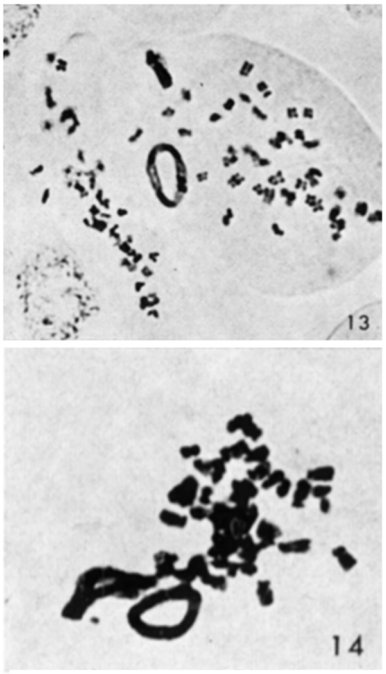
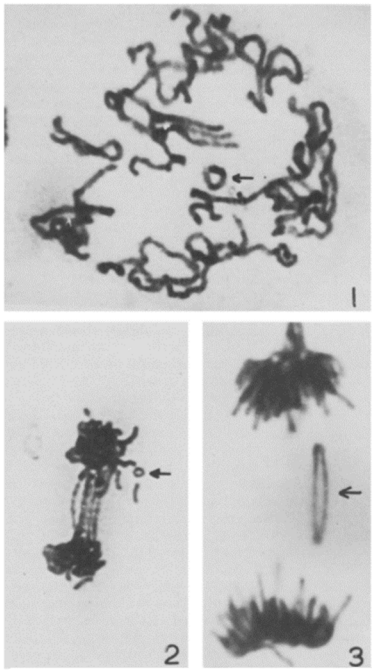
# Ring chromosomes

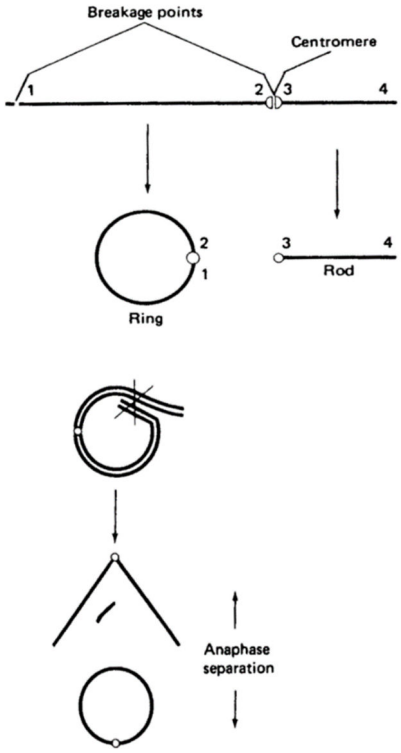
Review by **Yu, 2018**



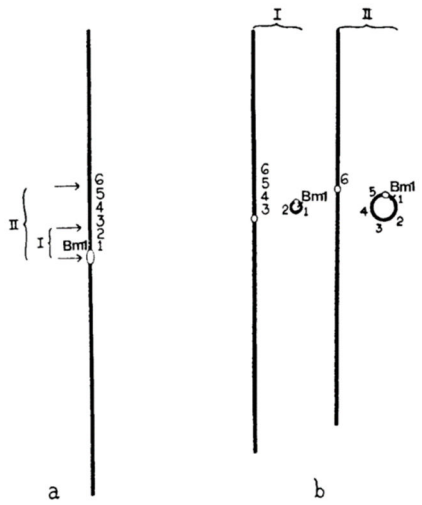

*Ring chromosomes in tobacco Gerstel & Burns, 1967*



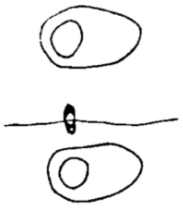

*Ring chromosomes in onion, Gohil & Kaul, 1983. Experentia 39: 1152-3.*



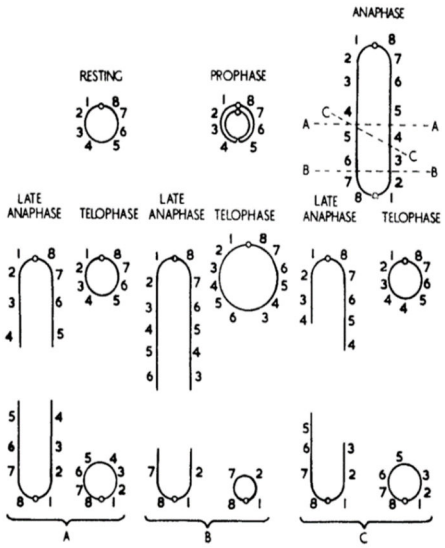

**McClintock, 1938**



| Ring size | Freq. double-sized rings |
|---|---|
| Same as rod | 15-20% |
| $^1/_{10}$ as big | 1% |
| $^1/_{25}$ as big | 0.2% |



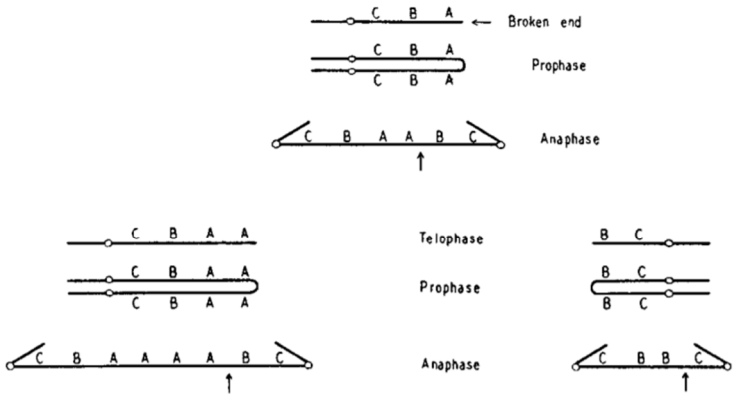
**McClintock, 1941**




## Breakage-Fusion-Bridge cycles

**McClintock, 1941; review by Jones, 2005**

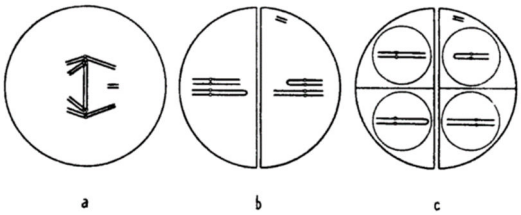
## Chromosome breakage fusion bridge cycles:

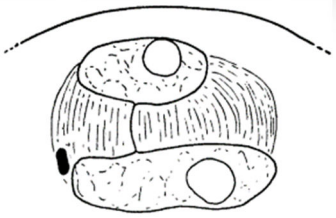



*from McClintock 1941*

## BFB in mitosis

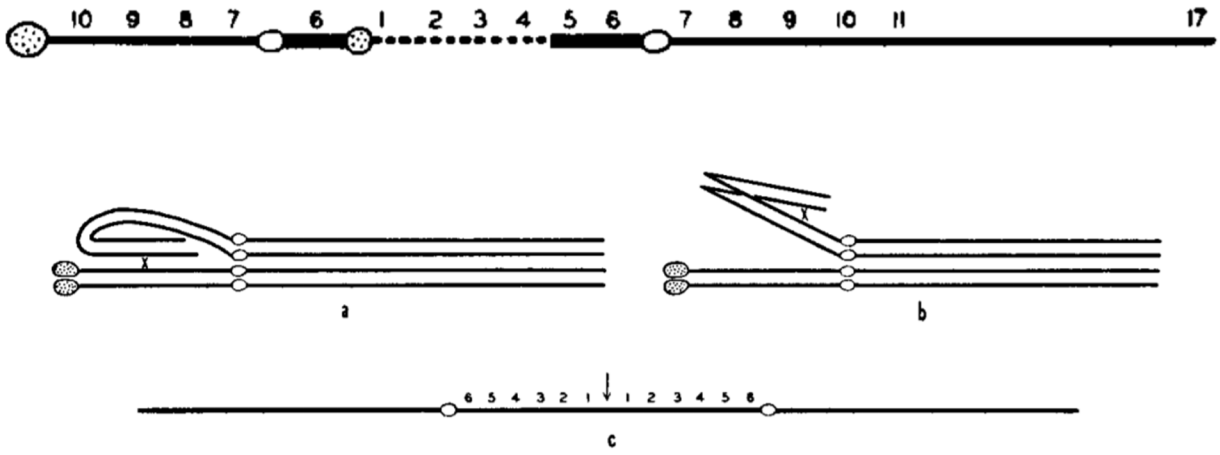
**McClintock, 1938**



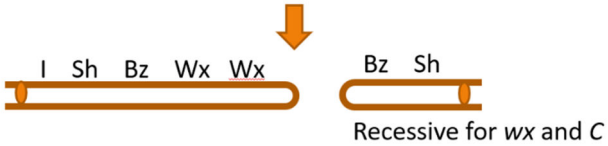


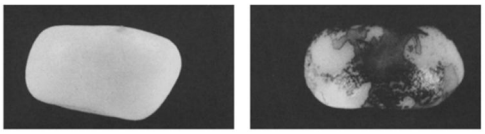
## BFB in the endosperm

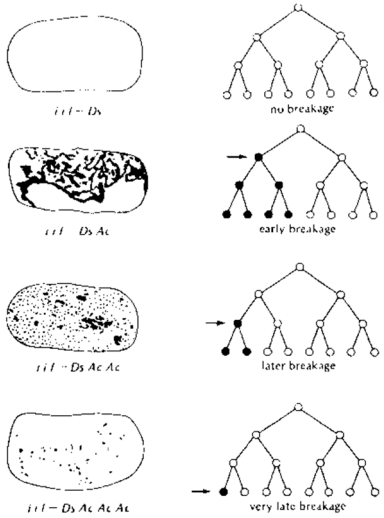
**McClintock, 1941**



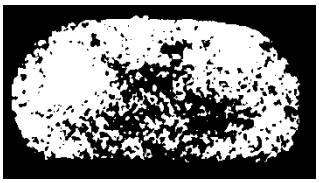
**McClintock, 1951**




*from Strickberger, 1972, after McClintock 1951*



# Rings and herbicide resistance

**Palmer amaranth, the king of weeds, cripples new herbicides**

Scientists in the US sound the alarm about a crop-smothering weed that is growing resistant to multiple herbicides

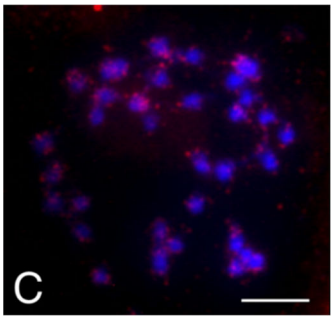
by Melody M. Bomgardner

August 3, 2019 | A version of this story appeared in Volume 97, Issue 31

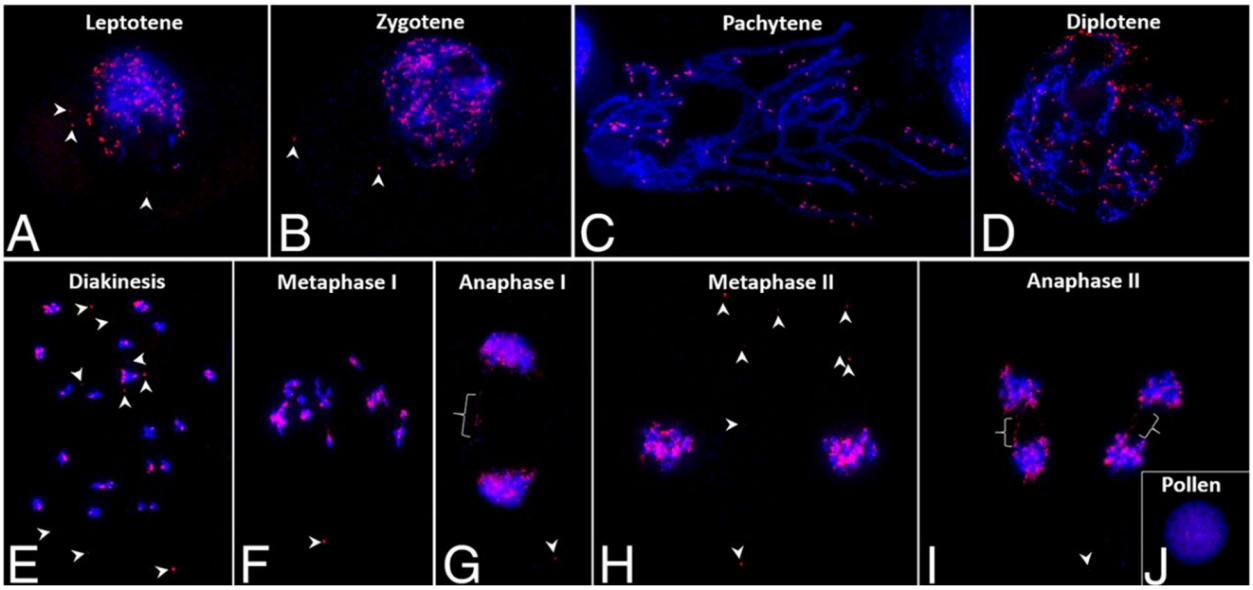
*https://cen.acs.org/business/specialty-chemicals/Palmer-amaranth-king-weeds-cripples/97/i31*

*https://cropwatch.unl.edu/2017/status-herbicide-resistant-weeds-nebraska/*

**Koo et al, 2018a; Molin et al, 2020**




*Gaines et al, 2009*




*Tethered and unthethered eccDNAs during meiosis. From Koo et al, 2018*

## Rings & BFB in herbicide tolerance

**Koo et al., 2018b**


*https://www.youtube.com/watch?v=DgpaxUkBeZA*