A Dihybrid Cross: New Tables of Genotype and Phenotype of The F2 Generation

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ABSTRACT:

It is a pedagogical reformatting to deduce the phenotypic and genotypic ratios of second-generation individuals in a dihybrid cross, which has become easier by using the ratios observed in a monohybrid cross as a basis. (The genotypic and phenotypic ratios of F2 offspring in a dihybrid cross can be derived more directly by applying the frequency ratios from individual monohybrid crosses)

Keywords: Phenotype, Genotype, Cross, Hybrid, Monohybrid, Dihybrid

Main text

A dihybrid cross involves breeding individuals with distinct alleles at two genetic loci (Solomon et al., 2011). Genetics textbooks commonly use a 4x4 table to determine the genotypes and phenotypes of F2-generation offspring, as depicted in Figure 1. We present an alternative method for calculating phenotypic and genotypic ratios in a Mendelian dihybrid cross which be considered as a novel approach for establishing the F2 generation in dihybrid cross genotypes (Table 3) and phenotypes (Table 4) (We present a method for deriving the genotypic (Table 3) and phenotypic (Table 4) ratios of the F2 generation in a dihybrid cross.") by utilising data directly obtained from monohybrid crosses (Fig.2, Tables 1 and 2).,

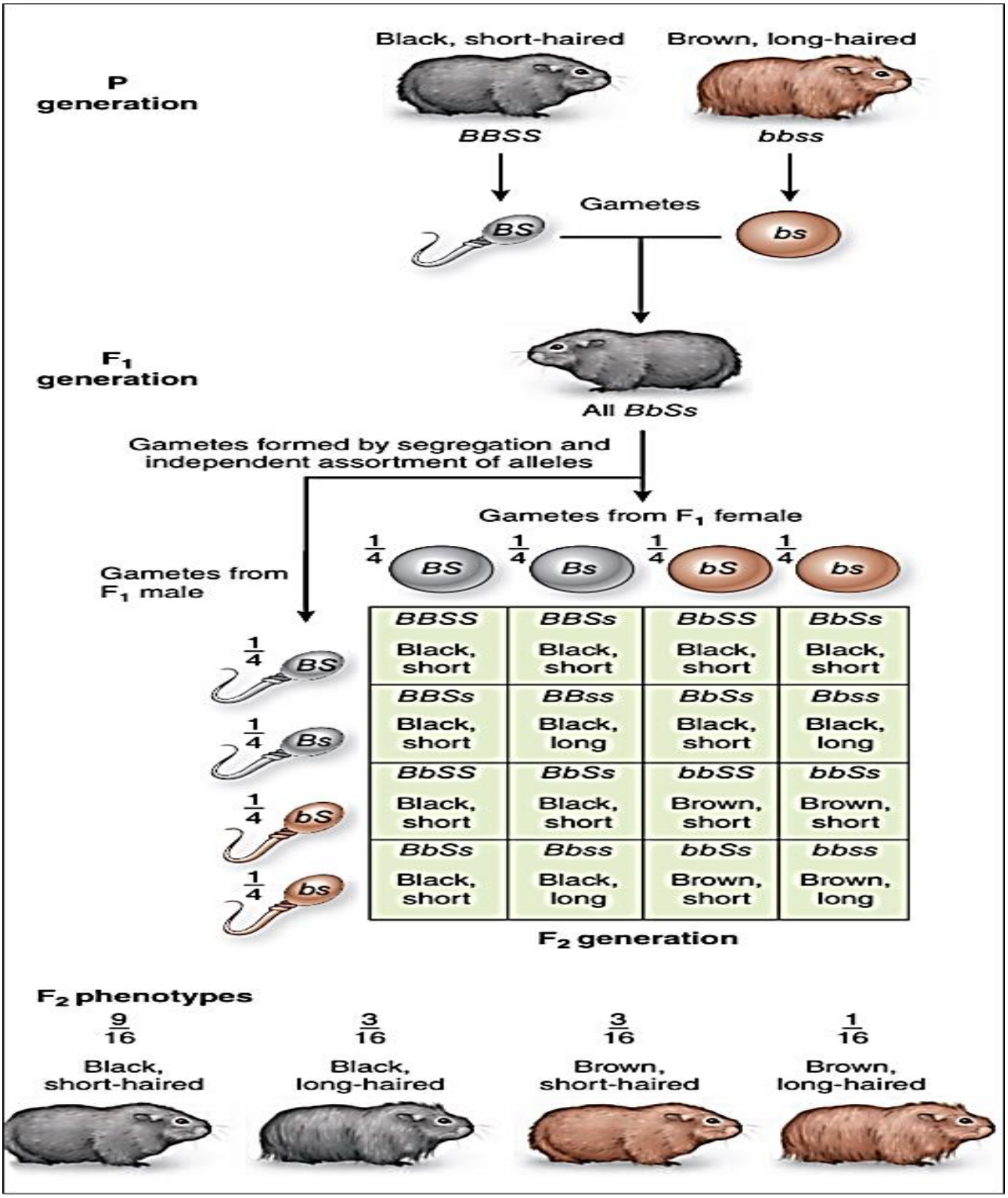

Figure 1. Dihybrid cross in guinea pigs (Solomon et al., 2011).

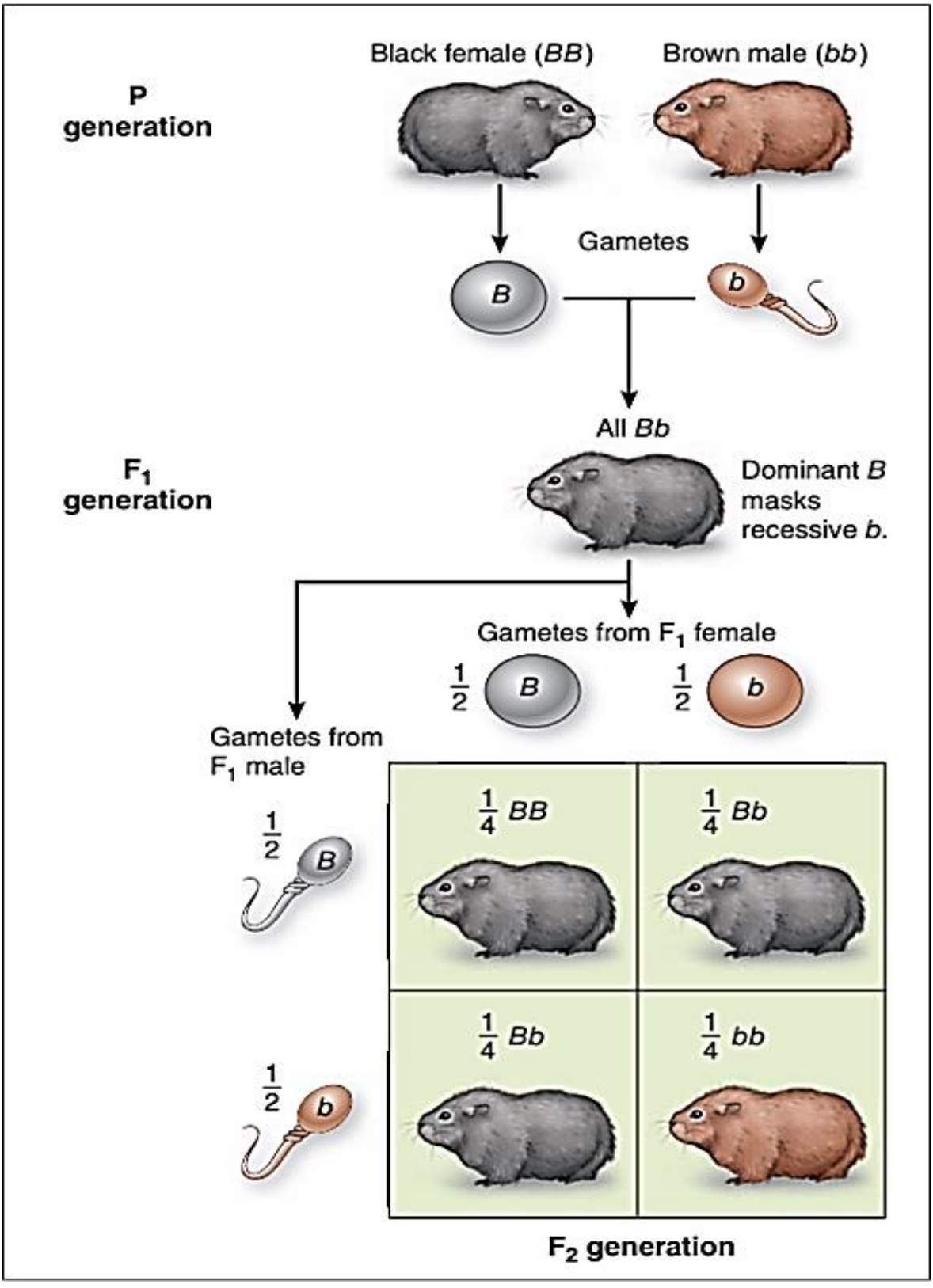

Figure 2. Monohybrid cross in guinea pigs (Solomon et al., 2011).

In the following example, a parent P1, a guinea pig with genotype BBSS, is crossed with a parent P2, a guinea pig with genotype aabb; thus, alleles S and B are dominant, and alleles s and b are recessive.

Table 1. Monohybrid cross: Genotype of F2 generation for hair length (S/s locus)

Gametes	**½ S**	**½ s**
½ S	**¼ SS**	**¼ Ss**
½ s	**¼ Ss**	**¼ ss**

Genotype: ¼ SS, 2/4 Ss and ¼ ss

Phenotype: ¾ Short and ¼ Long

Table 2. Monohybrid cross: Genotype of F2 generation for coat colour (B/b locus)

Gametes	**½ B**	**½ b**
½ B	**¼ BB**	**¼ Bb**
½ b	**¼ Bb**	**¼ bb**

Genotype: ¼ BB, 2/4 Bb and ¼ bb

Phenotype: ¾ Black and ¼ Brown

We use ratios of the monohybrid cross of each character to produce the F2 genotype and phenotype in the dihybrid cross.

Table 3. Dihybrid cross: Genotype ratios of F2 generation

F2 Genotype	**1/4SS**	**2/4Ss**	**1/4ss**
1/4BB	1/16 SS BB	2/16 Ss BB	1/16 ss BB
2/4Bb	2/16 SS Bb	4/16 Ss Bb	2/16 ss Bb
1/4bb	1/16 SS bb	2/16 Ss bb	1/16 ss bb

Table 4. Dihybrid cross: Phenotype ratios of F2 generation

Phenotype	**¾ Short**	**¼ long**
¾ Black	9/16 Black Short	3/16 Black Long
¼ Brown	3/16 Brown Short	1/16 Brown Long

Conclusions

The new table simplifies the process compared to the old method, facilitating the comprehension of binary hybrids, such as monohybrids, for secondary education teachers and students. This approach can be extended to trihybrid and tetrahybrid crosses, offering teachers and students a scalable method applicable beyond the dihybrid case.

Declarations

Ethical Approval and Consent to participate: "Not applicable".

Consent for publication: "Not applicable".

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Reference

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