

Functional Morphology and Seed Anatomy of the Invasive Weed, Benghal Dayflower (*Commelina benghalensis*): Implications for Dispersal by Mourning Doves

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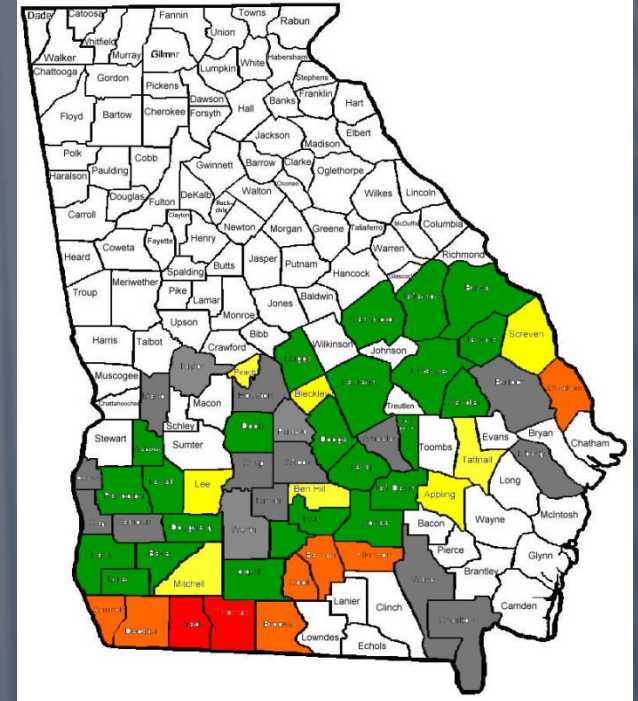
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GA

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Tifton, GA



Benghal Dayflower (also Tropical Spiderwort) (*Commelina benghalensis* L.)

- ✘ Native: tropical Asia, Africa, Pacific Islands (Faden 2000)
- ✘ Established in Florida as early as 1928.
- ✘ 1994: Brooks Co., GA; population discovered, reported to USDA-APHIS
- ✘ Noxious and invasive - Rapid recent expansion as agricultural weed
- ✘ Annual/perennial
- ✘ Reproduction by seeds and rhizomes
 - + Above and below ground flowers
- ✘ Up to 7,940 seeds/plant (Walker and Evenson, 1985)



Why has Benghal Dayflower become such a problem?



Cotton field from Spiderwort height

- Ideal climate
 - * 86-96⁰ F
- Glyphosate tolerant
- Weed shift resulting from ..
 - * *glyphosate use*
 - *Decreased competition*
 - *Decreased use of traditional herbicides*
- *Seed dispersal vectors?*

Could Mourning Doves Be Assisting in Dispersal of Bengal Dayflower?

Mourning Doves:



- **Granivorous**
 - Seed passage through bird gut can
 - Kill seeds
 - Have no effect
 - Enhance germination
- **Ubiquitous from Canada to Mexico**
 - (open woodland, forest edges, grasslands, fields, and residential areas)
- **Migratory but with stable year-round populations in Georgia**
- **Among top 10 most abundant migratory birds**
- **Nesting pairs breed primarily from February through October**

Best answer: Use captive birds → check seed viability after it passes through gut. We did not have the capability to do this.

Could Mourning Doves Be Assisting in Dispersal of Bengal Dayflower? - Methods



Doves
harvested by
hunters:
eviscerated in
lab

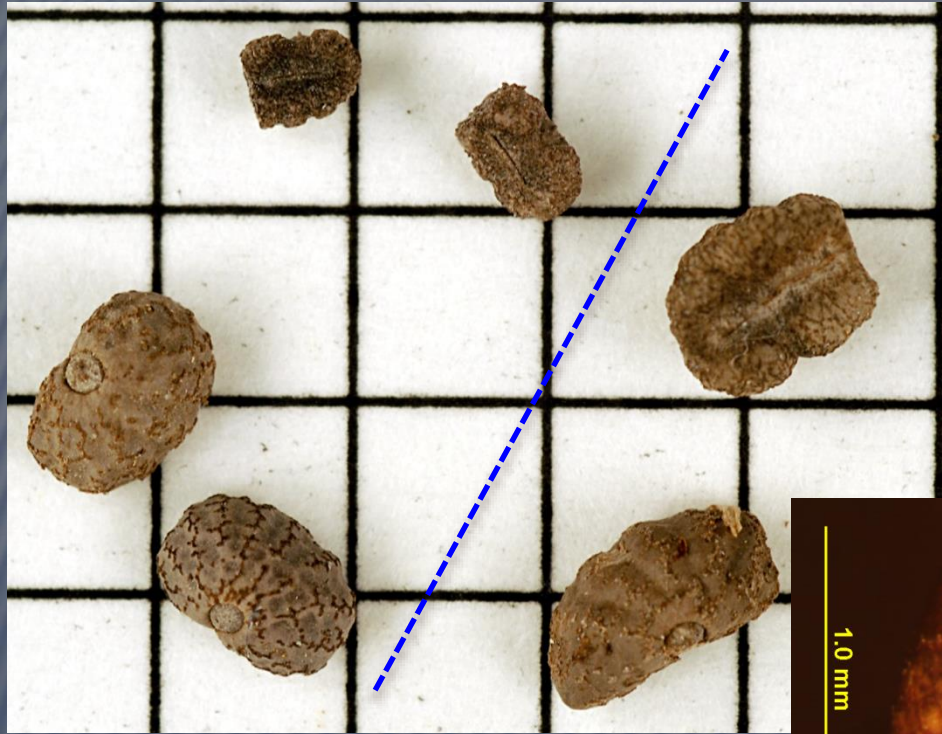


Contents of Crop and/or gizzard removed

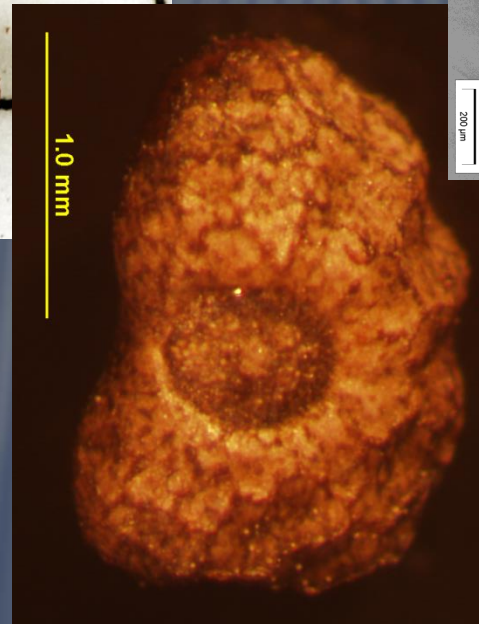


Gut contents dried
and placed in
packets for analysis

Benghal dayflower seeds are easily distinguished from other seeds:



Above: Seeds from aerial flowers on the left; larger seeds from subterranean flowers on the right.



Could Mourning Doves be assisting in dispersal of Benghal Dayflower? :

1. Do Mourning doves ingest Benghal dayflower seeds?

Table 1. Summary of doves harvested by year and the total recovered with Benghal dayflower seeds. All doves harvested in 2003 – 2005 were taken in Grady County. Doves from 2006 were taken from Cook or Berrien County as noted (n.d.: Not Determined).

Year	Number of doves harvested	Number of doves with <i>Commelina</i> seeds	Total <i>Commelina</i> seeds recovered	Percent of doves ingesting <i>Commelina</i> seeds	Average Number of <i>Commelina</i> seeds / bird
2003	6	*a	32	n.d.	5.3
2004	11	3	116	27.3	10.5
2005	14	9	90	64.3	6.4
2006 (Cook Co.)	32	6	209	18.8	6.5
2006 ^b (Berrien Co.)	7	7	2029	100	289.9

^a Dove gut contents from all doves collected in 2003 were combined.

Compare Berrien Co. data on next slide

Number of Benghal dayflower seeds in crop vs. gizzard organs from doves collected in Berrien Co. in 2006

Table 2. Number of Benghal dayflower seeds recovered separately from crop and gizzard in doves harvested in 2006 from Berrien County.

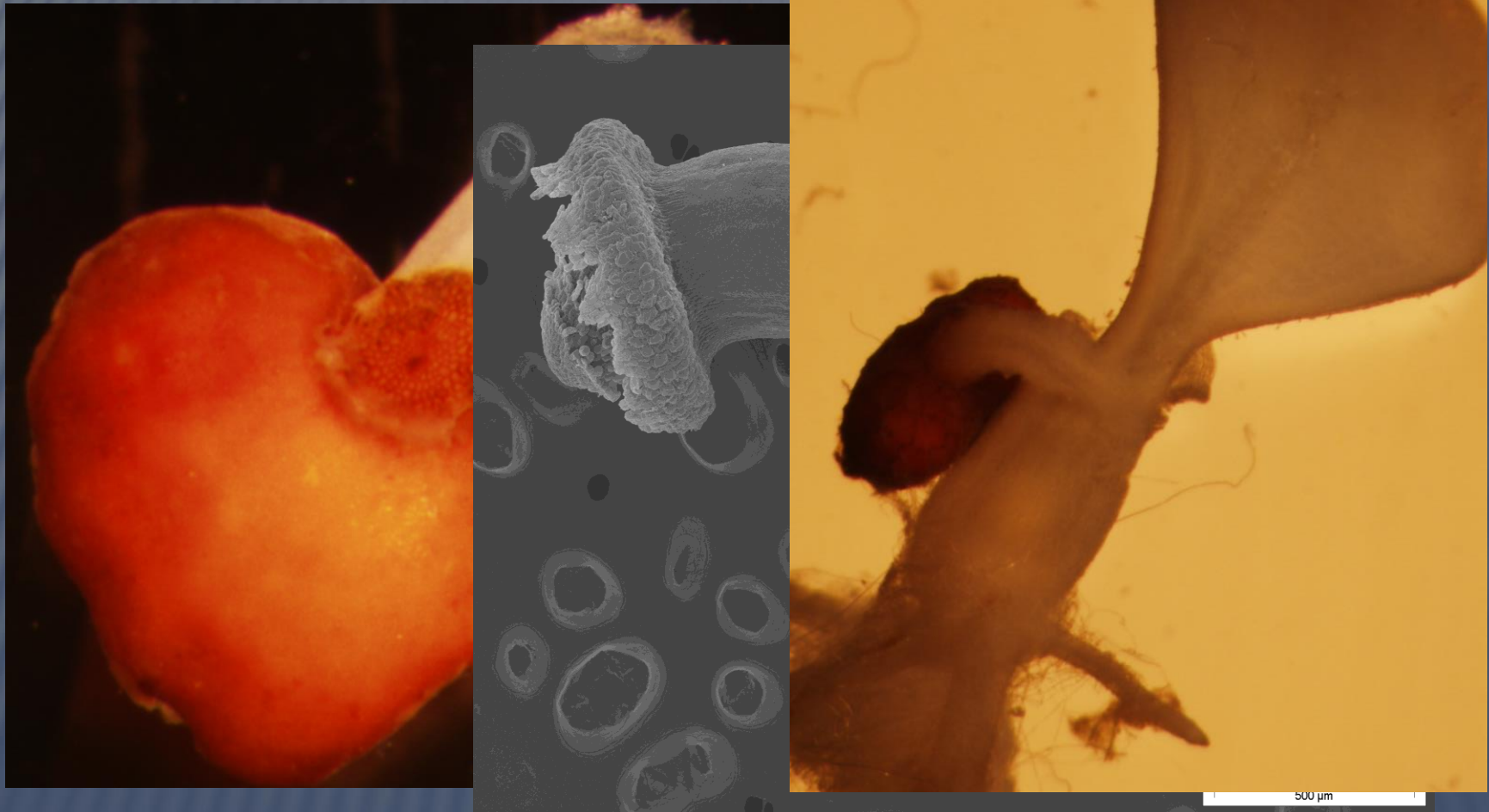
Bird Number	Organ	Seeds Recovered
Berrien.01	Crop	562
	Gizzard	123
Berrien.02	Crop	149
	Gizzard	122
Berrien.03	Crop	310
	Gizzard	104
Berrien.04*		115
Berrien.05	Crop	3
	Gizzard	42
Berrien.06	Crop	271
	Gizzard	123
Berrien.07	Crop	not recovered
	Gizzard	105



* Crop & Gizzard combined

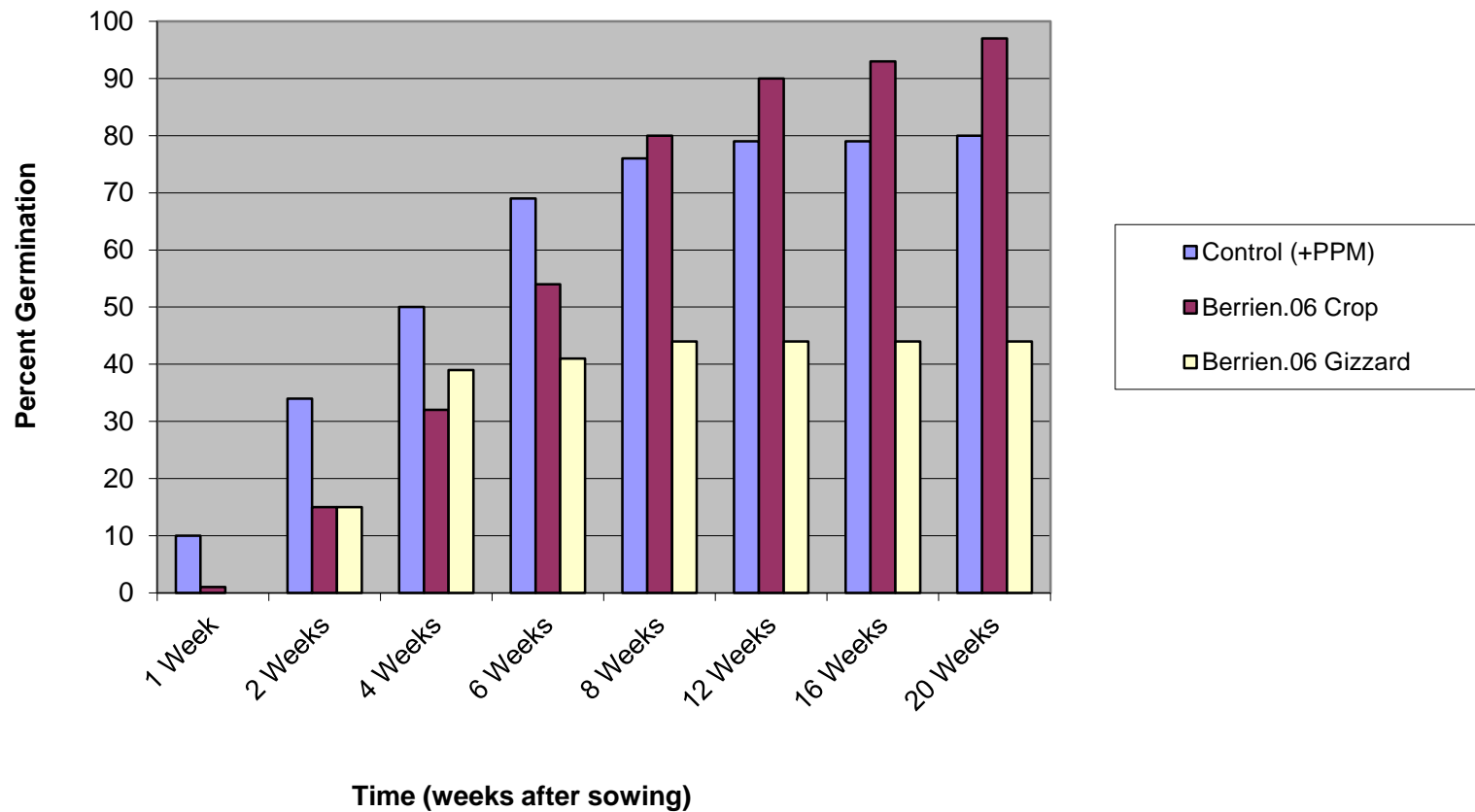
Do Bengal Dayflower seeds recovered from bird guts retain their ability to germinate?

Germination in Bengal dayflower



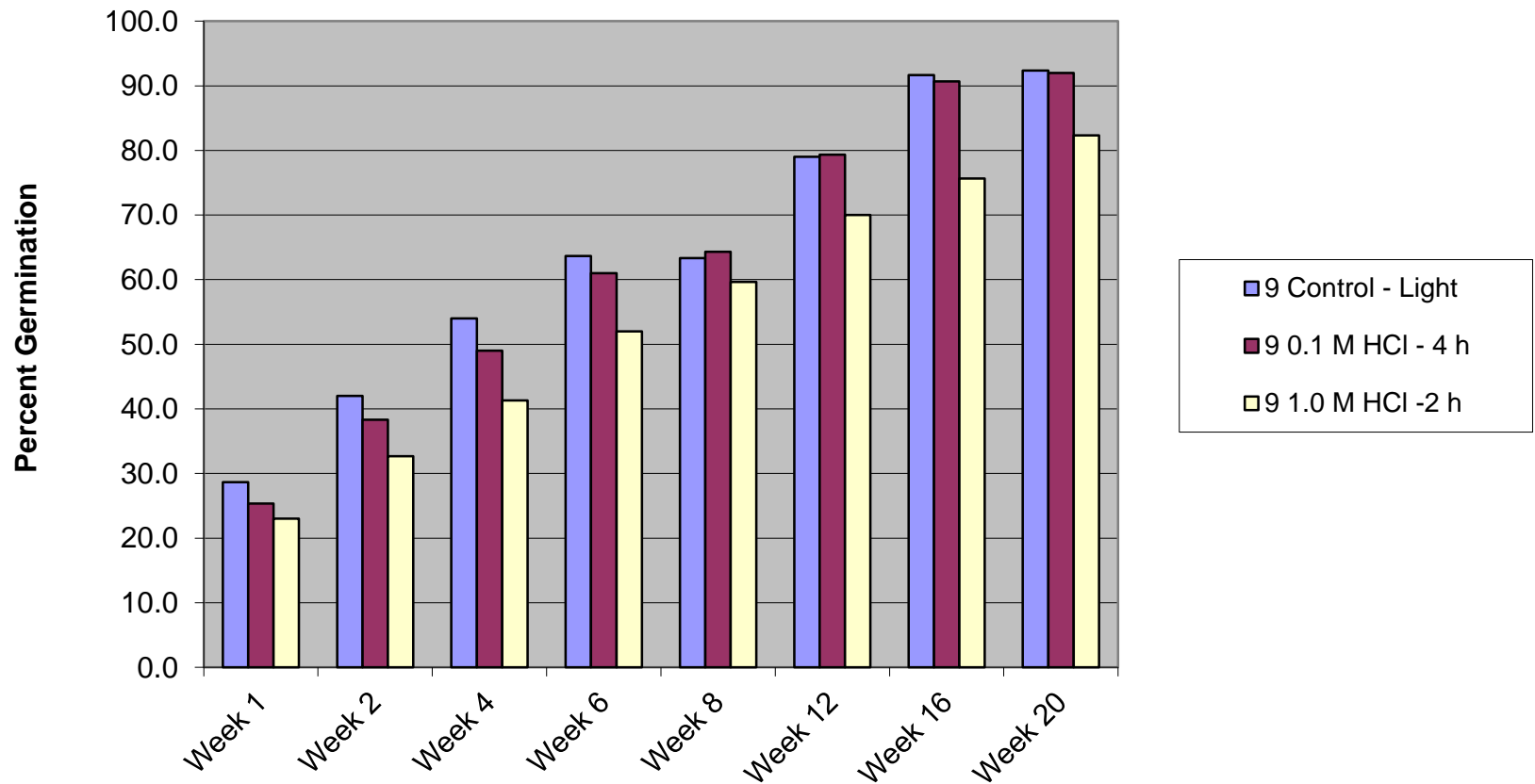
Do Bengal Dayflower seeds recovered from bird guts retain their ability to germinate?

Dove: Berrien.06 Crop vs. Gizzard



Can Benghal Dayflower Seeds withstand the acidic environment of the dove digestive tract?

Germination Comparison in 0.1M vs 1.0 M HCl



Can Benghal dayflower seeds withstand the mechanical stress in the gizzard?

Functional Morphology



Notes:

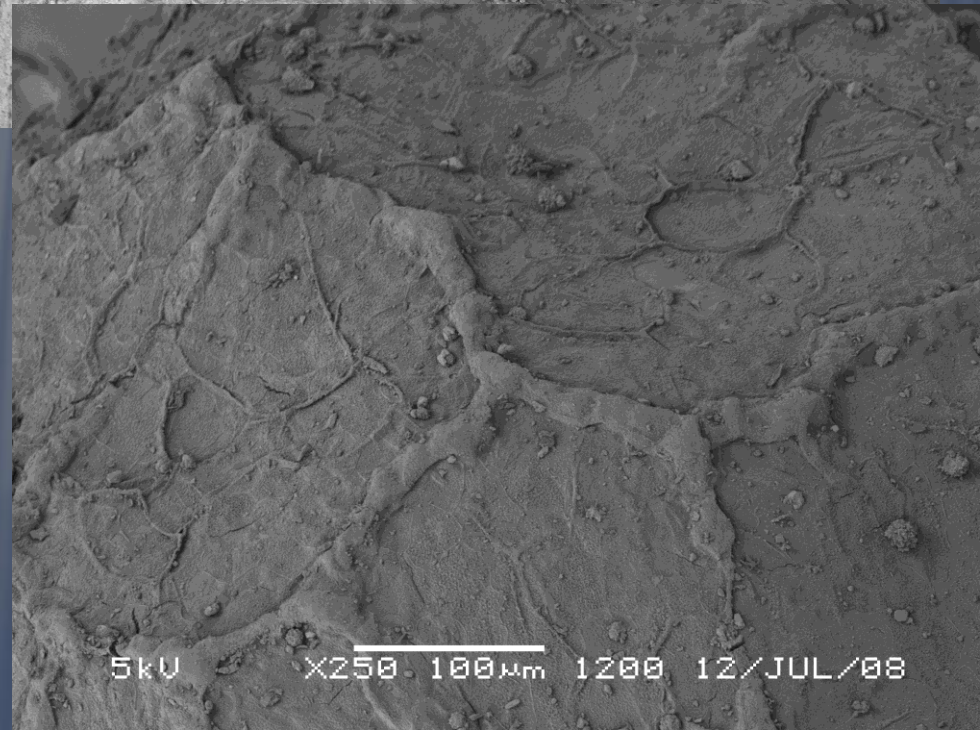
- About 40 – 50 % germination in seeds from gizzard
- Seeds mostly intact
- Some identifiable pieces
- Many other seeds found in crop can not be found in gizzard

Seeds from dove “Berrien06” gizzard

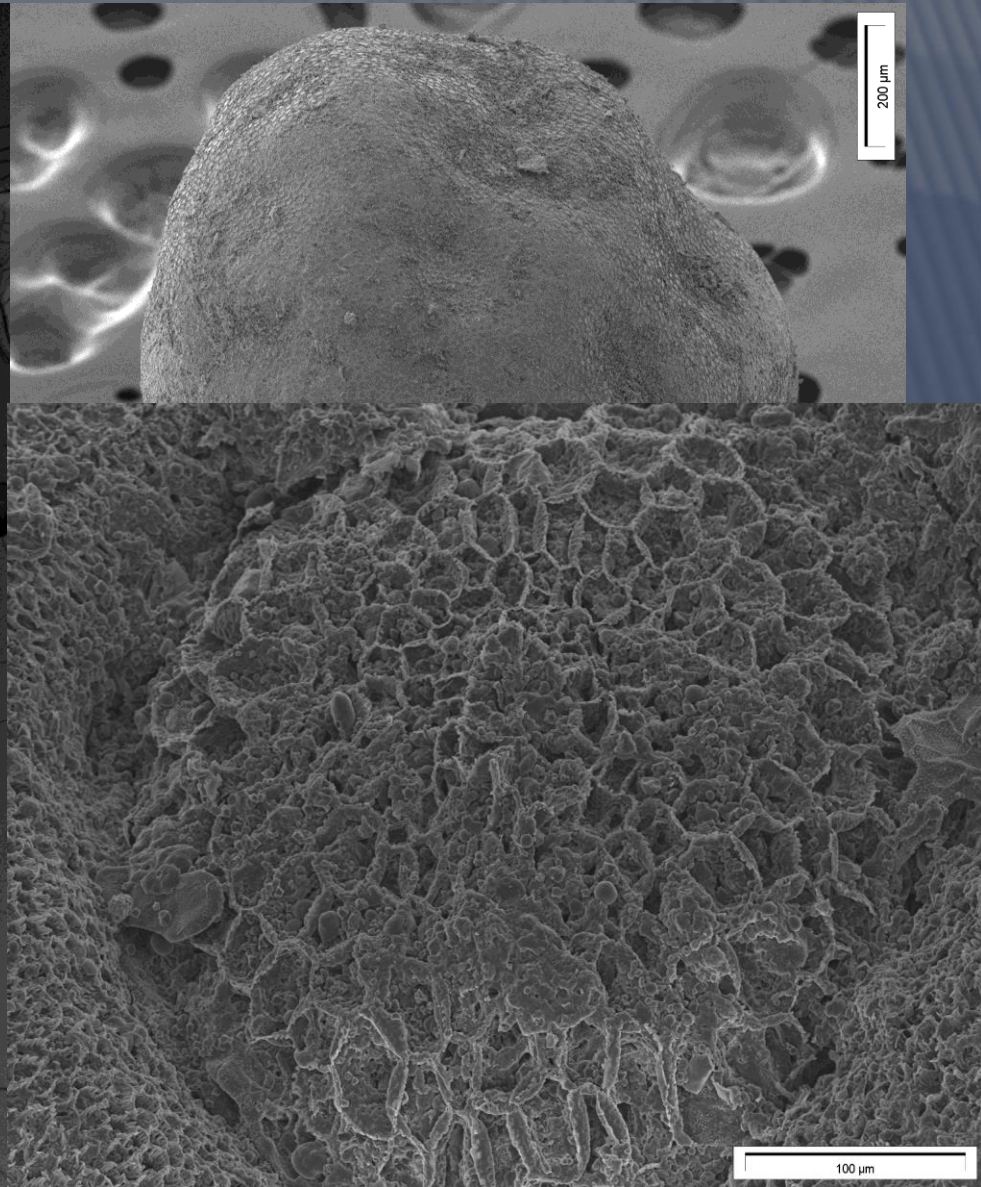
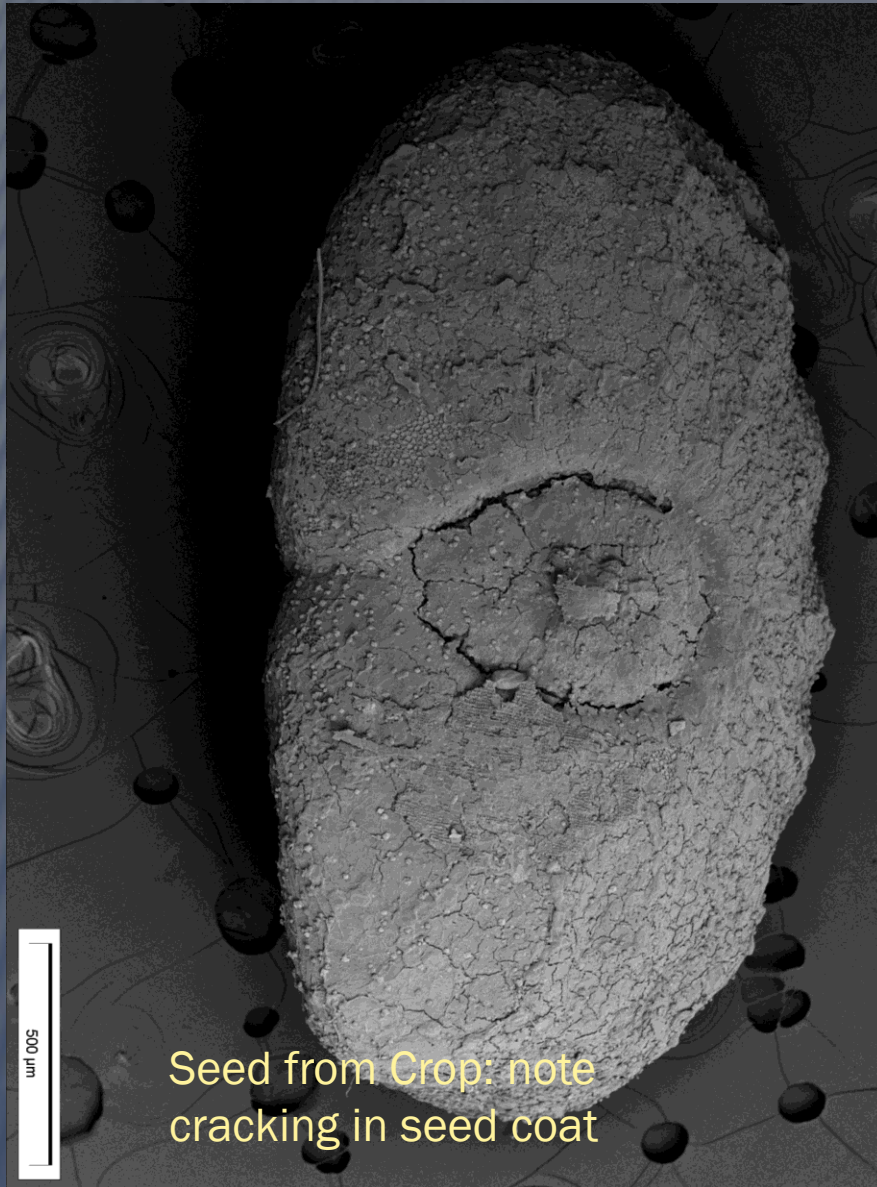
How does the morphology of Benghal dayflower seeds change during digestion in bird gut?

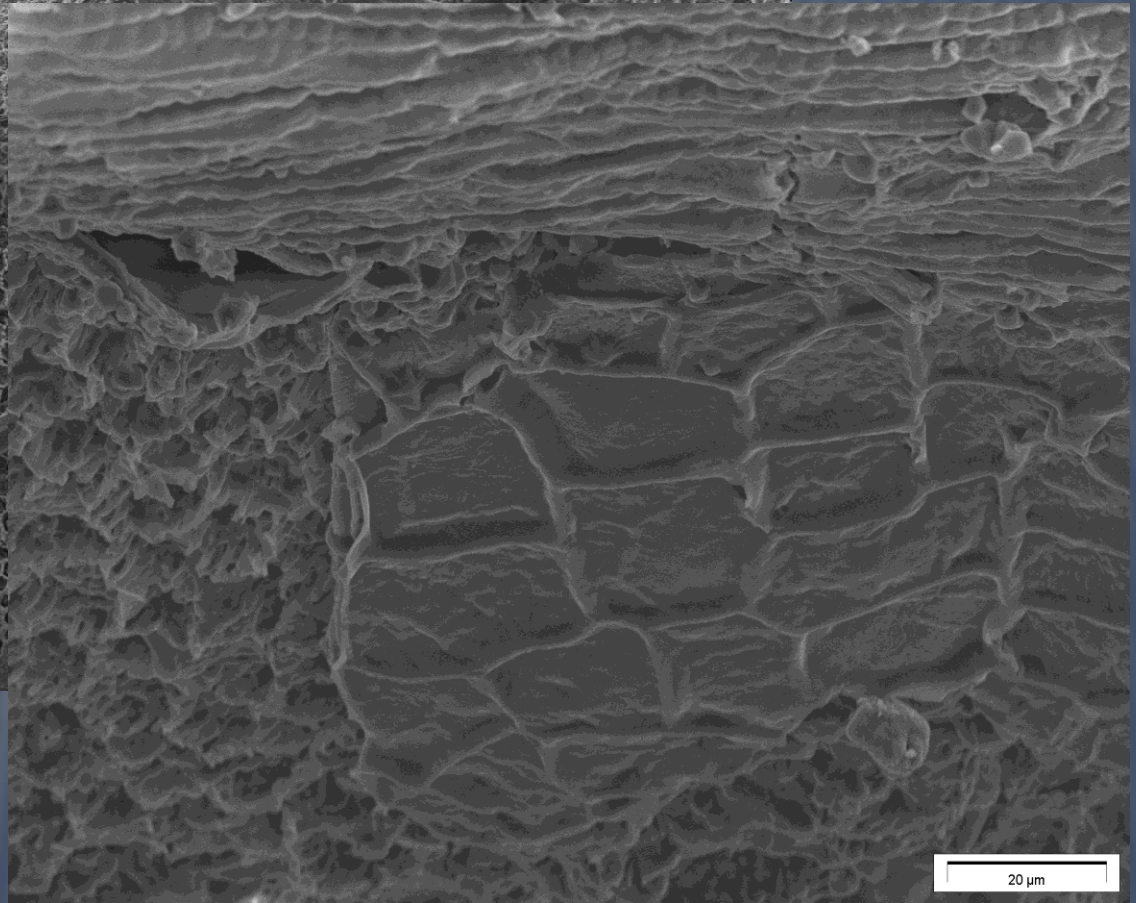
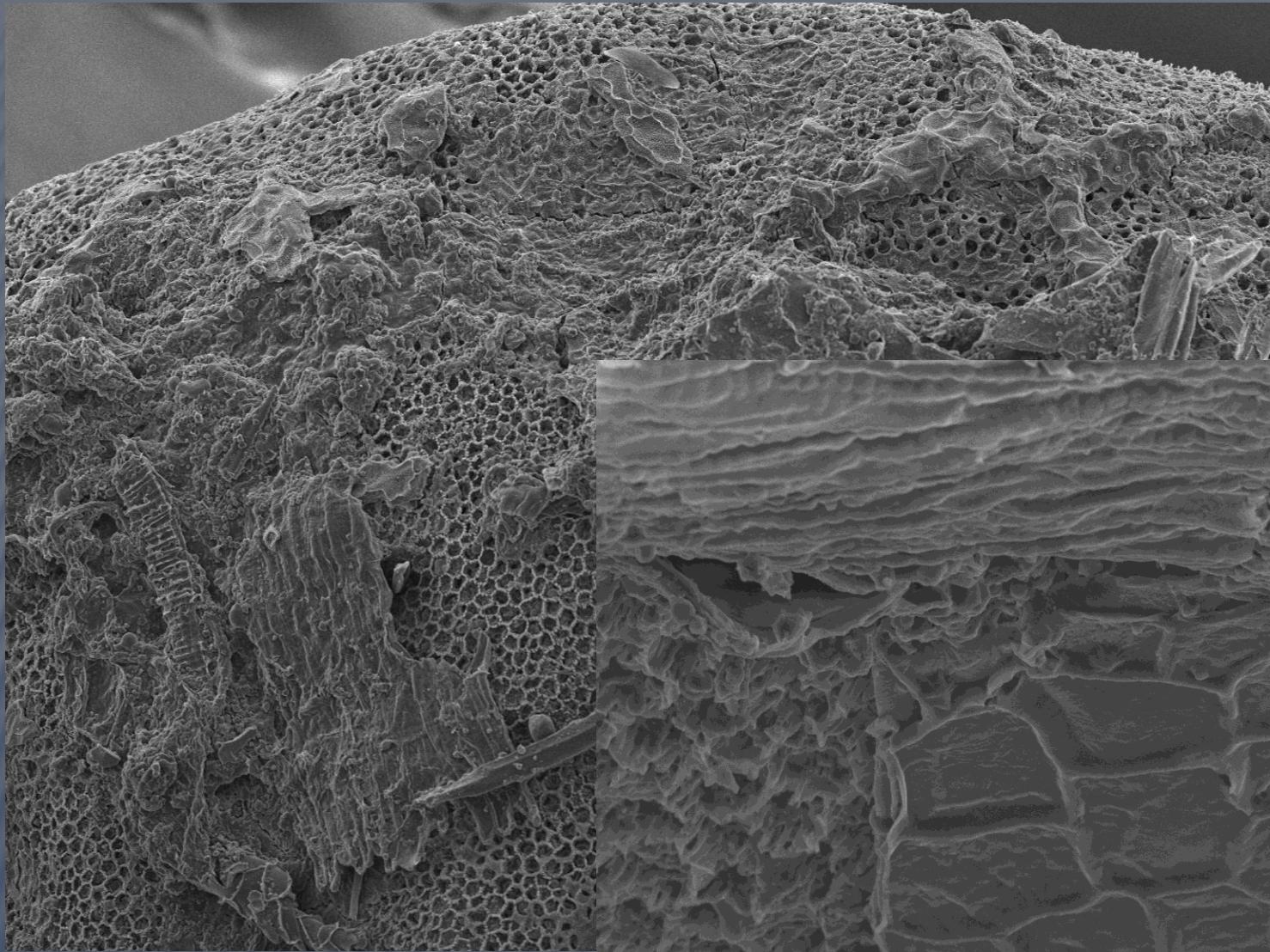


Control seed; unimbibed, BES image

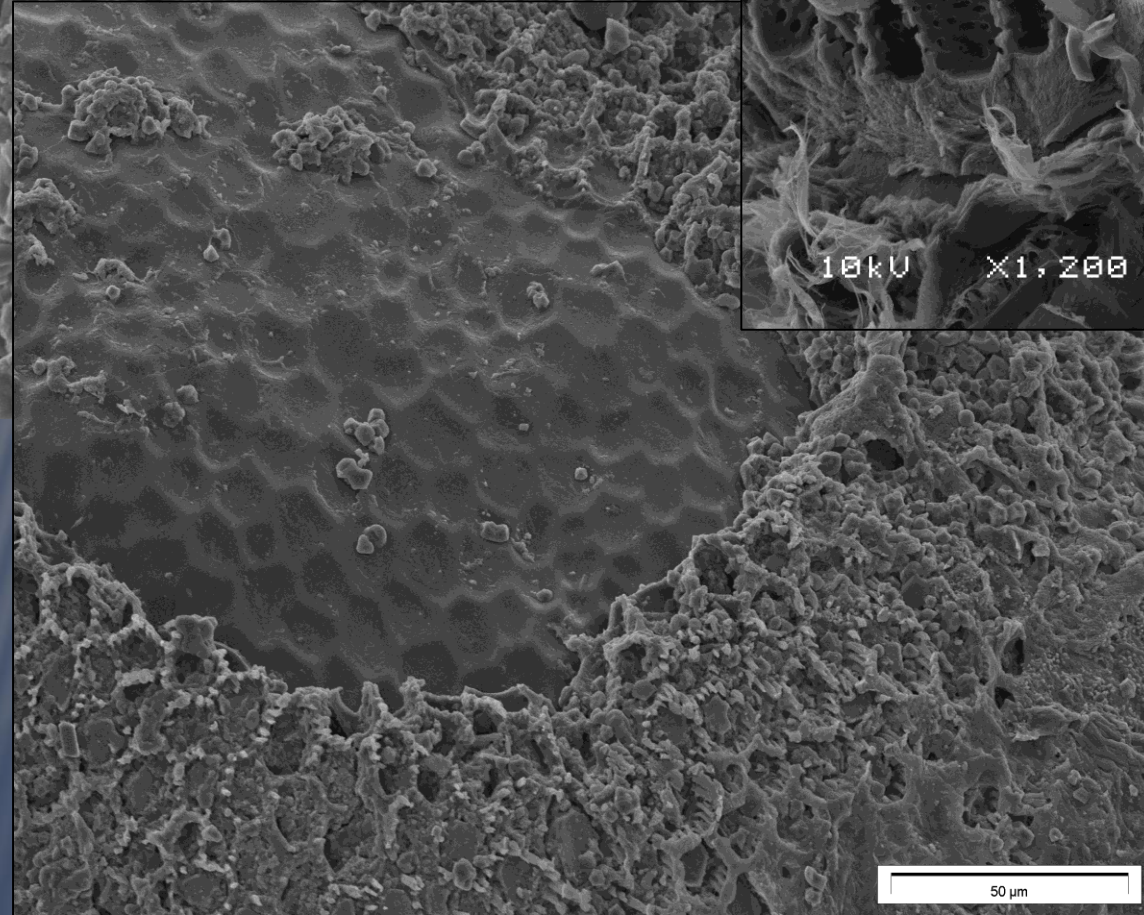
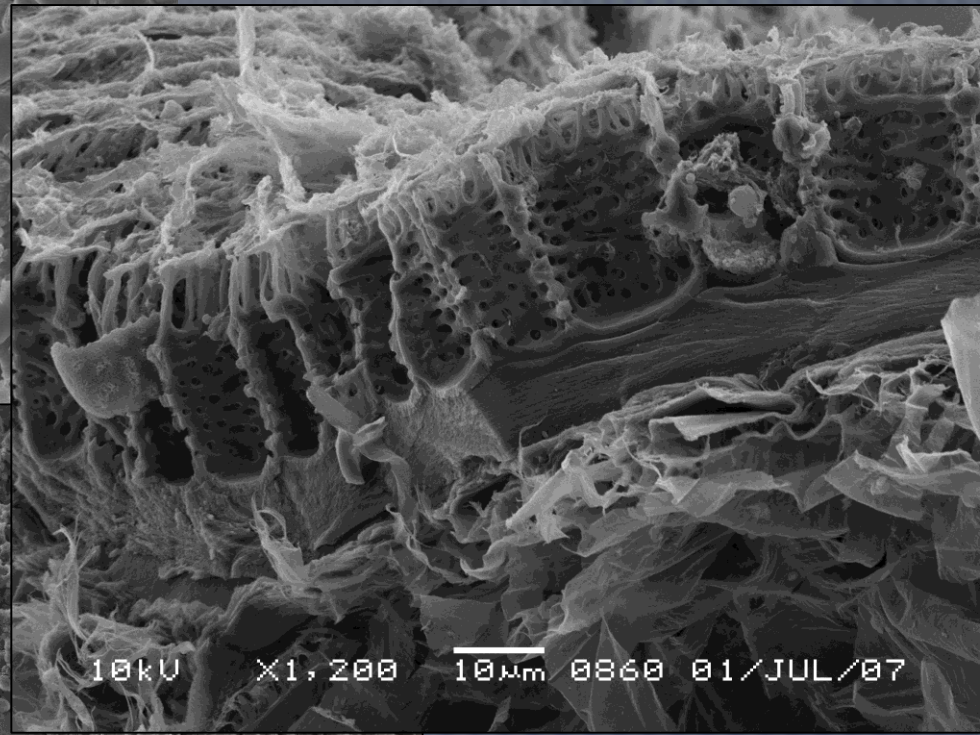
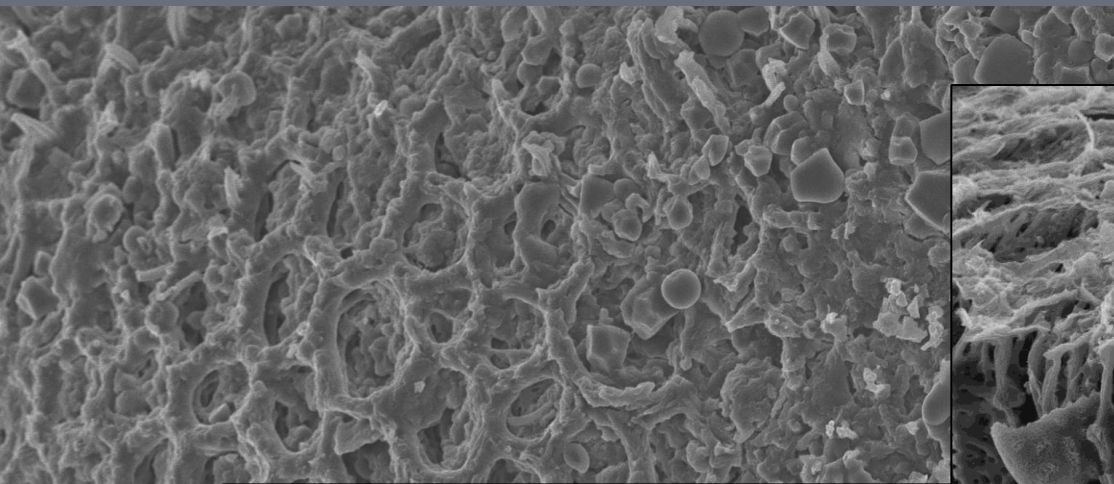


How does the morphology of Benghal dayflower seeds change during digestion in bird gut?





20 μ m



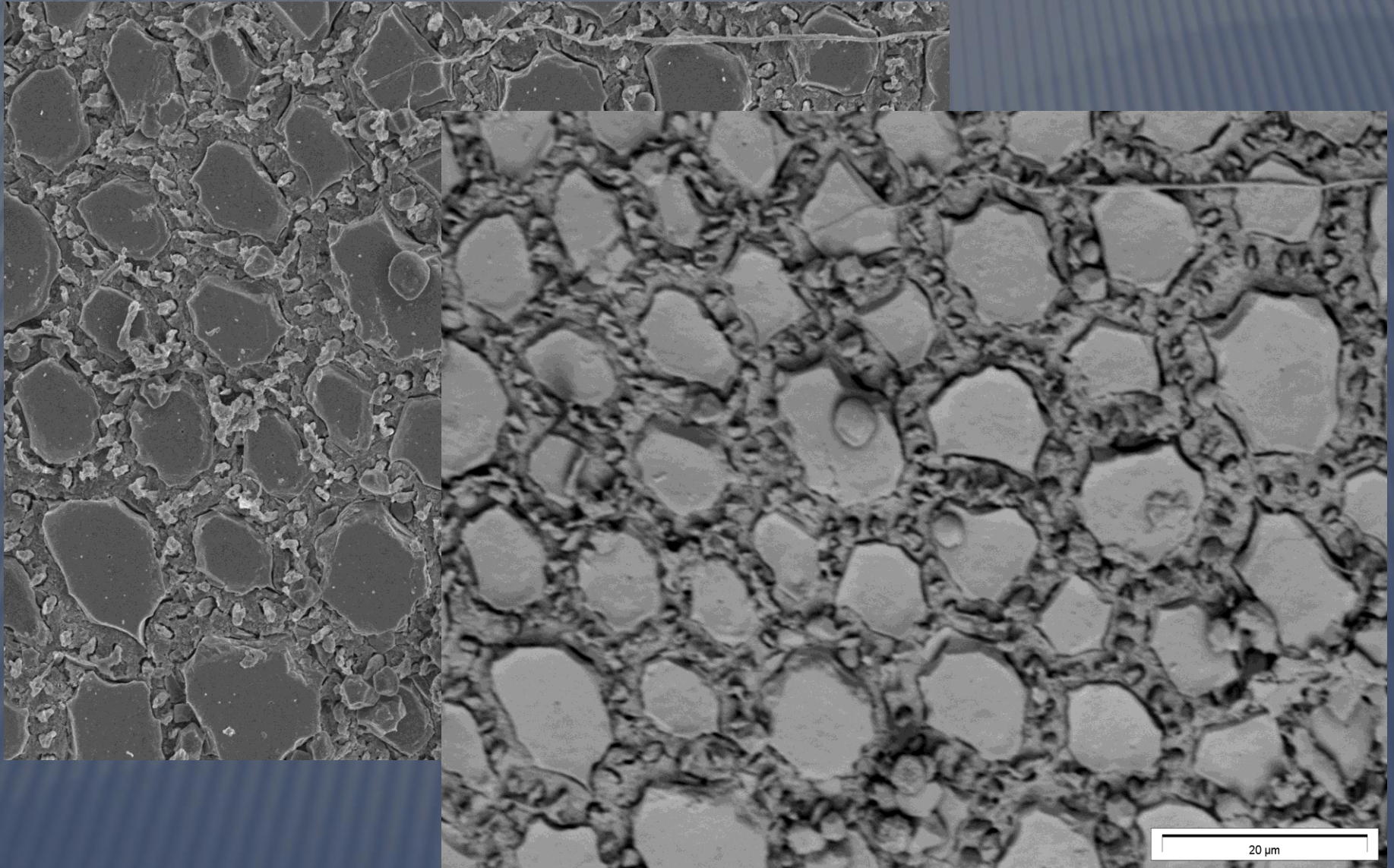
Do Bengal dayflower seeds provide a “reward” to birds?

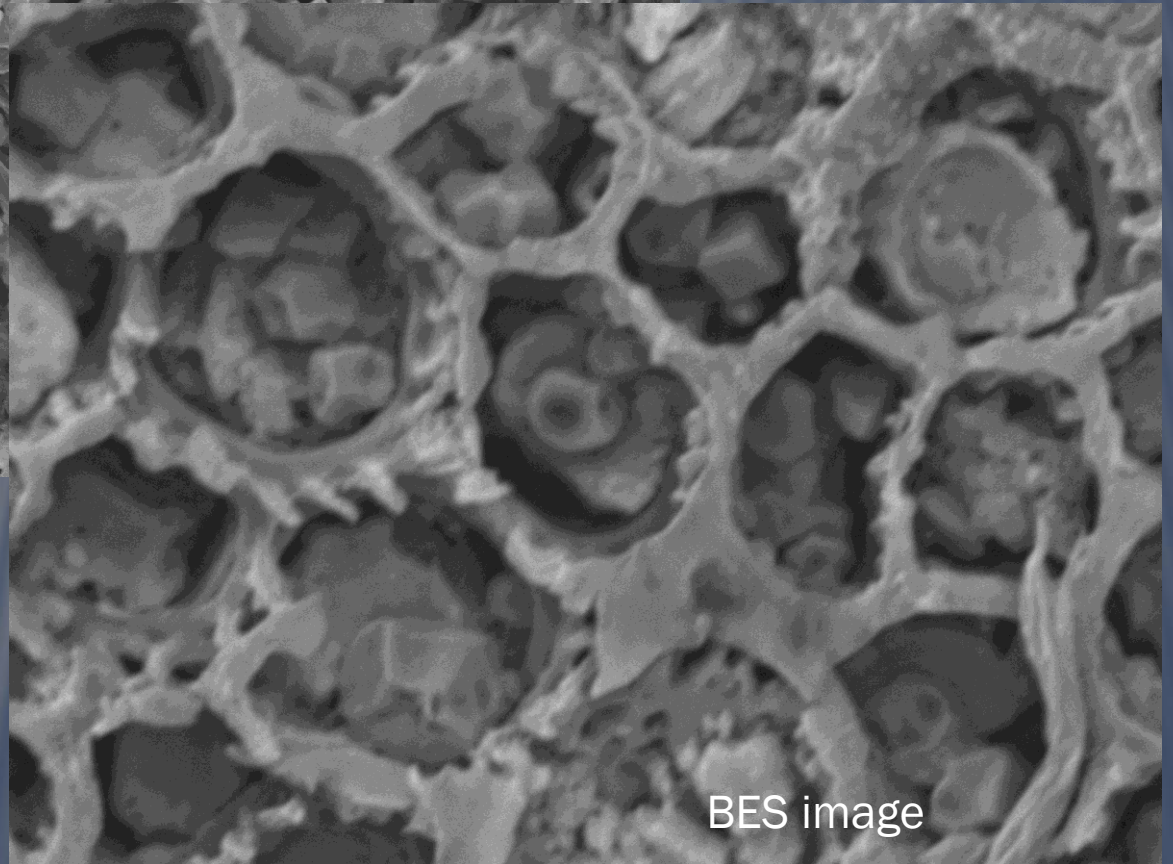
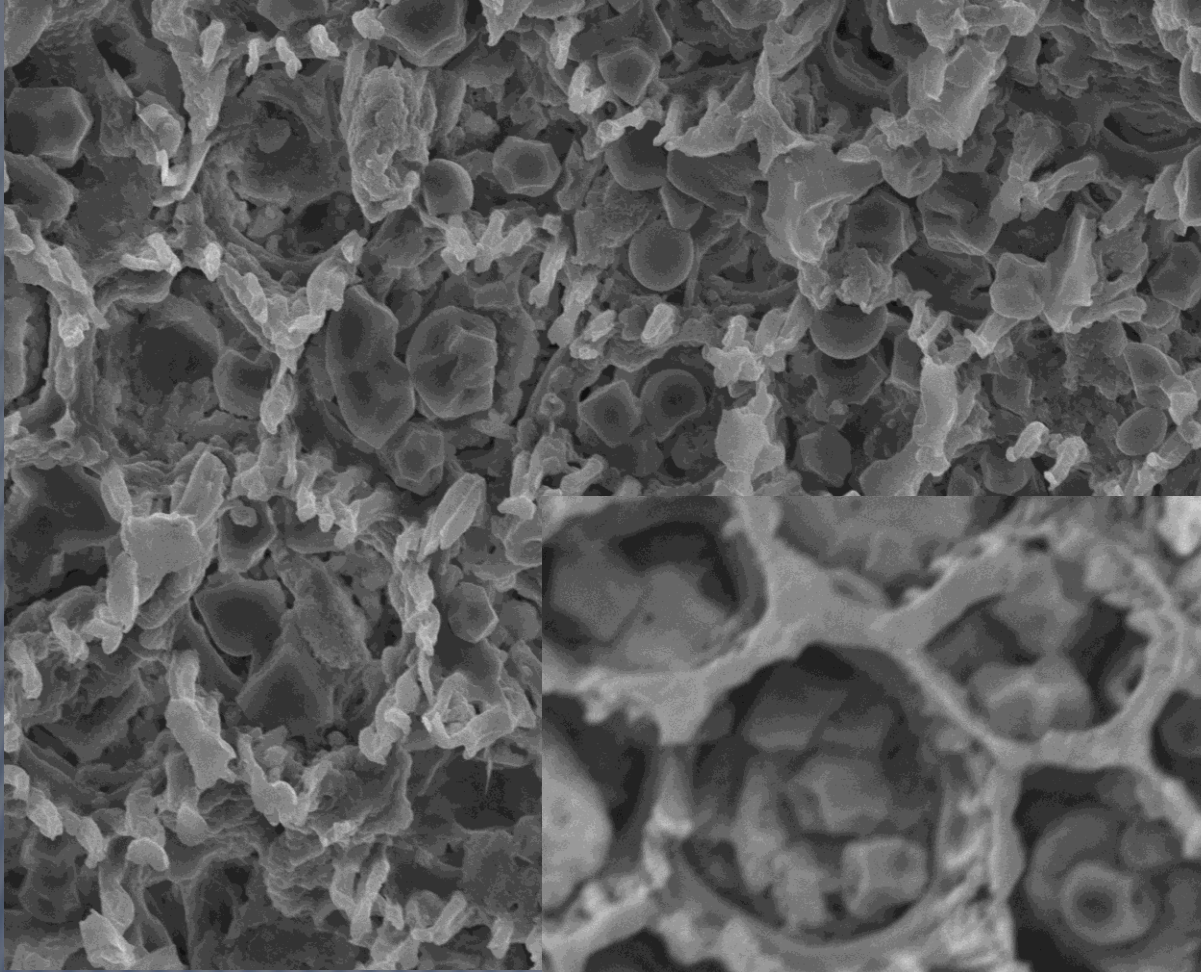
Note data from Poster presentation, Jarvis et al.

Seed Type:	Seed Frequency	Preference Index	Seed Type:	Seed Frequency	Preference Index
XI	124.69	0.34	I (<i>C. benghalensis</i>)	36.53	0.38
I (<i>C. benghalensis</i>)	36.53	0.38	VII	1.81	0.36
XXVII	10.72	0.02	XI	124.69	0.34
XIV	8.44	0.33	IX	1.73	0.33
XVI	3.64	0.11	XIV	8.44	0.33

Partial data from 35 different seed types found in doves (top five seed types from seed frequency data set and preference index data set). *Commelina benghalensis* is the second most frequently found seed and first in preference (more doves contained *C. benghalensis* than any other seed).

Do Bengal dayflower seeds provide a “reward” to birds?





What is the composition of these inclusions in the seed coat?
-- currently unanswered

BES image

CONCLUSIONS:

1. Benghal dayflower seeds are eaten by mourning doves.
2. Seeds are acid tolerant and germination may benefit from the scarifying effect of an acid treatment.
3. Benghal dayflower seeds are structurally reinforced against mechanical stresses.
4. Benghal dayflower seeds have a high potential to survive conditions in the dove gizzard.
5. The potential for doves to disperse Benghal dayflower seeds is severe and likely.
6. Other birds may contribute to the distribution of this and other weeds in agricultural systems.

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Philip Roberts

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Darrell Bryner

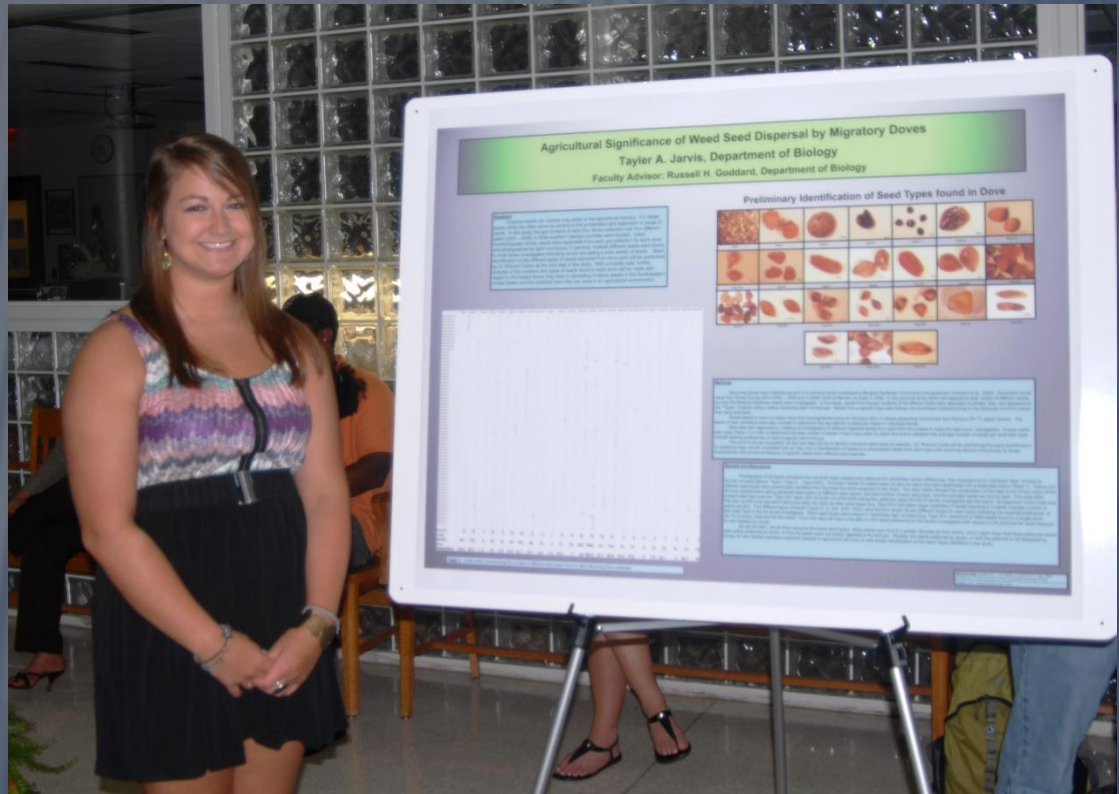


RELATED DEVELOPING INFORMATION:

Taylor Jarvis: undergraduate

Poster content:

Sorted other seeds present in the mourning doves used in this study for identification. Found about 30 different types of seeds eaten by mourning doves – identification is not yet complete



References:

Faden. R.B. 2000. Commelinaceae, pp. 170-197 in: FNA Editorial Committee. Flora North America 22. Oxford University Press, New York.

Walker, S.R. and J.P. Evenson. 1985. Biology of *Commelina benghalensis* L. in south-eastern Queensland. 1. Growth, development and seed production. *Weed Res.* 25:239-244.