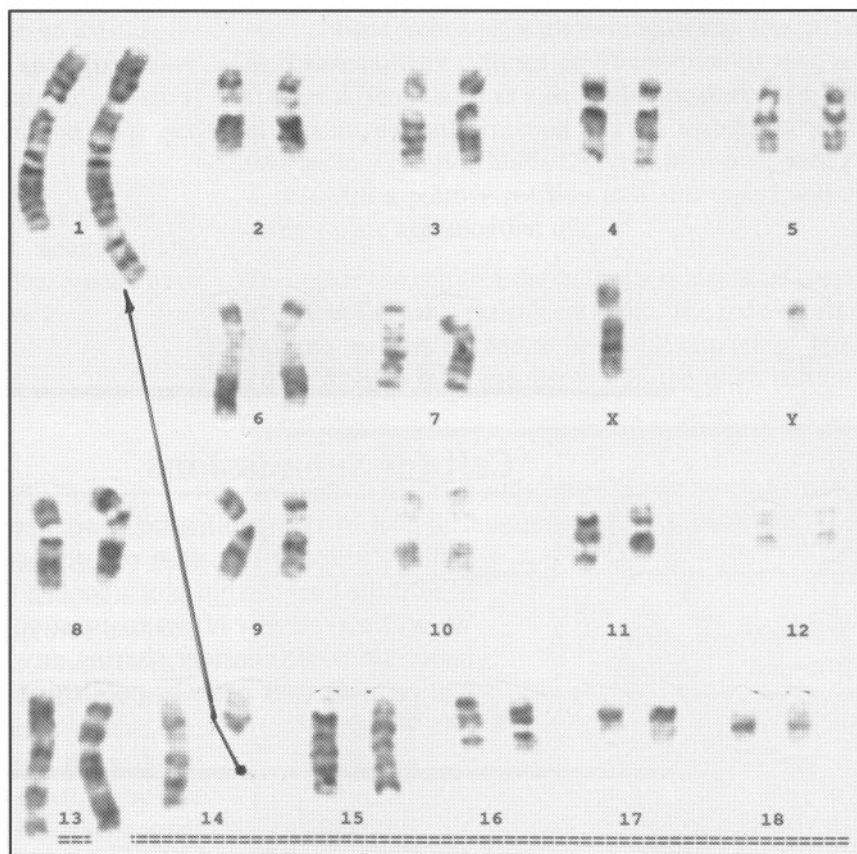


Fig 1.— Karyotype of a boar with a 1/14 chromosomal reciprocal translocation. Note that a part of one of the chromosome-14 pair is attached to one of the chromosome-1 pair.

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Table 1.— Effect of the 1/14 CRT boar on prolificacy

	Number of litters	Average litter size
Affected Boar	51	7.1 ±2.5
Normal Boars	167	10.8 ±2.6

Group: same sows; *P*-value < 0.0001

small litters and can have an economic impact on swine production;

- Production records should be checked to find boars that have sired small litters;
- Boars that sire small litters should have their chromosomes examined (cytogenetic testing) to determine if they are carriers of a CRT condition:
—if they are carriers of a CRT condition, any of their offspring retained for future breeding should be cytogenetically tested to determine if they have

inherited this disorder. Chances are that one-half or more of these offspring will be affected.

—if they are normal, investigative efforts can then be directed toward other causes of small litters.

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