Each *R. classicum* bacterium will do one of two things: split into two copies of itself with probability p or die with probability $1-p$.

Let the probability of colony extinction be D. This probability is the sum of $1-p$, representing death of the initial bacterium, and $p \times D^2$, representing the probability that the progeny line from each offspring also goes to extinction. We then have:

$$D = (1-p) + p \times D^2$$

$$0 = pD^2 - D + (1-p)$$

Factoring:

$$0 = \big(pD - (1-p)\big)(D-1)$$

$$0 = (pD + p - 1)(D-1)$$

$$0 = (p(D+1) - 1)(D-1)$$

Solving the left factor:

$$p(D+1) = 1$$

$$D = \frac{1}{p} - 1$$

However, in order to have an Everlasting colony, D is constrained:

$$1 > \frac{1}{p} - 1 \geq 0$$

$$2 > 1/p \geq 1$$

$$\frac{1}{2} < p \leq 1$$

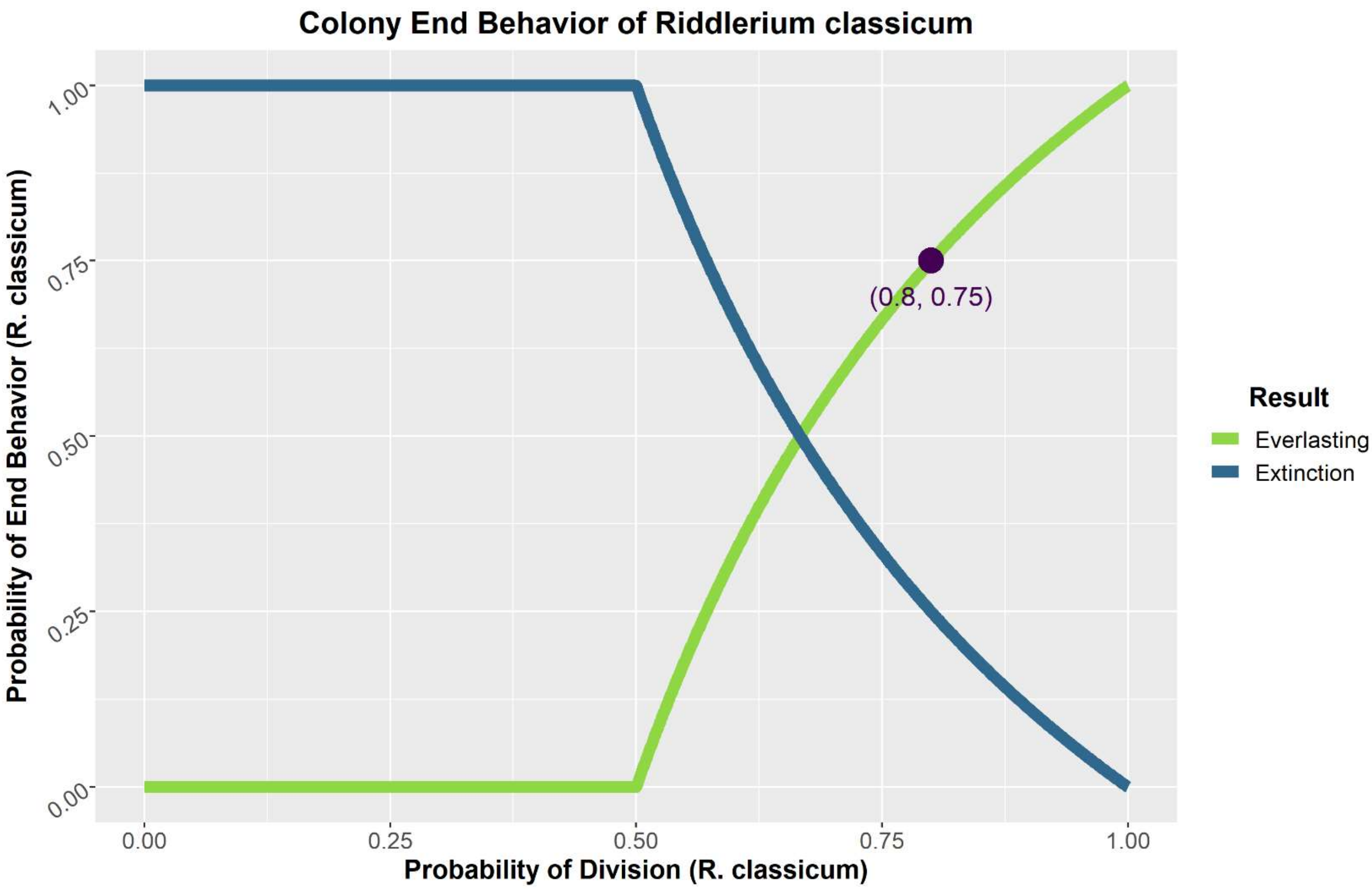
For $0 \leq p \leq \frac{1}{2}$, $D = 1$, from the earlier right factor, meaning Extinction is certain.

For $p = 0.8$, the probability of an Everlasting Colony is:

$$1 - \left(\frac{1}{p} - 1\right) = 2 - \frac{1}{p} = 2 - \frac{1}{.8} = \frac{3}{4} \; or \; 0.75$$

The results are summarized in the following table:

	Colony End Behavior of R. classicum	
Probability of Division	Extinction	Everlasting
$0 \leq p < \frac{1}{2}$	1	0
$\frac{1}{2} < p \leq 1$	$\frac{1}{p} - 1$	$2 - \frac{1}{p}$



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