

NOTES ON THE LIFE-HISTORIES OF SPECIES OF *HELIOTHIS* (LEPIDOPTERA : NOCTUIDAE) FROM QUEENSLAND

Concurrently with other studies of the four *Heliothis* species from Queensland—*H. armigera* (Hübner.), *H. assulta* Gn., *H. punctigera* Wallengr. and *H. rubrescens* (Walk.) (Kirkpatrick 1961a, 1961b, 1962)—the times taken for development of the various stages throughout the year were recorded. These records, which are presented in Tables 1–4, were made in an insectary at Nambour in south-eastern Queensland during 1957 and 1958. Daily maximum and minimum temperatures were taken and the mean monthly temperatures calculated from these data. Where the development times involved greater periods than a single month, the mean temperatures of the appropriate periods were calculated (Tables 2 and 3). Where more than five specimens were involved a standard error was calculated and a range is given where this occurred.

TABLE 1

DURATION (IN DAYS) OF THE EGG STAGE OF *Heliothis* SPECIES

Month	Mean Temperature (°C)	Species			
		<i>armigera</i>	<i>assulta</i>	<i>punctigera</i>	<i>rubrescens</i>
Jan. 	28.0	3.5 (3–4)	3.5 (3–4)	..	..
Feb. 	28.0	..	..	..	..
Mar. 	25.0	4.0	4.0	4.0	4.0
Apr. 	21.0	..	..	..	..
May 	18.0	5.5 (5–6)	5.5 (5–6)	..	5.5 (5–6)
June 	18.0	..	..	..	6.0
July 	15.5	..	..	..	..
Aug. 	18.0	..	..	..	..
Sept. 	21.0	..	..	5.5 (5–6)	..
Oct. 	27.0	4.0	4.0	..	4.0
Nov. 	27.0	..	..	4.0	4.0
Dec. 	28.0	..	..	..	..

TABLE 2
DURATION (IN DAYS) OF THE LARVAL STAGE OF *Heliothis* SPECIES

Month	Mean Temperature (°C)	Species			
		<i>armigera</i>	<i>assulta</i>	<i>punctigera</i>	<i>rubescens</i>
Jan.	28.0	..	..	..	..
Feb.	28.0	..	..	..	..
Mar.	25.0	24.5 ± 1.0 (16-30)	19.0 ± 1.0 (16-28)	..	23.0 ± 0.5 (21-25)
Apr.	21.0	32.0 ± 0.5 (27-40)	33.0 ± 1.0 (32-39)	..	..
May	18.0	36.0 ± 1.5 (26-47)	37.0 ± 0.5 (34-45)	39.0 ± 1.0 (36-45)	..
June-July	16.7	46	..	..	38
July-Aug.	16.7	..	..	..	..
Aug.-Sept.	19.5	..	..	..	..
Sept.	21.0	28.0 ± 0.5 (25-31)	..	26.5 ± 0.5 (23-34)	..
Oct.	27.0	..	27.0 ± 0	17.5 ± 0.5 (15-22)	..
Nov.	27.0	21.0 ± 1.0 (17-29)	..	18.0 ± 0.5 (16-20)	..
Dec.	28.0	..	19.0 ± 0.5 (17-22)	17.0 ± 0.5 (15-19)	..

TABLE 3
DURATION (IN DAYS) OF THE PUPAL STAGE OF *Heliothis* SPECIES

Month	Mean Temperature (°C)	Species			
		<i>armigera</i>	<i>assulta</i>	<i>punctigera</i>	<i>rubescens</i>
Jan.	28.0	15.5 ± 0.5 (13-18)	13.5 ± 1.0 (9-21)	15.0 ± 0	..
Feb.	28.0	15.5 ± 1.0 (10-20)	18.0 ± 0.5 (16-20)	..	..
Mar.	25.0	17.5 ± 2.0 (16-22)	16.0 ± 0.5 (18-23)	..	..
Apr.	21.0	19	25.0 ± 2.0 (14-30)	23.5 ± 1.0 (16-28)	23.0 ± 1.0 (21-27)
May	18.0	33.0 ± 2.0 (30-47)	33.5 ± 1.0 (33-45)	27.0 ± 2.0 (18-33)	..
June-July	16.7	55	64	50	..
July-Aug.	16.7	..	..	..	..
Aug.-Sept.	19.5	..	55	32.0 ± 4.0 (24-38)	..
Sept.	21.0	17.5 ± 0.5 (15-20)	..	..	..
Oct.	27.0	16.5 ± 1.0 (13-23)	19.5 ± 1.0 (18-30)	16.5 ± 0.5 (14-25)	..
Nov.	27.0	17.0 ± 0.5 (15-19)	16.5 ± 0.5 (14-26)	16.0 ± 0.5 (14-25)	..
Dec.	28.0	13.0 ± 0.5 (12-17)	..	13.5 ± 0.5 (10-17)	..

Development times recorded for the three economically important species—*armigera*, *assulta* and *punctigera*—are fairly representative for the temperature periods through the year.

Many pupae in the April-July period entered a period of quiescence which is probably a facultative diapause (Shumakov and Yakhimovich (1955) and Nel (1961) record a diapause in *H. armigera*), in which state they overwintered, the adults emerging with the onset of warmer weather in September-October. Relevant details for laboratory-reared specimens are given in Table 4.

TABLE 4
DURATION (IN DAYS) OF PERIODS OF QUIESCENCE OF
LABORATORY-REARED PUPAE OF *Heliothis* SPECIES

Species	No. of Records	Pupation		Month of Emergence
		Month	Mean Duration and Range	
<i>H. armigera</i>	3	April	186 (163-210)	Sept.-Oct.
	34	May	160 (142-184)	Oct.-Nov.
	16	June	105 (99-132)	Sept.-Oct.
	1	July	105	Oct.
<i>H. assulta</i>	2	May	140	Sept.
	23	June	110 (79-128)	Sept.-Oct.
	5	July	80 (76-85)	Sept.
<i>H. punctigera</i>	4	June	85 (78-101)	Sept.
<i>H. rubescens</i>	1	June	72	Sept.

Some pupae developed during April-September without diapause (see Table 3), and it is thus evident that this is not an essential part of the seasonal history of these species. That it does occur normally in the field, in southern Queensland at least, is suggested by general observations in crops and also by the results of light-trapping undertaken at Nambour and Toowoomba during 1957-1959, when adults were rarely taken from late May to early September but were captured in large numbers in mid-September and then regularly until early May.

Overall similarity is evident among the four species for development times, which decrease with increasing temperatures. In southern Queensland generally, non-diapausing pupae could give rise to 1-2 generations during the winter,

and over the warmer months (late September-early April) a generation every 6-7 weeks or 4-5 generations in that period can be expected, a total of 5-7 for the year. In some southern areas where colder conditions prevail, fewer generations and more general pupal diapause would occur. In warmer northern Queensland more than 5-7 generations per year are probable.

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