WHY ENHANCED PRODUCTION OF THE FLOWERS TREATED WITH EXOGENOUS BIOSTIMULANTS IS NOT CORRELATED WITH HIGHER SEED SET IN COMMON BUCKWHEAT (*FAGOPYRUM ESCULENTUM*)? – DATA FROM EMBRYOLOGY

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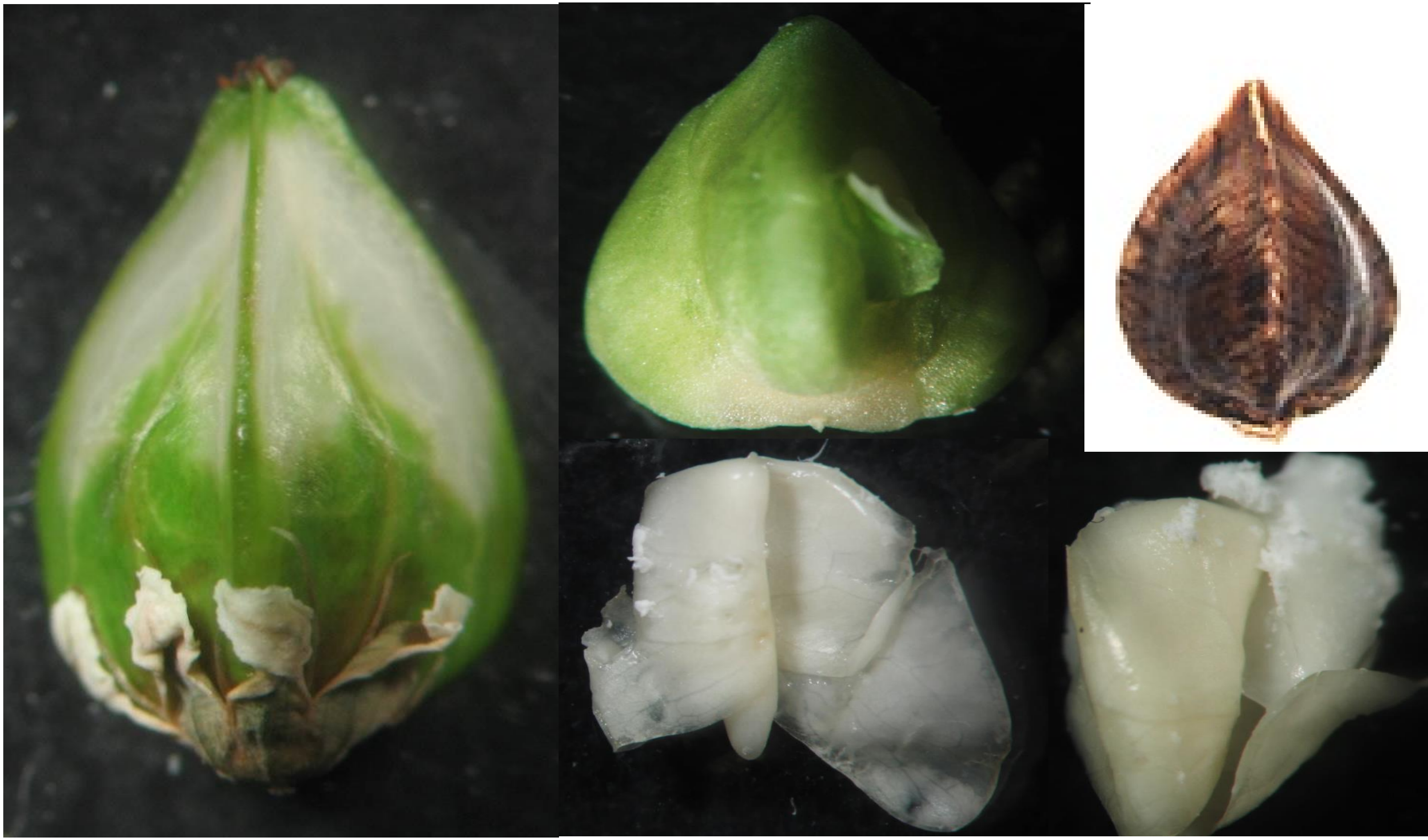
Fagopyrum esculentum Moench (Polygonaceae)



polysacharides

lipids

antioxidants (lignans)

steroles

proteins (gluten free)

vitamines (B)

minerals (K, P, Mg)

YIELD OF BUCKWHEAT

15-53%
(Cawoy et al. 2009)

YIELD IMPROVEMENT

1. **Fertilizers**
2. **Soil additives (hydrogel, zeolite)**
3. **Intense watering**
4. **Selenium spraying**
5. **etc.**

Tadin et al. 2007, Željko et al. 2014

cv. Kora

PLANT MATERIAL

http://hbp.pl/pl/rosliny-rolnicze-i-inne_91/gryka_116

AIMS

1. The reasons of low productivity
2. The possibility to incresase productivity via spraying with plant growth biostimulants (PGB)
- flower number
- seed (fruit) number
- seed (fruit) weight

Plant Growth Biostimulants (PGB)

1. Increase
- plant growth
- seed set and weight
- fruit set and weight

2. Reduce fruit drop

1. Putrescine (polyamin)
2. Cysteine (amoniacid)
3. Phytohormones
- BAP (cytokinin)
- NAA (synthetic auxin)
- GA_3 (giberelin)
4. Commercial products
- Tytanit (Ti)
- Asahi SL (nitrophenols)
5. NaCl

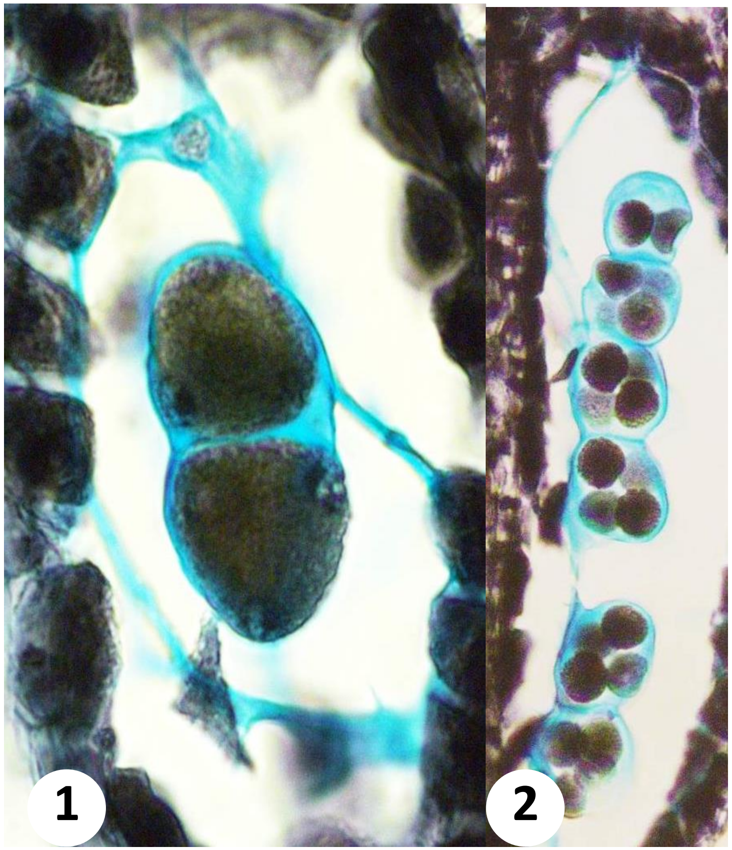
Martens et al. 1994, Khan et al. 2014

PGB	flower number		flower abortion (%)		weight of 1000 seed (g)	
	Kora	Panda	Kora	Panda	Kora	Panda
control	321.1c	419.0b	62.7e	79.1b	25.907c	28.882ab
cysteine	413.4abc	546.0a↑	72.7cd↑	77.3b	27.803ab↑	28.509ab
NAA	434.7ab↑	468.8ab	73.6c↑	78.0b	26.887abc	28.346ab
GA_3	342.3bc	373.6b	73.4c↑	78.6b	27.456abc	29.561a
Tytanit	458.2a↑	428.5b	80.3a↑	79.9b	26.359abc	27.965ab
NaCl	464.8a↑	390.3b	83.8a↑	74.2a↓	25.624c	27.966ab
Putrescine	372.0abc	449.2ab	67.7cde	76.1b	27.885a↑	28.736ab
BAP	346.8bc	467.2ab	69.7cd↑	84.1c↑	27.914a↑	29.504ab
Asahi SL	381.0abc	468.0ab	78.3b↑	79.0b	27.419abc	28.734ab
Mean	392.7	445.6	73.6	78.5	27.02	28.69

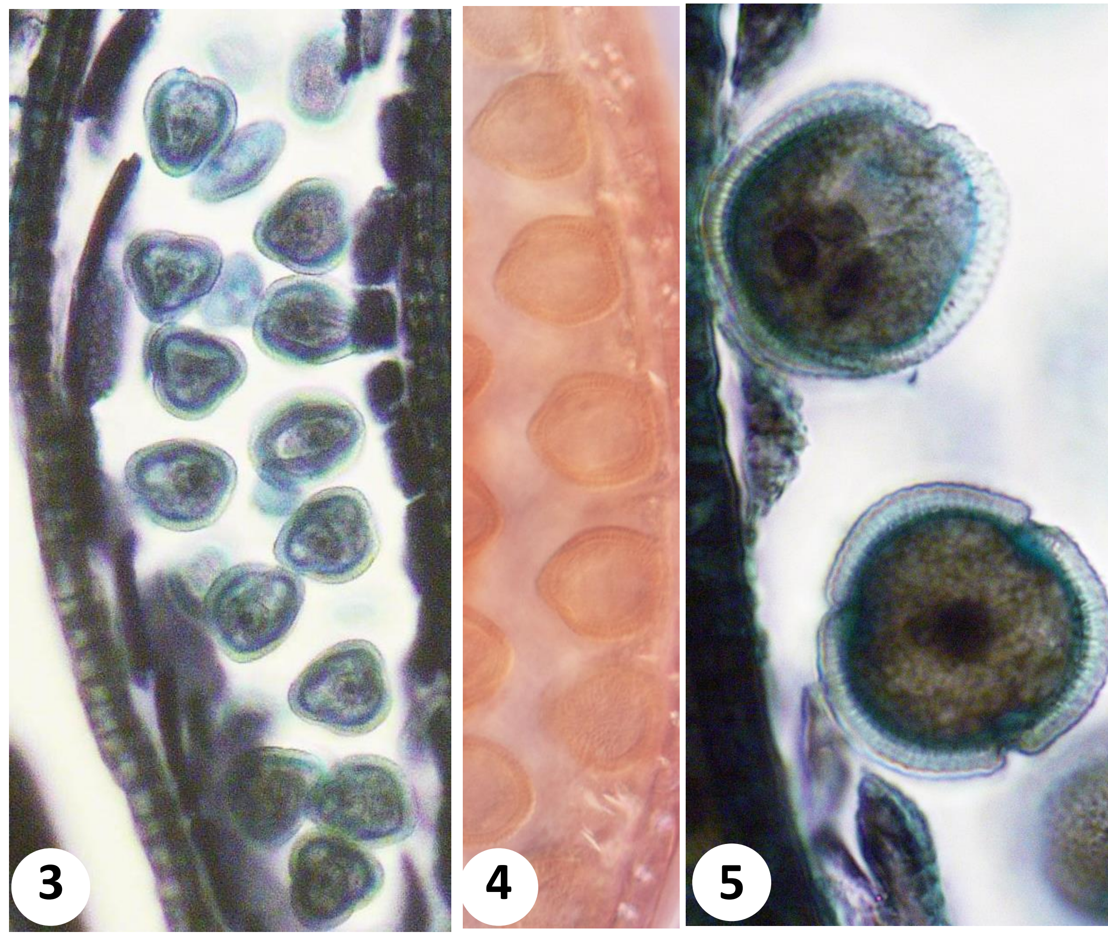
62.7-84.1%

♂

POLLEN DEVELOPMENT



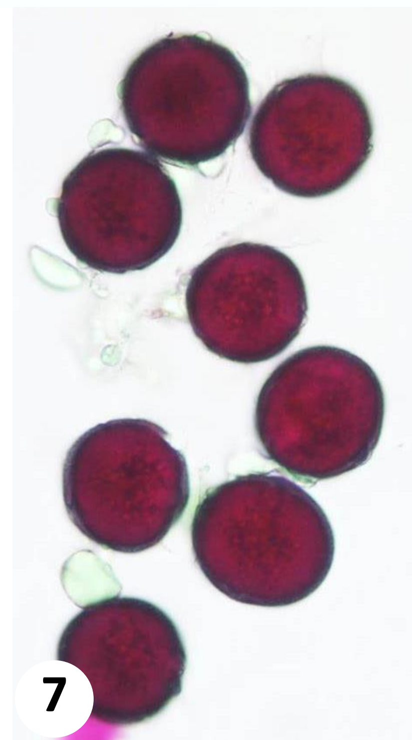
microsporogenesis

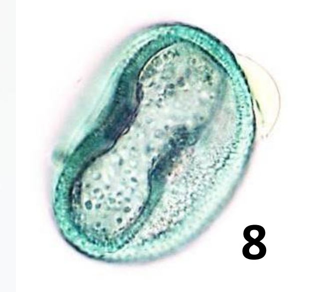


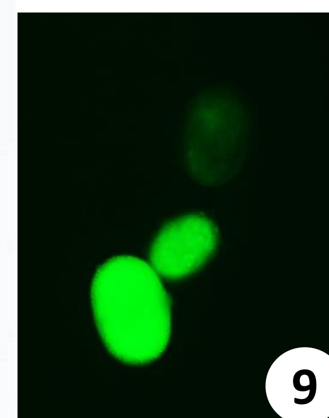
microgametophytogenesis

POLLEN VIABILITY ♂

PGB	cultivar	pollen viability (Alexander dyes) [%]	
		Mean	SD
control	Panda	99.8a	0.45
	Kora	99.8a	0.45
NAA	Panda	98.0a	3.94
	Kora	76.1b↓	18.57
BAP	Panda	91.2a	18.01
	Kora	94.6a	10.97
NaCl	Panda	99.6a	0.55
	Kora	99.8a	0.45
Asahi SL	Panda	99.8a	0.45
	Kora	99.6a	0.55
Cysteine	Panda	99.4a	0.89
	Kora	99.6a	0.55
Tytanit	Panda	98.4a	1.67
	Kora	98.6a	0.89
GA_3	Panda	95.2a	8.11
	Kora	99.8a	0.45
Putrescine	Panda	99.6a	0.55
	Kora	100.0a	0.00







Pollen germination

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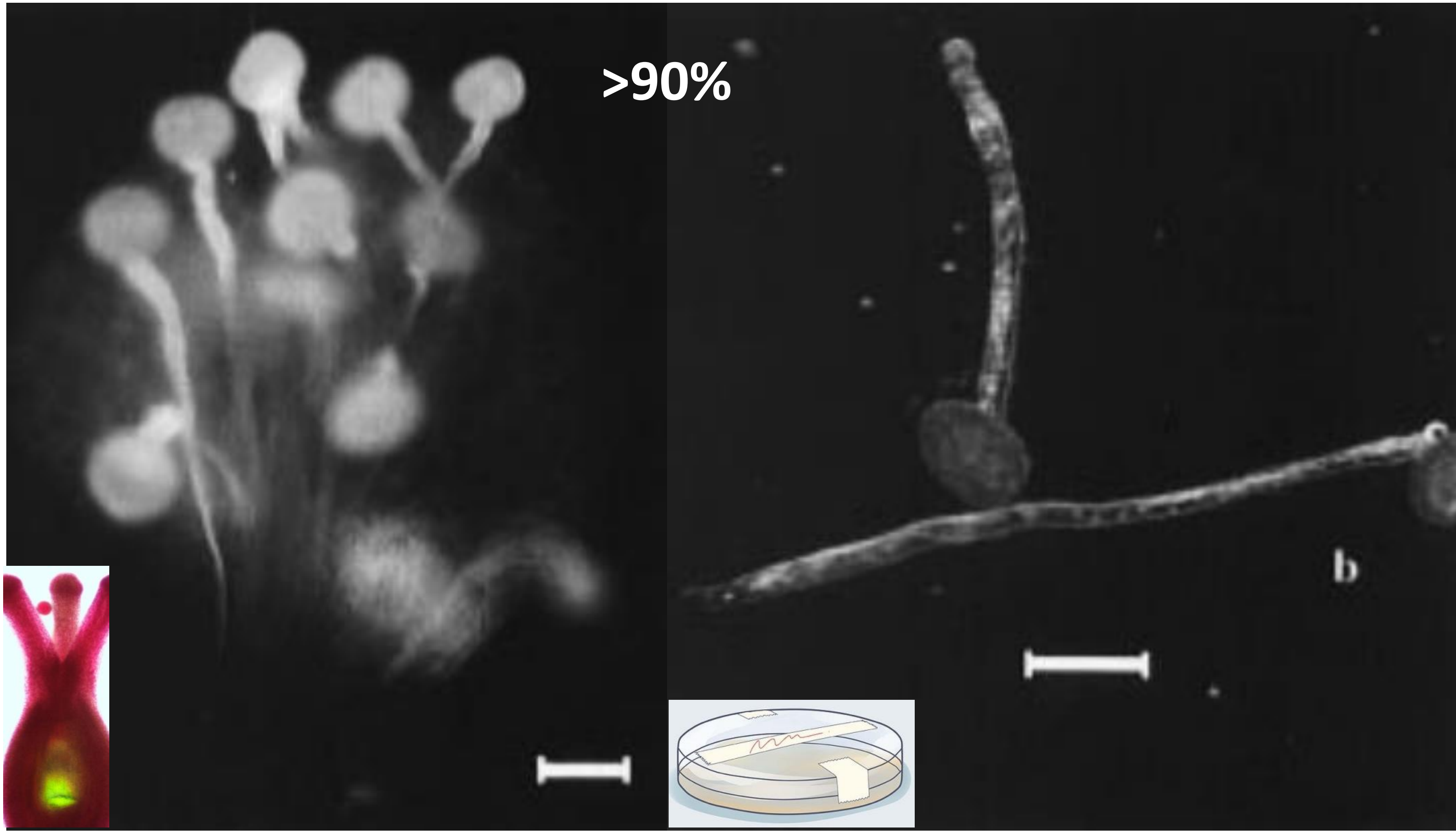

Adhikari et al. 1998

Regular development in ovules

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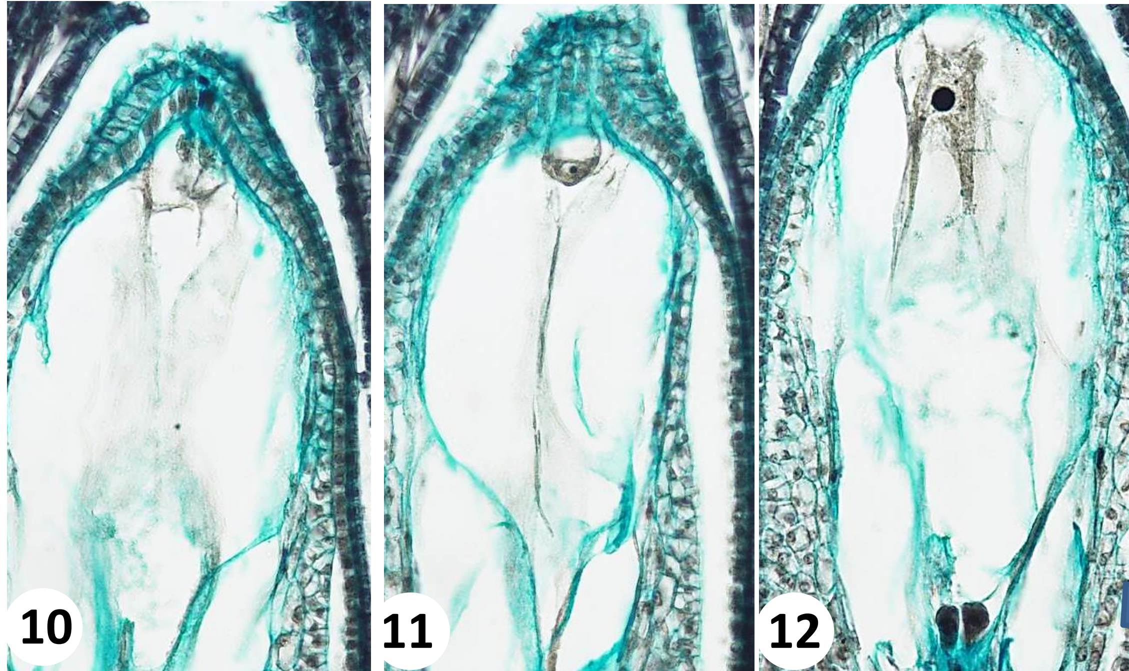
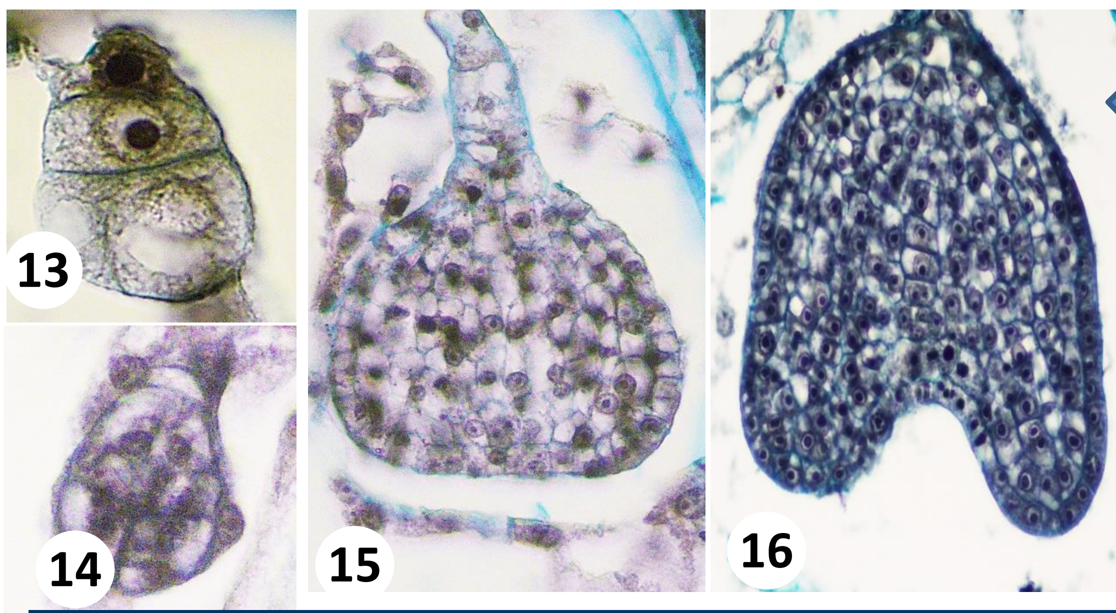
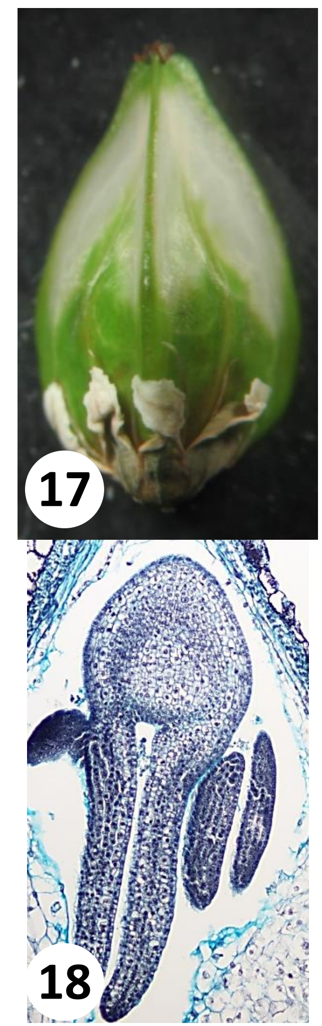


Regular female gametophyte development (Polygonum)

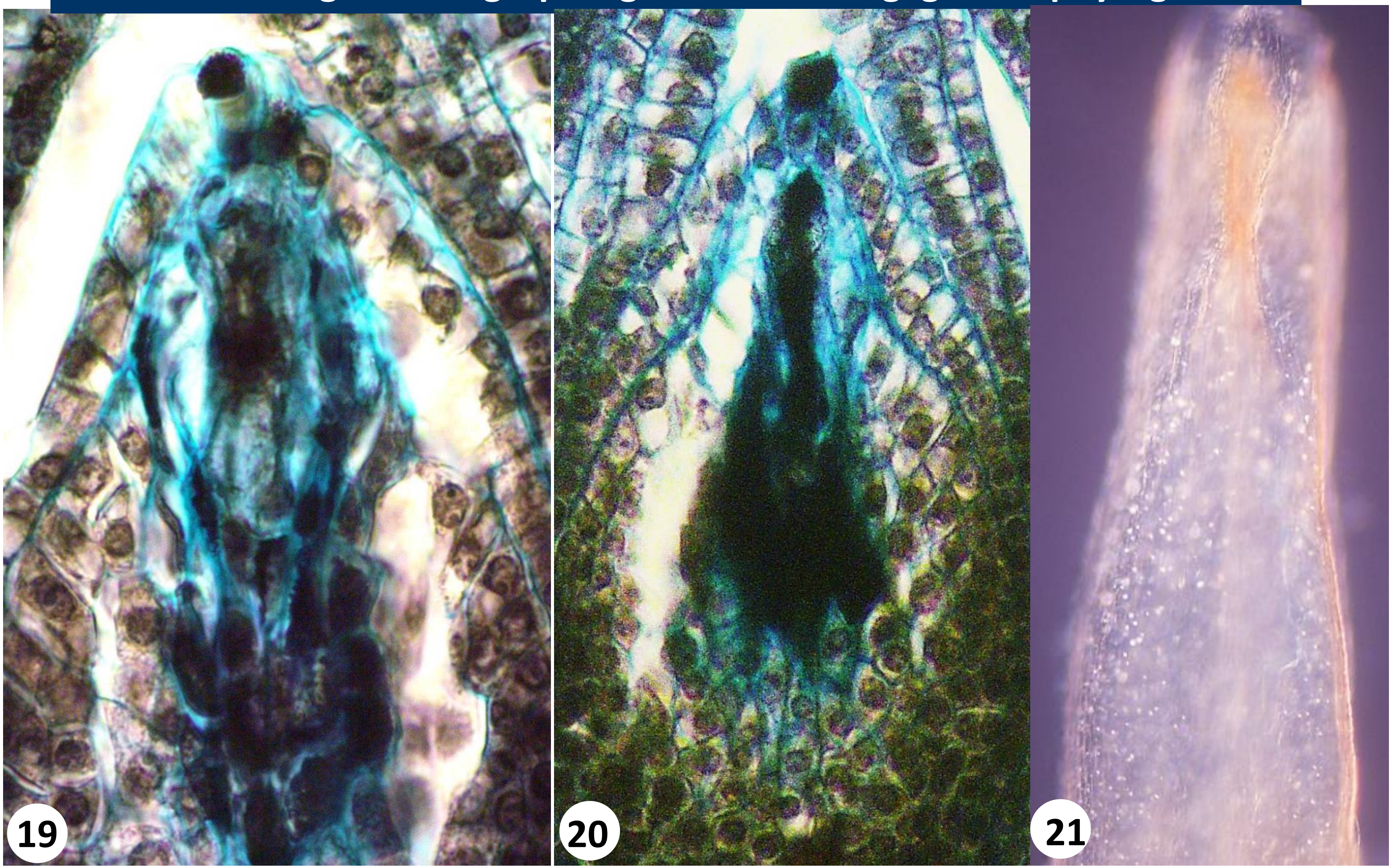


Regular embryo (Asterad) and endosperm formation



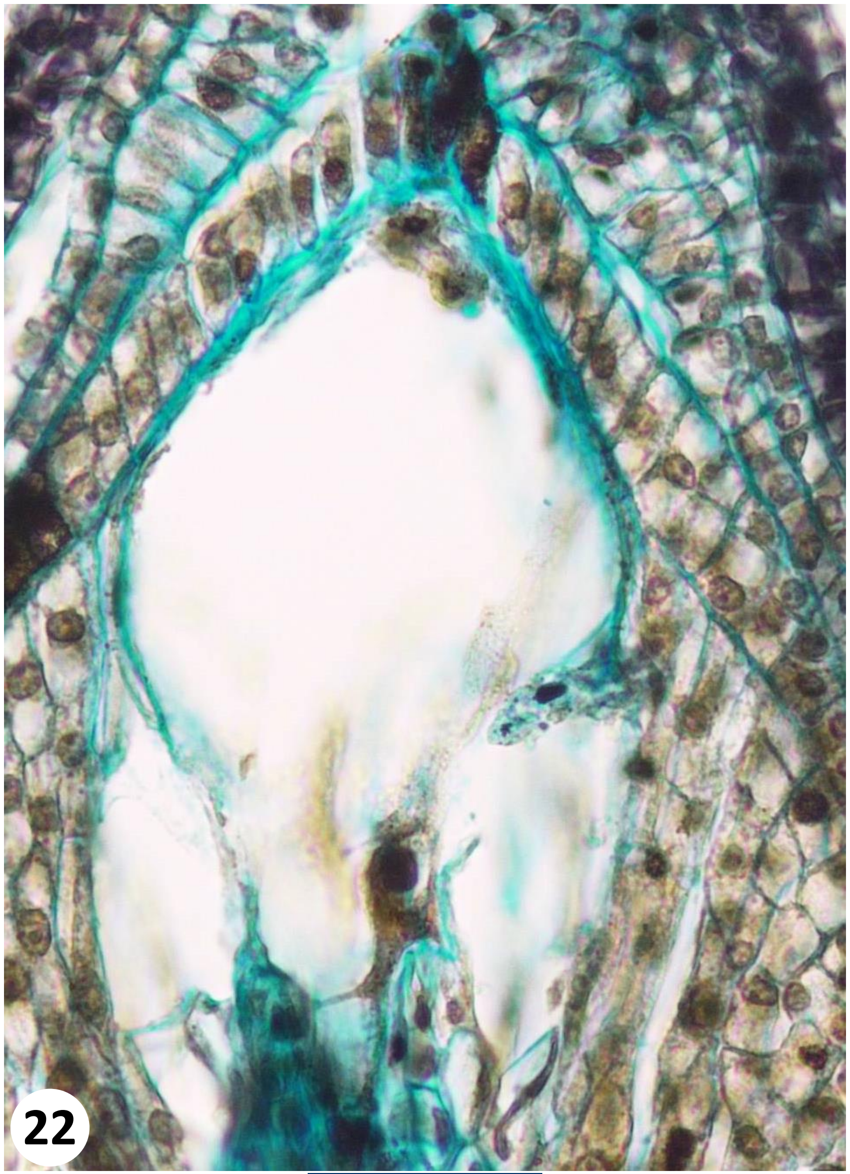
DEGENERTIONS BEFORE FERTILIZATION

1. Different stages of megasporogenesis and megagametophytogenesis

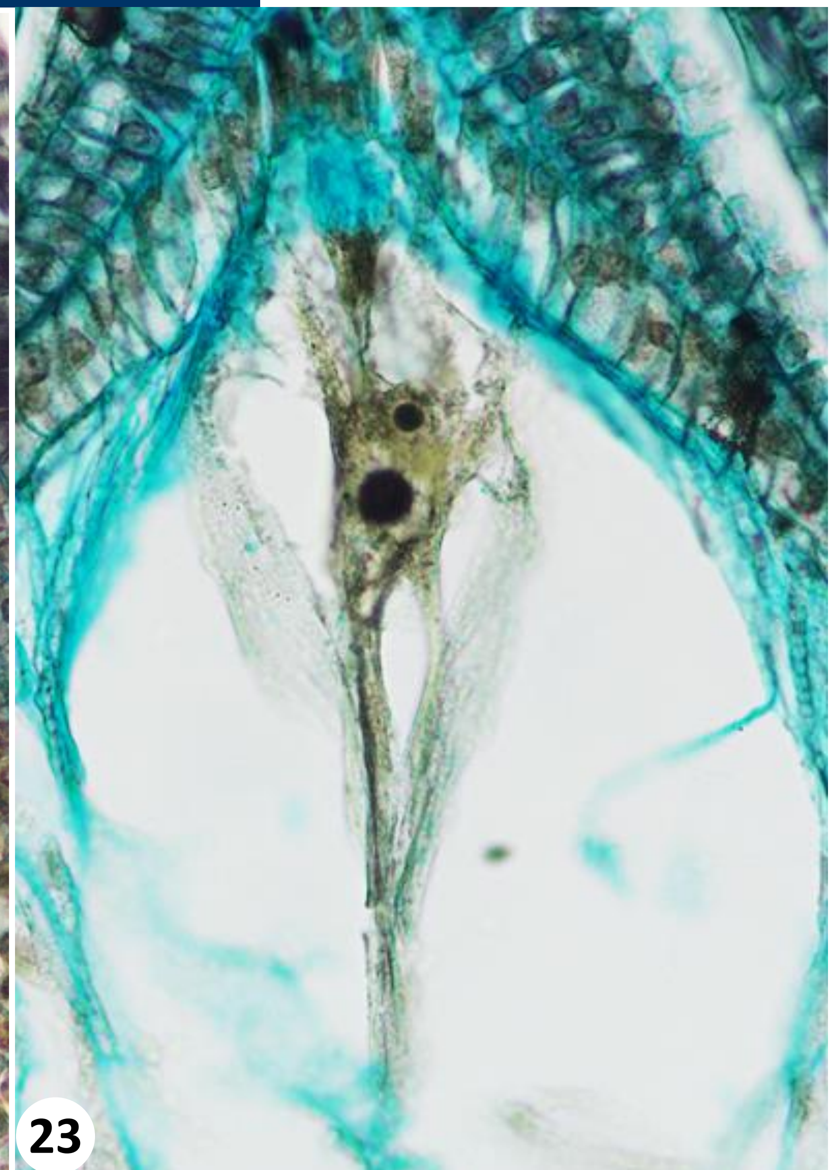


DEGENERTIONS BEFORE FERTILIZATION

2. Mature embryo sacs



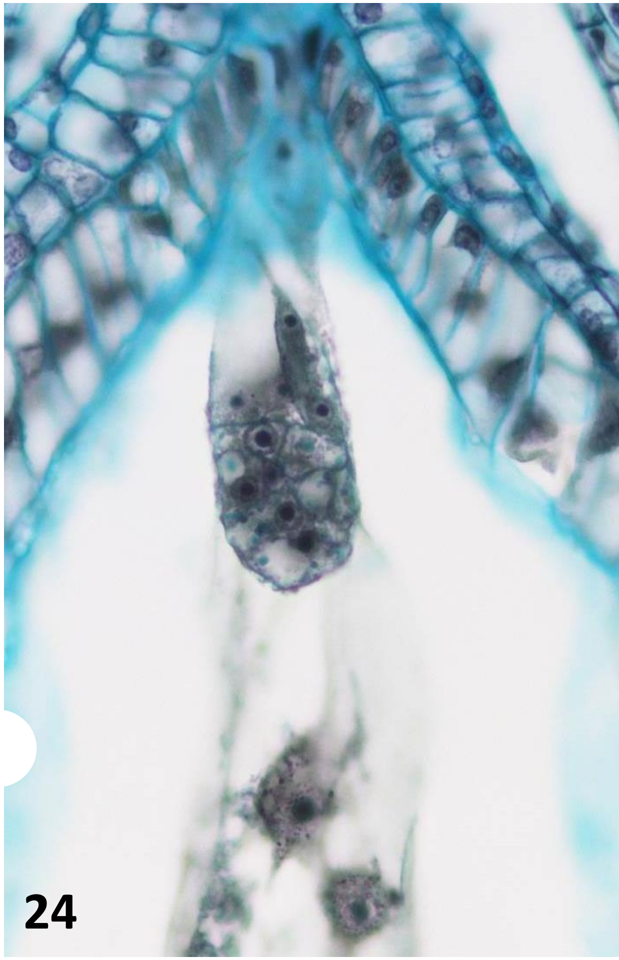
defective



normal but non-pollinated

DEGENERTIONS AFTER FERTILIZATION

3. disturbed embryos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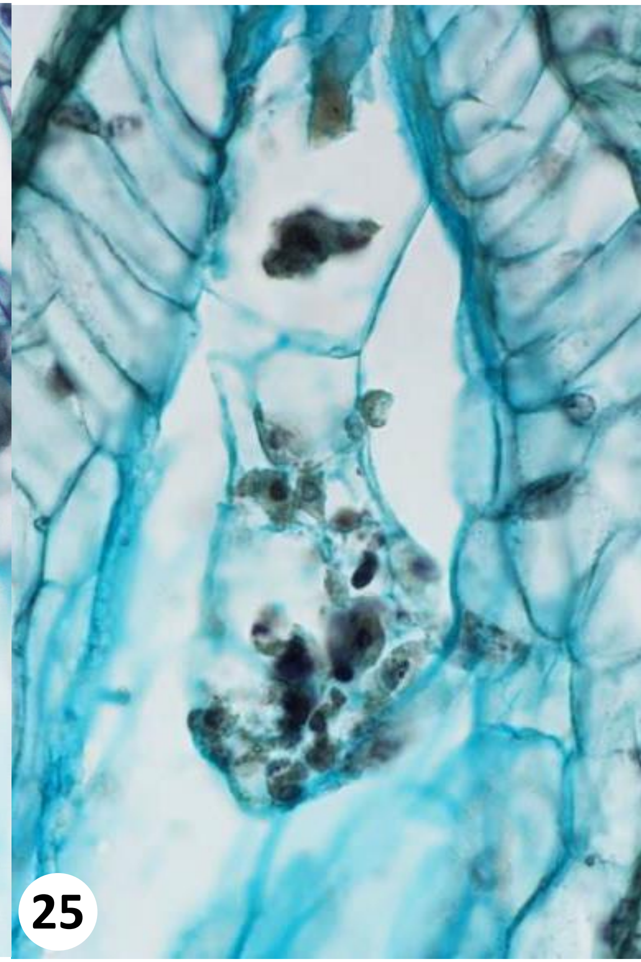
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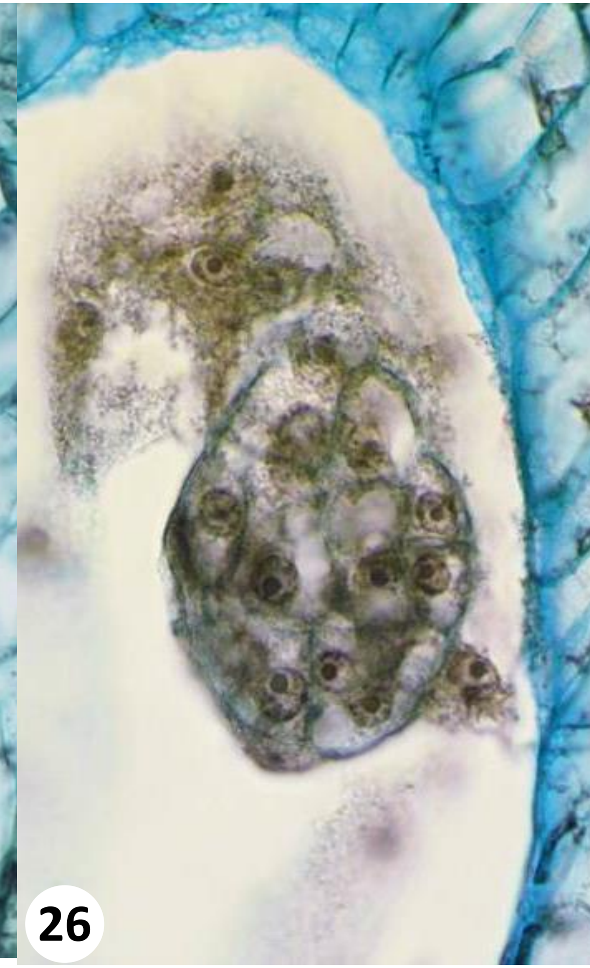
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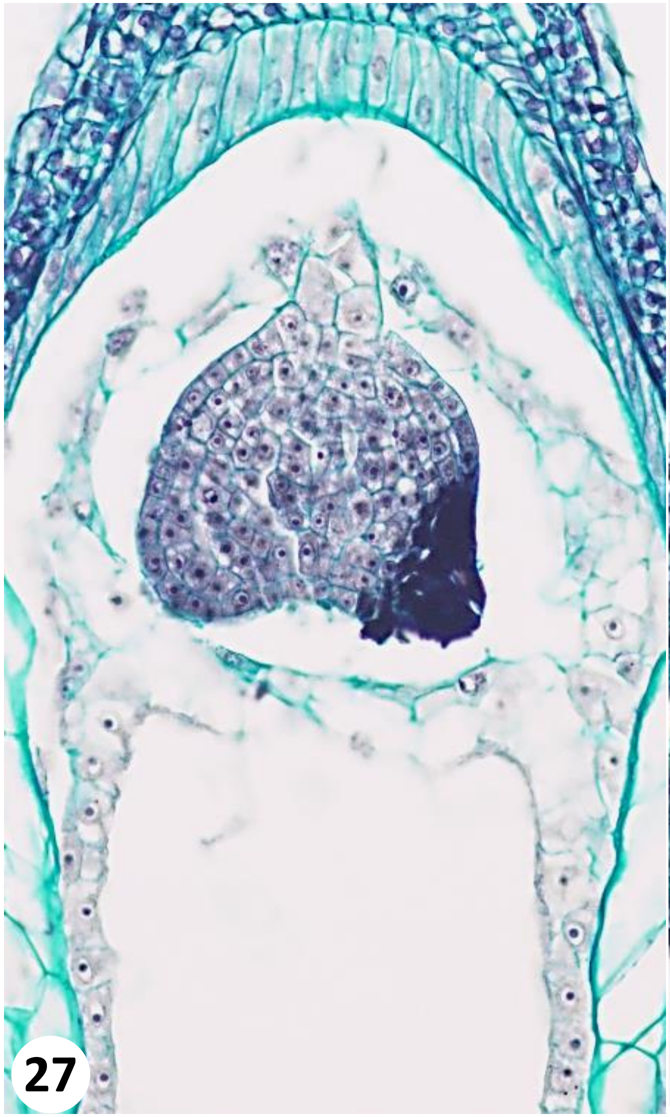
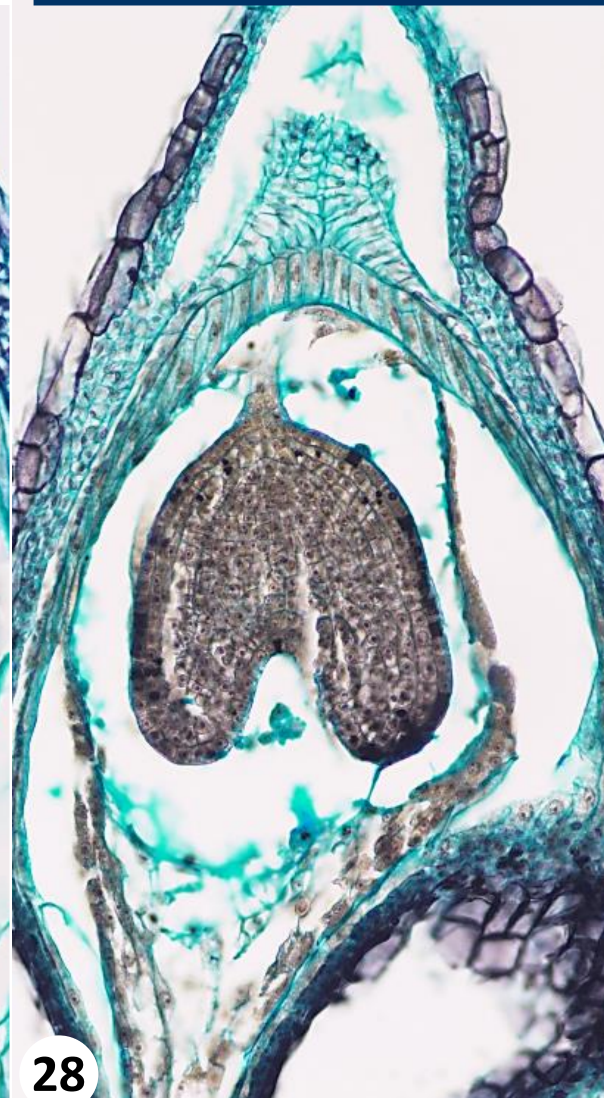
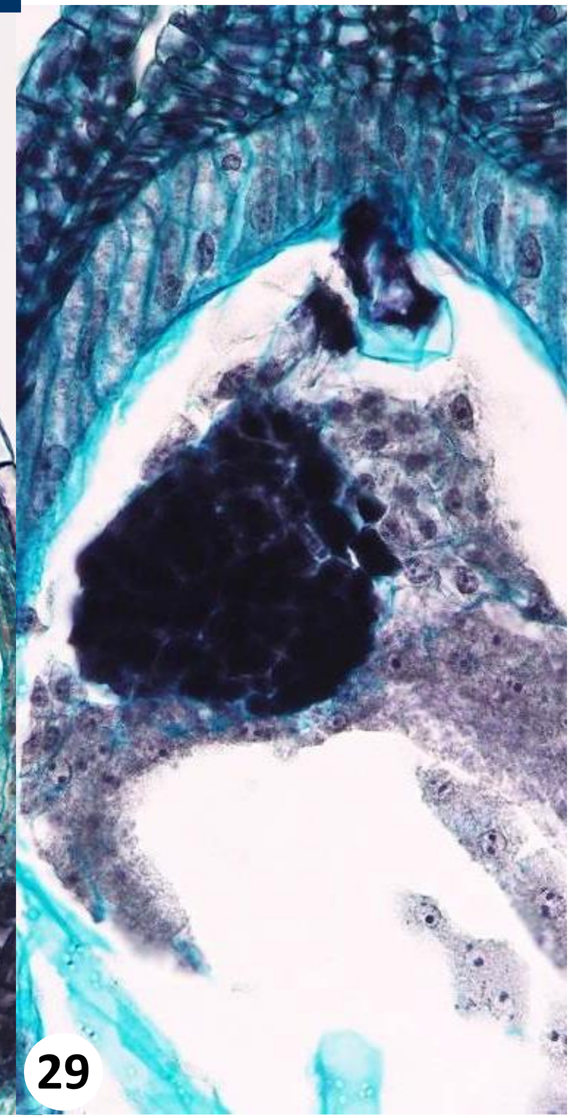
DEGENERTIONS AFTER FERTILIZATION

3. degenerated embryos

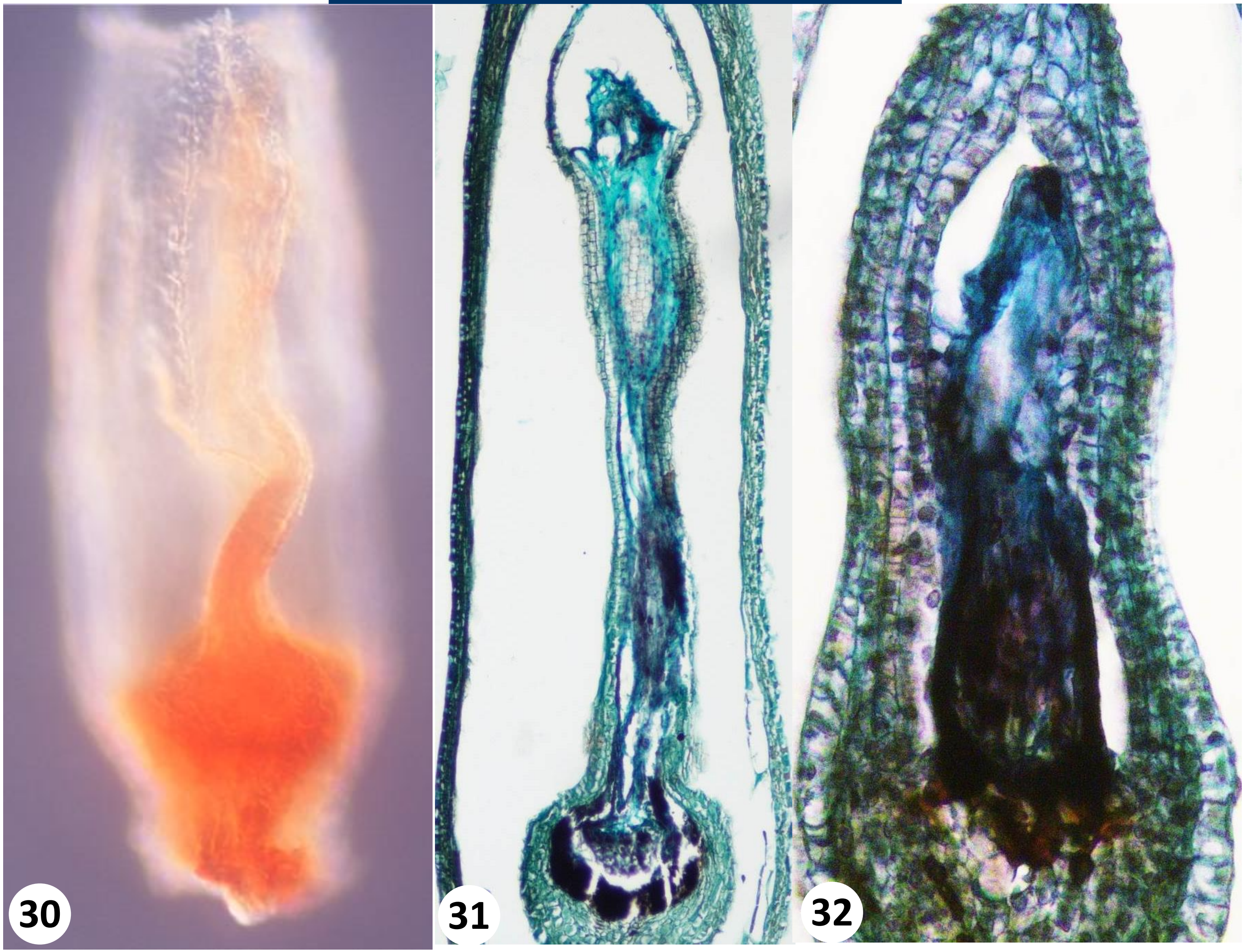






DEGENERTIONS OF OVULES

4. different stages of development



DEGENERTIONS OF FLOWERS

5. different stages of development

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DISTURBANCES AND DEGENERATIONS IN/OF OVULES

treatment / cultivar		control		cysteine		NAA		GA_3		Tytanit		NaCl		Putrescine		BAP		Asahi SL	
		Kora	Panda	Kora	Panda	Kora	Panda	Kora	Panda	Kora	Panda	Kora	Panda	Kora	Panda	Kora	Panda	Kora	Panda
Before fertilization	1.megasporogenesis and megagametophytogenesis	2.5	4.0	0	0	4.5	2.0	6.5	5.0	5.5	4.0	0	1	1.5	2.0	5.0	2.0	0	0
	2. mature gametophyte	32.5	30.5	50.0	56.0	54.5	48.0	43.5	56.0	50.0	51.0	45.0	45.0	50.0	49.5	50.0	40.0	51.0	55.0
After fertilization	3.embryogenesis	28.0	24.5	8.5	4.0	2.0	10.0	11.5	3.5	10.0	10.5	15.5	12.0	5.5	7.0	10.0	15.5	8.0	5.0
	Total (%)	62.0	59.0	58.5	60.0	60.0	60.0	61.5	64.5	65.5	65.5	60.5	58.0	57.0	58.5	65.0	57.5	59.0	60.0
4. Degeneration of ovules		10.0	9.5	7.0	10.0	4.5	3.0	9.5	11.0	13.0	12.0	8.0	12.0	4.0	11.5	2.0	10.0	9.0	2.0
5. Degenaration of flowers		0	0	5.0	5.0	9.0	7.5	1.0	5.0	6.5	6.0	2.0	0.5	4.0	0.5	3.0	1.0	3.0	8.5
Total		72.0	68.5	70.5	75.0	73.5	70.5	72.0	79.5 ↑	85.0 ↑	83.5 ↑	70.5	70.5	65.0 ↓	70.5	70.0	68.5	71.0	70.5

65.0-83.5%

CONCLUSIONS

1. LOW PRODUCTIVITY

- **Degeneration at different stages of ovule development; lack of fertilization (defective female gametophytes)**

2. ROLE OF PGB IN CROP IMPROVEMENT

- **Negligible - higher flower production is correlated with higher seed set only in NaCl Panda**
- **Positive influence on seeds’ weight in some treatments (cysteine, putrescine, BAP Kora)**

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