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EFFECTS OF VARIOUS PHOTOPERIODS ON COLOR AND PUBESCENCE IN *THYANTA CALCEATA* (HEMIPTERA: PENTATOMIDAE)[1]

J. E. McPherson[2]

ABSTRACT

Rearing immatures of *Thyanta calceata* in a range of photoperiods showed that a threshold photoperiod is involved in the adult dimorphic response (color and pubescence) with the mean threshold near 12.5L:11.5D. This threshold is consistent with the seasonal distribution of the adult morphs.

Thyanta calceata (Say) ranges from New England south to Florida, and west to Illinois (Blatchley, 1926) and Missouri (Oetting and Yonke, 1971). This phytophagous stink bug exhibits adult dimorphism in color and pubescence. McPherson (1977a) has shown it to be bivoltine and seasonally dimorphic; green adults with short pubescence (shorter than diameter of tibia) are found during summer months, and brown adults with long pubescence during the fall and spring. McPherson has also reported (1977b) that the summer and fall/spring morphs can be produced in the laboratory by rearing immatures under 16L:8D (light: dark) and 8L:16D photoperiods, respectively, and (1978) that the older instars are most sensitive to photoperiod influence. Not previously determined was the effect of a range of developmental photoperiods on color and pubescence. The results of experiments designed to determine this effect are presented here.

MATERIALS AND METHODS

Thirty males and 30 females from F_2 generation laboratory stock were placed in an incubator (23.9 ± 1.1°C) under an 18L:6D photoperiod; the stock was established with individuals collected in summer, 1976, from the LaRue-Pine Hills Ecological Area, Union County, in southern Illinois. They were maintained in mason jars (10 of each sex/jar) provided with cheesecloth as an oviposition site, filter paper, and paper toweling, and fed green snap beans (*Phaseolus vulgaris* L.) as described by McPherson (1971).

Each resulting egg cluster was placed in one of the following seven photoperiods and reared to adults as described by McPherson (1971): 8L:16D, 10L:14D, 12L:12D, 13L:11D, 14L:10D, 16L:8D, and 18L:6D. All experiments were conducted at 23.9 ± 1.1°C during the light and dark phases, and ca. 130 ft-c during the light phases (Ken-Rad, 15W Daylight, F15T8/D).

Adult characters compared were color (green or brown) and pubescence (long or short). Those animals intermediate in color (greenish patches or tinge) were scored as follows: if they had a dorsal transhumeral red to reddish-brown stripe (found in the normal green form) and green legs, they were scored as green for dorsal and ventral color, respectively, and if they lacked the stripe and had brown legs, they were scored as brown. Some adults were one color dorsally, the other ventrally. Short hairs were defined as those shorter than the diameter of the tibia.

Adults were compared in sequential pairs of increasing photophase (Table 1). For example, individuals reared in 10L:14D were compared with those reared in 8L:16D and

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Table 1. Comparison of color and pubescence between *Thyanta calceata* adults reared in various photoperiods.

		Color								
		Dorsal			Ventral			Pubescence		
Photoperiod	Sex	Green	Brown	Test[a]	Green	Brown	Test[a]	Short	Long	Test[a]
8L:16D	♂	0	20		0	20		0	20	
10L:14D		0	20	1.00	0	20	1.00	0	20	1.00
10L:14D	♂	0	20		0	20		0	20	
12L:12D		0	20	1.00	0	20	1.00	0	20	1.00
12L:12D	♂	0	20		0	20		0	20	
13L:11D		12	8	0.00	13	7	0.00	14	6	0.00
13L:11D	♂	12	8		13	7		14	6	
14L:10D		20	0	0.00	20	0	0.00	20	0	0.01
14L:10D	♂	20	0		20	0		20	0	
16L:8D		20	0	1.00	20	0	1.00	20	0	1.00
16L:8D	♂	20	0		20	0		20	0	
18L:6D		20	0	1.00	20	0	1.00	20	0	1.00
8L:16D	♀	0	20		0	20		0	20	
10L:14D		0	20	1.00	0	20	1.00	0	20	1.00
10L:14D	♀	0	20		0	20		0	20	
12L:12D		4	16	0.05	4	16	0.05	3	17	0.12
12L:12D	♀	4	16		4	16		3	17	
13L:11D		19	1	0.00	19	1	0.00	20	0	0.00
13L:11D	♀	19	1		19	1		20	0	
14L:10D		20	0	0.50	20	0	0.50	20	0	1.00
14L:10D	♀	20	0		20	0		20	0	
16L:8D		20	0	1.00	20	0	1.00	20	0	1.00
16L:8D	♀	20	0		20	0		20	0	
18L:6D		20	0	1.00	20	0	1.00	20	0	1.00

[a]Fisher exact probability test.

12L:12D. The differences between these pairs were tested with the Fisher exact probability test. The 0.01 level of significance was chosen because of the variable and subjective nature of color.

RESULTS

Rearing males in 8L:16D, 10L:14D, or 12L:12D produced only brown adults with long pubescence (Table 1). Sixty percent of adults reared in 13L:11D had green dorsal color, 65% green ventral color, and 70% short pubescence. This was significantly different from adults reared in both 12L:12D and 14L:10D, the latter and higher photophases (16L, 18L) producing 100% green adults with short pubescence (Table 1).

Rearing females in 8L:16D and 10L:14D produced only brown adults with long pubescence. Rearing them in 12L:12D produced 20% green adults and 15% with short

Table 2. First and last dates of seasonal occurrence of 4th and 5th instars and adults[a] and corresponding photophases[b].

Generation	Instar	Occurrence in Field Samples	Corresponding Photophases
Summer	4th	May 7-July 20	13 hr:55 min-14 hr:21 min
	5th	May 17-Aug. 1	14 hr:12 min-14 hr:3 min
	adult (green with short pubescence)	June 3-Sept. 7	14 hr:34 min-12 hr:45 min
Fall/spring	4th	Aug. 19-Sept. 27	13 hr:28 min-11 hr:58 min
	5th	Sept. 11-Oct. 7	12 hr:36 min-11 hr:35 min
	adult (brown with long pubescence)	Sept. 29-Nov. 16	11 hr:53 min-10 hr:11 min

[a]McPherson 1977a.
[b]At Cairo, Illinois (No. 1089, U. S. Government Printing Office, Washington, D. C., 1965).

pubescence, but this was not significantly different at the 0.01 level from those reared in 10L:14D. At 13L:11D, 95% green adults and 100% with short pubescence were produced, similar to the higher photophases (14L, 16L, 18L).

DISCUSSION

The results show that a threshold photoperiod is involved in the dimorphic response, that the mean threshold lies between 12L:12D and 13L:11D for both sexes, and that it is closer to 12L:12D for females than for males. Thus, the combined mean threshold for both sexes is near 12.5L:11.5D.

These results are consistent with those of earlier studies of the role of development photoperiod in producing adult dimorphism (McPherson, 1978) and of the life history of this insect in which seasonal dimorphism was observed (McPherson, 1977a). McPherson (1978) found that adult dimorphism was primarily the result of the photoperiod under which 4th and 5th instars were reared. He also reported (1977a) that summer generation adults (from immatures developing during the spring-summer months) were green with short pubescence, and fall/spring generation (overwintering) adults (from immatures developing during the summer-fall months) brown with long pubescence. During the field study, summer generation 4th and 5th instars were collected between 7 May and 1 Aug., the 1st adults 3 June. Natural photophases between 7 May and 1 Aug. were 13 hr:55 min (7 May) or higher (Table 2), peaking on 22 June (14 hr:43 min); all were above the mean threshold of the dimorphic response (12.5L:11.5D). Likewise, 4th and 5th instars of the fall/spring population were collected between 19 Aug. and 7 Oct., the 1st adults on 29 Sept. Photophases between 19 Aug. and 7 Oct. ranged from 13 hr:28 min to 11 hr: 35 min (Table 2). The 12.5L:11.5D photoperiod occurs on 13 Sept., about at the middle of the fall occurrence of 4ths and near the beginning of 5ths (McPherson, 1977a). Thus, 5th instars alone were sensitive enough to produce brown adults with long pubescence. This conclusion is supported by the fact that, though 4th and 5th instars exposed to 8L:16D in the laboratory (remaining instars reared in 16L:8D) were equally important in producing adults with long pubescence, the 5th instars were more important than 4ths in producing brown adults (males, 90-95%; females 40-50%) (McPherson, 1978).

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