



Agricultural Significance of Seed Dispersal by Migratory Doves

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Abstract

Invasive weeds can reduce crop yields in the agricultural industry. For larger seeds, birds can often serve as vectors in the proliferation and expansion in range of plants. In this study, the gut contents of sixty-four doves collected over four different years (2004 – 2006) were studied. Intact, morphologically similar seeds were separated from each gut collection for each dove and photographed by light microscopy and scanning electron microscopy. Preliminary results indicate that of the doves investigated; thirty-five different types of seeds were identified representing 35 different species of plants. In general, multiple different seeds were found in most doves investigated indicating doves are eating a wide variety of seeds. Data showing the distribution of seed types in doves were analyzed to evaluate the frequency that seeds were eaten by doves and also the preference of a particular seed type by doves. Preliminary seed identification of the different seed types is progressing and further analysis of the numbers and types of seeds found in each dove will be made with regard to the impact doves may have in spreading invasive weeds in the southeastern United States and the potential harm this can have in an agricultural environment.

Methods

Mourning doves were collected as part of a previous study investigating Benghal dayflower (*Commelina benghalensis*; Goddard, R.H., T.M. Webster, R. Carter, and T.L. Grey. 2009. Resistance of Benghal Dayflower (*Commelina benghalensis*) Seeds to Harsh Environments and the Implications for Dispersal by Mourning Doves (*Zenaidura macroura*) in Georgia, U.S.A. Weed Science 57: 603 – 612). Harvested doves came from Grady County, GA in 2004 – 2005 and in either Cook or Berrien counties in 2006. In the previous study, birds had ingested a wide variety of different seeds, but only the Benghal dayflower seeds were investigated. In this study, seeds from the gut contents of 64 different birds were separated by shape, size, and appearance into “Types” of seeds using a stereo dissecting light microscope. Seeds from a specific type were placed into envelopes corresponding to the particular bird from where they were extracted.

Seeds placed in each envelope were photographed using an Olympus SZX-12 stereo-dissecting microscope and Olympus DP-71 digital camera. The seeds of each envelope were counted to determine the abundance of particular seeds in individual doves.

Raw data was organized by collating all photographs of different ingested seeds from each bird into a table to make the task more manageable. A large data matrix was made in order to determine the total number of seeds of each type eaten by each bird and to establish the average number of seeds per dove that might indicate feeding preferences or seed longevity within the gut.

This work is not yet completed, as the next step will be to identify individual seed types by species (to be directed by Dr. Richard Carter, Director and Curator, VSC Herbarium). Currently each seed type is being analyzed using scanning electron microscopy images to reveal characteristic ultrastructural features of specific seeds from different plant species.

Conclusions:

- Not all birds consume the same seed types.
- Doves eat a variety of different seed types. In our data, the number of different seed types found per dove ranged from a single type to 7 different types extracted from a single dove.
- The seed types most frequently found (seed index values higher than 1.0) in doves in descending order were Types XI, I, XXVII, XIV, XVI, X, VII, XV, IX, IV, and II.
- The seed types most preferred by doves (seed preference value higher than 0.2) in descending order were Types I, VII, XI, IX, XIV, XV, and X.
- Seed type I is *Commelina benghalensis* L., an invasive weed pervasive in agricultural crops in the southeastern U.S. It ranks as number 2 and number 1 in the seed frequency and preference index lists indicating potential dispersal by doves.
- Whether other seeds preferred by doves, or with the potential to be dispersed by doves, to new habitats represent potential hazards to agriculture will have to await proper identification of the seed Types identified in this study.

Results:

Tabular data outlining the number of birds investigated, seeds and seed types identified from each bird according to identified seed types (see photos at right).

Table 2: Number and types of seeds extracted from dove guts.

Type	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII	Type VIII	Type IX	Type X
Count:	24	9	2	10	8	6	23	5	21	16
Total Seeds:	2338	71	2	110	16	29	116	55	111	194
Avg. Seeds/Bird	97.4	7.9	1.0	11.0	2.0	4.8	5.0	11.0	5.3	12.1
Seed Frequency Index (Total Seeds Found/Total of 64 birds)	36.5					0.45	1.81	0.86	1.73	3.03
Preference Index (Count/total birds)	0.38	0.14	0.03	0.16	0.125	0.09	0.36	0.08	0.33	0.25

Type	Type XI	Type XII	Type XIII	Type XIV	Type XV	Type XVI	Type XVII	Type XVIII	Type XIX	Type XX
Count:	22	5	4	21	20	7	10	1	3	2
Total Seeds:	7980	54	13	540	115	233	23	2	20	28
Avg. Seeds/Bird	124.7	10.8	3.3	23.7	5.8	33.3	2.3	2.0	6.7	14.0
Seed Frequency Index (Total Seeds Found/Total of 64 birds)	124.7					3.64	0.36	0.03	0.31	0.44
Preference Index (Count/total birds)	0.34	0.08	0.06	0.33	0.31	0.11	0.16	0.02	0.05	0.03

Type	Type XXI	Type XXII	Type XXIII	Type XXIV	Type XXV	Type XXVI	Type XXVII	Type XXVIII	Type XXIX	Type XXX
Count:	1	1	1	2	1	2	1	2	7	2
Total Seeds:	2	5	9	2	36	8	686	47	40	2
Avg. Seeds/Bird	2.0	5.0	9.0	1.0	36.0	4.0	686.0	23.5	5.7	1.0
Seed Frequency Index (Total Seeds Found/Total of 64 birds)	0.03	0.07	0.14	0.03	0.56	0.13	10.7	0.73	0.63	0.03
Preference Index (Count/total birds)	0.02	0.02	0.02	0.03	0.02	0.03	0.02	0.03	0.11	0.03

Type	Type XXXI	Type XXXII	Type XXXIII	Type XXXIV	Type XXXV
Count:	1	2	1	1	1
Total Seeds:	14	4	20	3	7
Avg. Seeds/Bird	14.0	2.0	20.0	3.0	7.0
Seed Frequency Index (Total Seeds Found/Total of 64 birds)	0.22	0.06	0.31	0.05	0.11
Preference Index (Count/total birds)	0.02	0.03	0.02	0.02	0.02

Table 3: Seed type data sorted by Seed preference and frequency data.

A seed frequency index was calculated by taking the total seeds extracted from all doves and dividing by the total of 64 doves analyzed. A seed preference index was calculated by taking the total number of doves containing a certain seed type and dividing by the total of 64 doves analyzed.

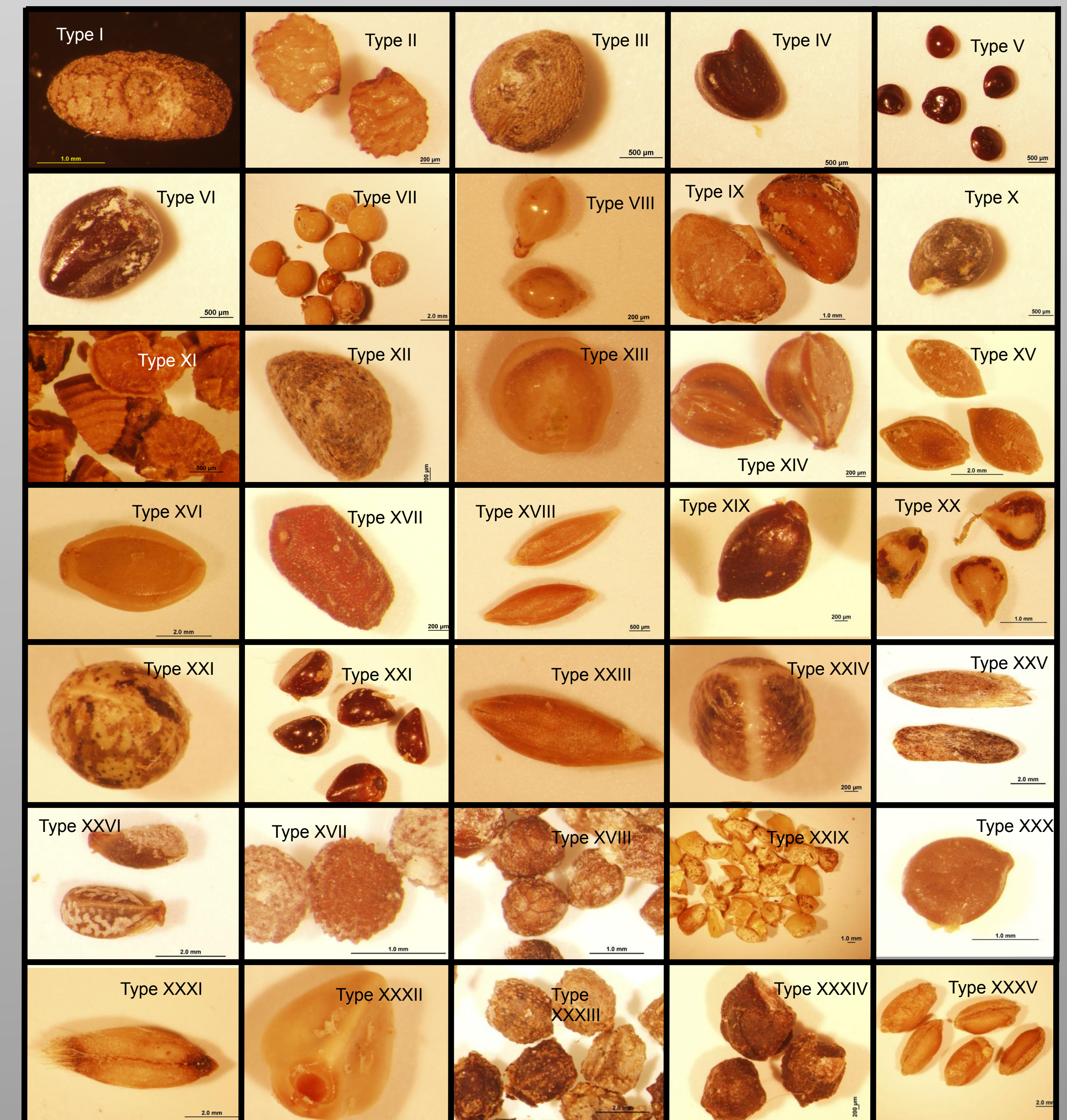
Seed Type:	Seed Frequency	Preference Index	Seed Type:	Seed Frequency	Preference Index	Seed Type:	Seed Frequency	Preference Index
I	36.53	0.38	XI	124.69	0.34	I	36.53	0.38
II	1.11	0.14	II	36.53	0.38	VII	1.81	0.36
III	0.03	0.03	XXVII	10.72	0.02	XI	124.69	0.34
IV	1.72	0.16	XIV	8.44	0.33	IX	1.73	0.33
IX	1.73	0.33	XVI	3.64	0.11	XIV	8.44	0.33
V	0.25	0.125	X	3.03	0.25	XV	1.8	0.31
VI	0.45	0.09	VII	1.81	0.36	X	3.03	0.25
VII	1.81	0.36	XV	1.8	0.31	IV	1.72	0.16
VIII	0.86	0.08	IX	1.73	0.33	XVII	0.36	0.16
X	3.03	0.25	IV	1.72	0.16	II	1.11	0.14
XI	124.69	0.34	II	1.11	0.14	V	0.25	0.125
XII	0.86	0.08	XII	0.86	0.08	XVI	3.64	0.11
XIII	0.2	0.06	VIII	0.86	0.08	XXIX	0.63	0.11
XIV	8.44	0.33	XXVIII	0.73	0.03	VI	0.45	0.09
XIX	0.31	0.05	XXIX	0.63	0.11	VIII	0.86	0.08
XV	1.8	0.31	XXV	0.56	0.02	XII	0.86	0.08
XVI	3.64	0.11	VI	0.45	0.09	XIII	0.2	0.06
XVII	0.36	0.16	XX	0.44	0.03	XIX	0.31	0.05
XXVIII	0.03	0.02	XVII	0.36	0.16	III	0.03	0.03
XX	0.44	0.03	XXXIII	0.31	0.02	XX	0.44	0.03
XXI	0.31	0.02	XXI	0.31	0.02	XXIV	0.03	0.03
XXII	0.078	0.02	XIX	0.31	0.05	XXVI	0.13	0.03
XXIII	0.14	0.02	V	0.25	0.125	XXVIII	0.73	0.03
XXIV	0.03	0.03	XXXI	0.22	0.02	XXX	0.03	0.03
XXIX	0.63	0.11	XIII	0.2	0.06	XXXII	0.06	0.03
XXV	0.56	0.02	XXIII	0.14	0.02	XVIII	0.03	0.02
XXVI	0.13	0.03	XXXVI	0.13	0.03	XXI	0.31	0.02
XXVII	10.72	0.02	XXXV	0.11	0.02	XXII	0.078	0.02
XXXVIII	0.73	0.03	XXII	0.078	0.02	XXIII	0.14	0.02
XXX	0.03	0.03	XXXII	0.06	0.03	XXV	0.56	0.02
XXXI	0.22	0.02	XXXIV	0.05	0.02	XXVII	10.72	0.02
XXXII	0.06	0.03	XXX	0.03	0.03	XXXI	0.22	0.02
XXXIII	0.31	0.02	XXIV	0.03	0.03	XXXIII	0.31	0.02
XXXIV	0.05	0.02	XVIII	0.03	0.02	XXXIV	0.05	0.02
XXXV	0.11	0.02	III	0.03	0.03	XXXV	0.11	0.02

Table 1: Source of Doves.

Year Collected	County location of Collection	# Doves Harvested
2004	Grady	11
2005	Grady	14
2006	Cook County	32
2006	Berrien County	7
	Total Doves Analyzed	64

Preliminary Identification of Seed Types found in Doves:

Photographs of 35 different seed types preliminarily identified from seeds ingested by doves. Compare with Frequency and preference data at left.



	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII	Type VIII	Type IX	Type X	Type XI	Type XII	Type XIII	Type XIV	Type XV	Type XVI	Type XVII	Type XVIII	Type XIX	Type XX	Type XXI	Type XXII	Type XXIII	Type XXIV	
2006.Berrien01.Crop	200	4	1	1	5																				
2006.Berrien01.Giz	2	1			1	1	2	1	3																
2006.Berrien02.Crop	32			1																					
2006.Berrien02.Giz	18			2		17	10			1	1										4				
2006.Berrien03.Crop	200													4											
2006.Berrien03.Giz						1																			
2006.Berrien04.Crop	2														2										
2006.Berrien05.Crop																							10		
2006.Berrien05.Giz									1				2			1					2				
2006.Berrien06.Crop		2				8							2												
2006.Berrien06.Giz							2						13												
2006.Berrien07.Giz	2	27			2							1	4				4	3							
Cook2006.01				1								10					13								
Cook2006.02		5							1				14				5								
Cook2006.03													43				1								
Cook2006.04													200				195								
Cook2006.05											1						1		23						
Cook2006.06					1			9					53				1			3					
Cook2006.07							3					2	1	140											
Cook2006.08				4			8				4						1								
Cook2006.09							5										11								
Cook2006.10				1													6								
Cook2006.11				22			5						61												
Cook2006.12		5					3						3	3											
Cook2006.13													30				9								
Cook2006.14													6												
Cook2006.15						5	1																		
Cook2006.16		7					5						7												
Cook2006.17						2	19						17					1							
Cook2006.18							1											1							
Cook2006.19							10						20		1	2			26						
Cook2006.20							13																		
Cook2006.21							12																		
Cook2006.22							6					4						3							
Cook2006.23												45						3							
Cook2006.24							1										1			3					
Cook2006.25						28	7											9							
Cook2006.26						4							5	52	1										
Cook2006.27				30		9							12												
Cook2006.28						2							4	21				13							
Cook2006.29																	1								
Cook2006.30																		29							
Cook2006.31												11					1	11							
Cook2006.32				5																					
2005.Grady.01													1	2				1							
2005.Grady.02																									
2005.Grady.03					1												1								
2005.Grady.04															2										
2005.Grady.05																1		16							
2005.Grady.06																									
2005.Grady.07														123											
2005.Grady.08				1		1										1									
2005.Grady.09						1						7		8											
2005.Grady.10													1												
2005.Grady.11													1				6		2						
2005.Grady.12		19				1											25	1							
2005.Grady.13																		12							
2005.Grady.14							1						1		5										
2004.Grady.01																		28	1						
2004.Grady.02		3	9						1									18	3						
2004.Grady.03																		16							
2004.Grady.04															15	20					33	7	42		
2004.Grady.05			83																						
2004.Grady.06									1				35											14	
2004.Grady.07			3						2				17	3826											
2004.Grady.08									30													1			
2004.Grady.09																		120							
2004.Grady.10																		7							
2004.Grady.11			1											16	3415										
Count:	8	12	1	10	5	13	19	5	4	1	8	8	22	18	18	21	3	2	2	3	1	2	1	1	
Total																									
Seeds:	467	178	2	78	15	93	133	48	10	2	73	35	528	7896	121	344	31	31	8	19	34	10	43	15	
Avg.																									
Seeds/Bird	93.4	25.4	1.3	13	4.3	12.4	12.7	13.7	3.3	1.3	14.6	7	44	6	12.1	29.9	12.4	15.5	4	7.6	22.7	5	28.7	10	