

Table 4 Two-locus haplotype probabilities at generation F_k in the formation of four-way RIL by sibling mating

Chr.	Individual	Prototype	No. states	Probability of each
A	Random	AA	4	$\frac{1}{4(1+6r)} - \left[\frac{6r^2-7r-3rs}{4(1+6r)s} \right] \left(\frac{1-2r+s}{4} \right)^k + \left[\frac{6r^2-7r+3rs}{4(1+6r)s} \right] \left(\frac{1-2r-s}{4} \right)^k$
		AB	4	$\frac{r}{2(1+6r)} + \left[\frac{10r^2-r-rs}{4(1+6r)s} \right] \left(\frac{1-2r+s}{4} \right)^k - \left[\frac{10r^2-r+rs}{4(1+6r)s} \right] \left(\frac{1-2r-s}{4} \right)^k$
		AC	8	$\frac{r}{2(1+6r)} - \left[\frac{2r^2+3r+rs}{4(1+6r)s} \right] \left(\frac{1-2r+s}{4} \right)^k + \left[\frac{2r^2+3r-rs}{4(1+6r)s} \right] \left(\frac{1-2r-s}{4} \right)^k$
X	Female	AA	2	$\frac{1}{3(1+4r)} + \frac{1}{6(1+r)} \left(-\frac{1}{2} \right)^k - \left[\frac{4r^3-(4r^2+3r)t+3r^2-5r}{4(4r^2+5r+1)t} \right] \left(\frac{1-r+t}{4} \right)^k + \left[\frac{4r^3+(4r^2+3r)t+3r^2-5r}{4(4r^2+5r+1)t} \right] \left(\frac{1-r-t}{4} \right)^k$
		AB	2	$\frac{2r}{3(1+4r)} + \frac{r}{3(1+r)} \left(-\frac{1}{2} \right)^k + \left[\frac{2r^3+6r^2-(2r^2+r)t}{2(4r^2+5r+1)t} \right] \left(\frac{1-r+t}{4} \right)^k - \left[\frac{2r^3+6r^2+(2r^2+r)t}{2(4r^2+5r+1)t} \right] \left(\frac{1-r-t}{4} \right)^k$
		AC	4	$\frac{2r}{3(1+4r)} - \frac{r}{6(1+r)} \left(-\frac{1}{2} \right)^k - \left[\frac{9r^2+5r+rt}{4(4r^2+5r+1)t} \right] \left(\frac{1-r+t}{4} \right)^k + \left[\frac{9r^2+5r-rt}{4(4r^2+5r+1)t} \right] \left(\frac{1-r-t}{4} \right)^k$
		CC	1	$\frac{1}{3(1+4r)} - \frac{1}{3(1+r)} \left(-\frac{1}{2} \right)^k + \left[\frac{9r^2+5r+rt}{2(4r^2+5r+1)t} \right] \left(\frac{1-r+t}{4} \right)^k - \left[\frac{9r^2+5r-rt}{2(4r^2+5r+1)t} \right] \left(\frac{1-r-t}{4} \right)^k$
X	Male	AA	2	$\frac{1}{3(1+4r)} - \frac{1}{3(1+r)} \left(-\frac{1}{2} \right)^k + \left[\frac{r^3-(8r^3+r^2-3r)t-10r^2+5r}{2(4r^4-35r^3-29r^2+15r+5)} \right] \left(\frac{1-r+t}{4} \right)^k + \left[\frac{r^3+(8r^3+r^2-3r)t-10r^2+5r}{2(4r^4-35r^3-29r^2+15r+5)} \right] \left(\frac{1-r-t}{4} \right)^k$
		AB	2	$\frac{2r}{3(1+4r)} - \frac{2r}{3(1+r)} \left(-\frac{1}{2} \right)^k + \left[\frac{r^4+(5r^3-r)t-10r^3+5r^2}{4r^4-35r^3-29r^2+15r+5} \right] \left(\frac{1-r+t}{4} \right)^k + \left[\frac{r^4-(5r^3-r)t-10r^3+5r^2}{4r^4-35r^3-29r^2+15r+5} \right] \left(\frac{1-r-t}{4} \right)^k$
		AC	4	$\frac{2r}{3(1+4r)} + \frac{r}{3(1+r)} \left(-\frac{1}{2} \right)^k - \left[\frac{2r^4+(2r^3-r^2+r)t-19r^3+5r}{2(4r^4-35r^3-29r^2+15r+5)} \right] \left(\frac{1-r+t}{4} \right)^k - \left[\frac{2r^4-(2r^3-r^2+r)t-19r^3+5r}{2(4r^4-35r^3-29r^2+15r+5)} \right] \left(\frac{1-r-t}{4} \right)^k$
		CC	1	$\frac{1}{3(1+4r)} + \frac{2}{3(1+r)} \left(-\frac{1}{2} \right)^k + \left[\frac{2r^4+(2r^3-r^2+r)t-19r^3+5r}{4r^4-35r^3-29r^2+15r+5} \right] \left(\frac{1-r+t}{4} \right)^k + \left[\frac{2r^4-(2r^3-r^2+r)t-19r^3+5r}{4r^4-35r^3-29r^2+15r+5} \right] \left(\frac{1-r-t}{4} \right)^k$

$s = \sqrt{4r^2-12r+5}$ and $t = \sqrt{r^2-10r+5}$; the autosomal haplotype probabilities are valid for $r < \frac{1}{2}$.