

Phyllophaga Collected at Light Traps in Indiana (Scarabaeidae, Coleoptera)

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Introduction

Records of the May beetles (Phyllophaga) collected at light traps in Indiana were kept for 1951, 1952, 1954 and 1955. In 1951 two series of traps using various colored lamps were operated in vegetable gardens in Marion Co. In 1952 six different lamps were operated in a field of Mammoth clover in Tippecanoe Co. (G)². In 1954 a single trap equipped with a 15-watt 360 BL lamp was operated in each of the following counties: Jefferson (A), LaPorte, Lawrence, Posey and Tippecanoe (D). In addition a single trap equipped with a 75-watt incandescent lamp and a series of traps each equipped with 15-watt 360 BL lamps and placed at different heights were operated in Tippecanoe County (D). All of the traps in 1954 were located in farm yards at some distance from crops. In 1955 the same traps were operated in the same locations in Jefferson (A), Lawrence and Tippecanoe Counties (D). In addition two traps each equipped with a 15-watt 360 BL lamp were operated in a tobacco field at Wirt (Jefferson Co.) (B), a trap equipped with 400-watt mercury vapor lamp in a tobacco field near Madison (Jefferson Co.) (C), and a trap equipped with two 30-watt 360 BL lamps in a tobacco field on the Andrews' farm (Jefferson Co.) (A). Also a few collections were made at a trap lighted with a 400-watt mercury vapor lamp which was placed in a corn field in St. Joseph County and at some traps operated in August and September in a corn field in Tippecanoe County (E, F).

In most seasons the traps were not operated until after the main flight of May beetles was over and in no season were they in operation at the time of the earliest flight. In 1951 the traps were installed on May

1. The authors wish to acknowledge the following persons for their contributions toward making this paper possible: Dr. Milton W. Sanderson, Illinois Natural History Survey and Prof. J. J. Davis, Department of Entomology, Purdue University, for determining large series of Phyllophaga reported herein; Dr. G. E. Marshall (Lawrence Co.), Mr. Stanley Andrews (Jefferson Co.), Miss Carolyn Upshaw (Posey County) and Mr. Kenneth Freyer (LaPorte Co.) for collecting daily the insects caught the preceding nights and for caring for such collections and the traps for the entire trapping period.

2. The letters (A through G) are used to designate the various sites in Jefferson and Tippecanoe counties where traps were operated at several locations. These are as follows:

A—The Andrew's Farm; Jefferson Co.

B—The Harrell Farm; Wirt, Indiana, Jefferson Co.

C—The Davis Farm; Madison, Indiana, Jefferson Co.

D—The Purdue Electric Farm; Tippecanoe Co.

E—Corn fields along South River Road; Lafayette, Indiana, Tippecanoe Co.

F—Experimental traps on the property of Mr. J. G. Taylor; Tippecanoe Co.

G—The Kirker Farm; Tippecanoe Co.

17, in 1952 on June 10, in 1954 the earliest were installed on April 10 and in 1955 on April 19. The traps in the various localities in 1954 and 1955 were not all installed on the same date.

Thirteen types of lamps were used in the experiments. Besides a frosted incandescent, mercury vapor and a heat lamp which gave out no visible radiation, the following ten kinds were used:³ germicidal (2537-5780, 2537), erythema (max. output at 3250), 360 BL (3100-4400, 3500), blue fluorescent (3200-7500, 4400), daylight fluorescent (3000-7800, 5700), Lumiline (3700-30,000 plus, 10,000), green fluorescent (4500-6500, 5300), gold fluorescent (5100-7600, 5900), pink fluorescent (5400-8000 plus, 6100), and red fluorescent (5800-8000 plus, 6400). All of the lamps but the green, gold, pink, red and the heat lamp gave off at least part of their energy in the ultra violet region of the spectrum.

Comparative Attractiveness of Colored Lights

In 1951, two series of like traps but utilizing bulbs of different colors were maintained in vegetable gardens in Marion County. These collection data are summarized in Tables 1 and 2.

TABLE 1. Comparative Attractiveness of Different Colored Lights.
(Hafer Bros., Marion Co., 1951).

Species		Germi- cidal	Erythe- mal	360-BL	Blue	Lumi- line	Gold	Red
<i>P. hirticula</i>	F	2	6	10	5	2		
	M	2	9	10	5	4		
<i>P. crenulata</i> ^a	F							
	M	4	6	13	10	5		
<i>P. futilis</i>	F	1	0	5	4	1	1	1
	M	7	10	20	10	13	6	0
<i>P. fervida</i>	F	0	3		2	3		
	M	3	2		2	1		
<i>P. bipartita</i>	F	7	24	45	40	8		2
	M	0	19	32	18	4		3
<i>P. rugosa</i>	F		0					
	M		1					
Totals	F	10	33	60	51	14	1	3
	M	12	41	62	35	22	6	3

a. Individuals not recorded according to sex and not included in totals.

3. The range of the spectral distributions and the region of maximum output in Angstroms is placed in parentheses after each lamp.

TABLE 2. Comparative Attractiveness of Different Colored Lights.
(Meyers', Marion Co., 1951)

Species		Germi- cidal	Erythe- mal	360-BL	Blue	Green	Pink	Heat
<i>P. hirticula</i>	F	2	13	4	3		0	
	M	7	13	7	8		2	
<i>P. ilicis</i>	F		0					
	M		1					
<i>P. crenulata</i> ^b	F							
	M	18	4	11	20	2	4	
<i>P. futilis</i>	F	2	5	2	2	2	4	
	M	20	8	11	10	8	8	
<i>P. fervida</i>	F	4	5	1	1	5	1	
	M	2	1	3	0	1	3	
<i>P. bipartita</i>	F	27	18	36	36	16	20	
	M	16	14	18	24	13	8	
Totals	F	35	41	43	42	23	25	0
	M	45	37	39	42	22	21	0

b. Individuals not recorded according to sex and not included in totals.

In 1952, a series of six traps using six different colored fluorescent lamps were maintained from June 10 to 16, both dates inclusive, overlooking a field of mammoth clover in Tippecanoe County. Table 3 summarizes these collection data.

TABLE 3. Summary of Species and Individuals Taken in Light Traps
With Variously-colored Bulbs. (Tippecanoe Co. (G), June 10-16, 1952.)

Species		Erythe- mal	360-BL	Blue	Green	Pink	White	Totals
<i>P. hirticula</i>	F	1	3	3	0	3	5	5
	M	17	19	18	12	23	23	112
<i>P. ilicis</i>	F	0	0	0		0	0	0
	M	2	1	3		1	4	11
<i>P. crenulata</i>	F	1	0	0	0	0	0	1
	M	1	5	3	2	2	1	14
<i>P. futilis</i>	F	0		0	0	0	0	0
	M	2		1	1	3	1	8
<i>P. fervida</i>	F	1			1			2
	M	0			0			0
<i>P. rugosa</i>	F	1	7	1	1	1	3	14
	M	11	22	7	5	14	10	69
<i>P. drakii</i>	F		0					0
	M		1					1
Totals	F	4	10	4	2	4	8	32
	M	33	48	32	20	43	39	215

For the past two years (1954-55) two traps have been operated at the Purdue Electric Farm, Tippecanoe County. One trap utilizes a 75-W incandescent bulb while the other is fitted with a 360-BL fluorescent light. A summary of these results is given in Table 5.

TABLE 4. Summary of Species and Individuals Taken in High-Low Light Traps. (Tippecanoe Co. (G), June 17-23, 1952.)

Species		High	Low	Totals
<i>P. hirticula</i>	F	1	3	4
	M	8	13	21
<i>P. ilicis</i>	F	0	0	0
	M	3	2	5
<i>P. crenulata</i>	F		0	0
	M		4	4
<i>P. prunina</i>	F		0	0
	M		1	1
<i>P. futilis</i>	F	0	0	0
	M	1	2	3
<i>P. rugosa</i>	F	1	1	2
	M	0	4	4
Totals	F	2	4	6
	M	12	26	38

TABLE 5. Comparison of Species and Individuals Taken at Two Light Traps in 1954 and 1955, One with a 360-BL Fluorescent Bulb and One With a 75-W Incandescent Bulb. (Purdue Electric Farm, D).

Species		1954			1955		
		360-BL	75 W	Totals	360-BL	75 W	Totals
<i>P. hirticula</i>	F	40	20	60	11	6	17
	M	29	16	45	19	16	35
<i>P. crenulata</i>	F			0	0		0
	M			0	1		1
<i>P. implicita</i>	F	0		0	5	5	10
	M	3		3	5	2	7
<i>P. inersa</i>	F			0	0	0	0
	M			0	2	2	4
<i>P. vehemens</i>	F		0	0			0
	M		3	3			0
<i>P. futilis</i>	F	7	5	12	3	4	7
	M	90	190	280	31	24	55
<i>P. fervida</i>	F	1	4	5	2	1	3
	M	10	1	11	12	7	19
<i>P. fusca</i>	F	9	13	22			0
	M	25	46	71			0
<i>P. bipartita</i>	F	8	2	10	0		0
	M	1	0	1	1		1
Totals	F	65	44	109	21	16	37
	M	158	256	414	71	51	126

Height and Direction of Flight

From June 17 to 23, 1952, four traps were maintained at the Kirker field, all traps having 360-BL fluorescent bulbs. Two of the traps were placed approximately four feet from the ground (designated as high) and two were placed two feet from the ground (designated as low). The traps were alternated daily between the four and two-foot levels. Table 5 summarizes these results.

From June 10 to 23, 1954, twelve traps were maintained at the Purdue Electric Farm, all traps having 360-BL fluorescent bulbs. Four traps were placed on each of three sides of the "barn lot" so that traps faced east, north and west. In addition to the direction of facing the traps were affixed at four and twelve feet positions as follows: one pole with a trap at four feet (designated as 4); one pole with a trap at twelve feet (designated as 12); one pole with two traps, one at four feet (designated as 4A), and one at twelve feet (designated as 12A). The positions of the poles with attached traps were made at random on each of the three sides. In analyzing the effectiveness of the traps used in combination, the symbol 12/4 designates traps on the same pole and the symbol 4-12 designates the traps on individual poles. The results are presented in Tables 6, 7, 8, 9.

TABLE 6. Summary of Species and Individuals Taken in North-Facing Light Traps. (Purdue Electric Farm (D), June 10-23, 1954)

		Height				Totals
Species		4A	12A	4	12	
<i>P. hirticula</i>	F	32	6	30	11	79
	M	12	5	18	5	40
<i>P. crenulata</i>	F	0				0
	M	1				1
<i>P. tristis</i>	F		1			1
	M		0			0
<i>P. implicita</i>	F		6			6
	M		1			1
<i>P. futilis</i>	F	6	1	2	1	10
	M	6	0	22	7	35
<i>P. fervida</i>	F			3		3
	M			0		0
<i>P. fusca</i>	F	7	0	9	1	17
	M	0	1	5	0	6
<i>P. bipartita</i>	F	1		1		2
	M	2		1		3
Totals	F	46	14	45	13	118
	M	21	7	46	12	86

TABLE 7. Summary of Species and Individuals Taken in East-Facing Light Traps. (Purdue Electric Farm (D), June 10-23, 1954.)

		Height				
Species		4A	12A	4	12	Totals
<i>P. hirticula</i>	F	21	3	20	9	53
	M	19	0	21	0	40
<i>P. futilis</i>	F	4	1	4	1	10
	M	4	2	16	1	23
<i>P. fusca</i>	F	4	1	5	3	13
	M	2	0	0	1	3
<i>P. bipartita</i>	F		0		1	1
	M		1		0	1
Totals	F	29	5	29	14	77
	M	25	3	37	2	67

TABLE 8. Summary of Species and Individuals Taken in West-Facing Traps. (Purdue Electric Farm (D), June 10-23, 1954.)

		Height				
Species		4A	12A	4	12	Totals
<i>P. hirticula</i>	F	14	4	24	6	48
	M	4	1	19	6	30
<i>P. prunina</i>	F	0				0
	M	1				1
<i>P. balia</i>	F				0	0
	M				1	1
<i>P. futilis</i>	F	1	4	4	0	9
	M	5	5	18	2	30
<i>P. fusca</i>	F			1	0	1
	M			4	1	5
<i>P. bipartita</i>	F	2	1	4		7
	M	5	0	0		5
Totals	F	17	9	33	6	65
	M	15	6	41	10	72

TABLE 9. Summary of Species and Individuals Taken in Traps at 4 ft. and 12 ft. Heights Irrespective of Trap Facing. (Purdue Electric Farm (D), June 10-23, 1954.)

Species				Totals	Combination	
		4	12		12/4	4-12
<i>P. hirticula</i>	F	141	39	180	80	100
	M	93	17	110	41	69
<i>P. crenulata</i>	F	0		0	0	
	M	1		1	1	
<i>P. tristis</i>	F		1	1	1	
			0	0	0	
<i>P. prunina</i>	F	0		0	0	
	M	1		1	1	
<i>P. implicita</i>	F		6	6	6	
			1	1	1	
<i>P. balia</i>	F		0	0		0
	M		1	1		1
<i>P. futilis</i>	F	21	8	29	17	12
	M	71	17	88	22	66
<i>P. fervida</i>	F	3		3		3
	M	0		0		0
<i>P. fusca</i>	F	26	5	31	12	19
	M	11	3	14	3	11
<i>P. bipartita</i>	F	8	2	10	4	6
	M	8	1	9	8	1
Totals	F	199	61	260	120	140
	M	185	40	225	77	148

Species Collected in Light Traps

In the four years collecting 22 of the 39 species of Phyllophaga known to occur in the state were taken. Three species, *P. hirticula* (Knoch), *P. crenulata* (Froelich) and *P. implicita* (Horn) were taken in all seven counties. *P. congrua* (Le Conte) was taken only in Posey County and *P. crassissima* (Blanchard) only in St. Joseph County.

P. hirticula (Knoch) (2190 specimens; 29.2% females).

Jefferson Co. 30/V-11/VII/54 —3♀, 17♂ (A): 15/VI-7/VII/55 —1—1♀, 2♂ (A): 16/VI-7/VII/55 —3♀, 1♂ (B). LaPorte Co. 16/V-31/VII/54 —76♀, 660♂.

Lawrence Co. 27/IV-2/VI/54 —190♀, 430♂: 17/V-20/VI/55 —7♀, 6♂.

Marion Co. 19/V-29/VI/51 —78♀, 102♂. Posey Co. 24-31/V/54 —1♀, 1♂.

St. Joseph Co. 1-22/VI/55 —2♀. Tippecanoe Co. 10-16/VI/52 —19♀, 133♂ (G): 29/IV-4/VII/54 —240♀, 160♂ (D): 1/V-28/VI/55 —17♀, 35♂ (D): 15/VI-14/VII/55 —3♀, 3♂ (E).

P. ilicis (Knoch) (53 specimens; 11.3% females).

Jefferson Co. 23/VI-12/VII/55 —1 ♀, 3 ♂ (A): 16-27/VI/55 —1 ♀, 1 ♂ (B).

LaPorte Co. 1/VII/54 —1 ♂. Lawrence Co. 30/IV-30/VI/54 —2 ♀, 13 ♂: 20-29/V/55 —1 ♀, 7 ♂. Marion Co. 28/VI/51 —1 ♂. Tippecanoe Co. 10-16/VI/52 —16 ♂ (G): 17/VI-24/VII/55 —1 ♀, 5 ♂ (E).

P. crenulata (Froelich) (234 specimens; 3.6% females).⁴

Jefferson Co. 16/VI-7/VII/55 —7 ♂ (C): 20/VI-25/VII/55 —5 ♂. (A): 28/VI-14/VII/55 —2 ♂ (B). LaPorte Co. 23/V-13/VII/54 —6 ♂. Lawrence Co. 3/V-30/VI/54 —1 ♀, 16 ♂: 17/V-1/VIII/55 —8 ♂. Marion Co. 17/V-16/VIII/51 —124 specimens (not sexed). Posey Co. 17/V-5/VII/51 —16 ♂. St. Joseph Co. 8/VI-11/VII/55 —9 ♂. Tippecanoe Co. 10-16/VI/52 —1 ♀, 18 ♂ (G): 18/VI/54 —1 ♂ (D): 19/VI/55 —1 ♂ (D): 5-20/VII/55 —2 ♀, 21 ♂ (E): 16-25/VII/55 —14 ♂ (F).

P. tristis (Fabricius) (18 specimens: 77.7% females).

LaPorte Co. 16/V-8/VI/54 —3 ♀. Lawrence Co. 30/IV-1/V/54 —3 ♀, 2 ♂; 17/V/55 —1 ♀. Marion Co. 8/VI/51 —7 ♀, 1 ♂. Tippecanoe Co. 10/VI/54 —1 ♀ (D).

P. micans (Knoch) (2 specimens; 100% females).

Lawrence Co. 12/VI/54 —1 ♀. Marion Co. 19/V/51 —1 ♀.

P. prunina (LeConte) (10 specimens; 30% females).

Lawrence Co. 30/V-9/VI/54 —3 ♀, 2 ♂: 18/VI/55 —1 ♂. St. Joseph Co. 8-22/VI/55 —2 ♂. Tippecanoe Co. 22/VI/52 —1 ♂ (G): 21/VI/54 —1 ♂ (D).

P. crassissima (Blanchard) (1 specimen; 100% females).

St. Joseph Co. 8-22/VI/55 —1 ♀.

P. implicita (Horn) (187 specimens; 70% females).

Jefferson Co. 16/VI-7/VII/55 —2 ♂ (C). LaPorte Co. 30/V-26/VI/54 —14 ♀, 9 ♂. Lawrence Co. 6-12/VI/54 —1 ♀, 9 ♂: 17-29/V/55 —23 ♀, 18 ♂. Marion Co. 24/V/51 —1 ♀. Posey Co. 24/V/54 —1 ♂. St. Joseph Co. 1-22/VI/55 —66 ♀, 6 ♂. Tippecanoe Co. 7-10/VI/54 —6 ♀, 4 ♂ (D): 4/V-20/VI/55 —10 ♀, 7 ♂ (D): 15-24/VI/55 —10 ♀, 3 ♂ (E).

P. longitarsa (Say) (546 specimens; 68.5% females).

Jefferson Co. 20-22/VII/54 —3 ♀, 21 ♂ (A). Posey Co. 15/VI-15/VIII/54 —371 ♀. 151 ♂.

P. balia (Say) (3 specimens; 33.3% females).

Jefferson Co. 8-14/VII/55 —1 ♀ (B). Lawrence Co. 18/VII/55 —1 ♂, Tippecanoe Co. 15/VI/54 —1 ♂ (D).

4. Percent of females does not include catches taken in Marion County since these individuals were not recorded as to sex.

P. ephilida (Say) (1503 specimens; 9.9% females).

Jefferson Co. 6/VII-1/IX/54 —9♀, 22♂ (A): 8/VII-25/VIII/55 —16♀, 186♂ (A): 89♀, 775♂ (B): 13-26/VII/55 —81♂ (C). Lawrence Co. 1/VII-17/VIII/54 —8♀, 68♂: 9/VII-2/IX/55 —3♀, 181♂. Posey Co. 4/VII-20/VIII/54 —24♀, 40♂. Tippecanoe Co. 1/VIII/55 —1♂ (E).

P. inversa (Horn) (157 specimens; 5.1% females).

Jefferson Co. 16/VI-7/VII/55 —1♀, 8♂ (B). LaPorte Co. 16/V-24/VI/54 —3♀, 123♂. Lawrence Co. 7-10/VI/54 —1♀, 2♂: 17-21/V/55 —1♀, 1♂. St. Joseph Co. 8-22/VI/55 —1♀, 2♂. Tippecanoe Co. 3/V-20/VI/55 —4♂ (D): 15-17/VI/55 —1♀, 9♂ (E).

P. congrua (LeConte) (20 specimens; 25% females).

Posey Co. 26/IV-29/V/54 —5♀, 15♂.

P. vehemens (Horn) (21 specimens; 4.7% females).

Lawrence Co. 13/V-15/VI/54 —1♀, 5♂. Posey Co. 21/IV-30/V/54 —12♂. Tippecanoe Co. 22/V/54 —3♂ (D).

P. futilis (LeConte) (1029 specimens; 13.7% females).

Jefferson Co. 30/V-14/VI/54 —4♂ (A). Lawrence Co. 20/IV-24/VI/54 —9♀, 121♂: 24-29/V/55 —3♀, 1♂. Marion Co. 17/V-7/VII/51 —65♀, 301♂. Posey Co. 20/IV-30/V/54 —13♀, 24♂. St. Joseph Co. 1-22/VI/55 —2♂. Tippecanoe Co. 10-23/VI/52 —11♂ (G): 29/IV-26/VI/54 —41♀, 368♂ (D): 28/IV-2/VII/55 —7♀, 55♂ (D): 15/VI-10/VII/55 —3♀, 1♂ (E).

P. fervida (Fabricius) (564 specimens; 21.1% females).

LaPorte Co. 14/V-30/VI/54 —32♀, 291♂. Lawrence Co. 19/IV-10/VI/54 —23♀, 71♂: 21-29/V/55 —2♂. Marion Co. 17/V-22/VI/51 —49♀, 51♂. Posey Co. 25/IV/54 —1♂. Tippecanoe Co. 12-14/VI/52 2♀ (G): 24/IV-10/VI/54 —8♀, 11♂ (D): 20/V/55 —3♀, 19♂ (D): 15/VI/55 —2♀ (E).

P. fusca (Froelich) (225 specimens; 41.3% females).

Jefferson Co. 30/V-23/VI/54 —6♀, 9♂ (A). Lawrence Co. 30/IV-2/VII/54 —8♂. Tippecanoe Co. 21/IV-26/VI/54 —85♀, 115♂ (D): 4/V-15/VI/55 —2♀ (D).

P. bipartita (Horn) (918 specimens; 57.7% females).

Jefferson Co. 30/V-11/VI/54 —2♀, 2♂ (A). Lawrence Co. 19/IV-2/VIII/54 —3♀, 11♂. Marion Co. 17/V-2/VII/51 —487♀, 313♂. Posey Co. 21/IV-22/VII/54 —17♀, 52♂. Tippecanoe Co. 28/V-23/VI/54 —20♀, 10♂ (D): 11/VI/55 —1♂ (D).

P. anxia (LeConte) (28 specimens; no females).

LaPorte Co. 15/V-8/VI/54 —22♂. Lawrence Co. 29/IV-28/VI/54 —2♂. Posey Co. 20/VI-13/VII/54 —4♂.

P. hornii (Smith) (6 specimens; 16.7% females).

Jefferson Co. 12-19/VI/55 —3♂ (A). Lawrence Co. 24-29/V/55 —2♂. St. Joseph Co. 8-22/VI/55 —1♀.

P. rugosa (Melsheimer) (195 specimens; 27.2% females).

Jefferson Co. 8/VI-26/VII/55 —7♀, 33♂ (A): 15/VI-14/VII/55 —16♀ 15♂ (B): 16/VI-7/VII/55 —3♀, 8♂ (C). Marion Co. 19-29/VI/51 3♀, 3♂. St. Joseph Co. 8-22/VI/55 —2♀, 2♂. Tippecanoe Co. 10-23/VI/52 —16♀, 73♂ (G): 17/VI-19/VII/55 —5♀, 8♂ (E): 24-25/VII/55 —1♀ (E).

P. drakii (Kirby) (2 specimens; no females).

Lawrence Co. 17/VI/55 —1♂. Tippecanoe Co. 15/VI/52 —1♂ (G).

Summary

1. Light traps were operated in seven Indiana counties (Jefferson, LaPorte, Lawrence, Marion, Posey, St. Joseph and Tippecanoe) for one or more of the years 1951, 1952, 1954 and 1955.

2. Several lights were used as attractants in various combinations. These light sources were 75-W incandescent, 400-W mercury vapor, lumiline, heat coil and the fluorescent lamps 360-BL, blue, erythema (sun lamp), daylight, germicidal, gold, green, pink and red.

3. In the four years collecting 22 of the 39 species of Phyllophaga known to occur in the state were taken.

4. In a study of relative attractiveness of lamps it was found that more species as well as individuals came to the lamps emitting shorter wavelengths of energy (blue, 360-BL, erythema, germicidal).

5. There appeared to be no significant sex preference for any of the colored lights used (insufficient numbers taken at gold).

6. In comparing a 360-BL fluorescent lamp with a 75-W incandescent lamp in 1954 and 1955, it was found that each lamp attracted an equal number of species but that the incandescent lamp attracted more individuals. However, a significantly higher percentage of those caught at the 360-BL lamp were females (27 to 17).

7. In tests on height of traps preferred by May beetles it was found that more individuals were taken at traps nearest the ground.

8. In studies on direction of flights it was found that more individuals were taken in north-facing traps. East-facing traps ranked second and west-facing traps were third.

9. The ratio of females to males attracted to lights depends on the light source (fluorescent or incandescent), the trap site, the time of year that beetles are collected, and species.