9. FIVESTRIPED SQUIRREL *FUNAMBULUS PENNANTI* WROUGHTON, A PREDATOR OF *HELICOVERPA ARMIGERA* HB. (LEPIDOPTERA: NOCTUIDAE)

The gram pod borer *Helicoverpa armigera* Hb. (Lepidoptera: Noctuidae) is one of the most destructive pests of many important crops with ubiquitous distribution. It is highly polyphagous and is distributed widely over the tropic and subtropic areas of nearly 63 countries (Boadley, 1977). Although voluminous work has been done on invertebrate predators and parasites of *H. armigera* in India (Achan *et al.* 1968, Rao, 1974), little information is available on its avian and mammalian predators. We studied the predation of the fivestriped squirrel *Funambulus pennanti* Wroughton on *H. armigera.*

The common squirrel or fivestriped squirrel *Funambulus pennanti* Wroughton was observed feeding on the pupae of *H. armigera* by digging out the soil in a gram (*Cicer arietinum* L.) field (Parasara, 1989). Inability of *Helicoverpa* larvae to go deep in the hard soil is reported by Jayaraj (1981), however, in other soil types *Helicoverpa* larvae pupate at a depth of 2.5 to 7.5 cm (Haseman, 1915) and over wintering pupae reach a depth of 10 to 15 cm (Bishop, 1929).

This squirrel is a granivorous rodent (Barnett and Prakash 1975, Prater 1974). However, occasional insectivory has been reported, Krishnaswami and Chowhan (1956) studied the gut content of 36 squirrels and found remains of lac insect *Kerrica lacca* (Kerr.), termite, ants, beetles, moths, wasp, louse, mite and lepidopteran larvae. Recently, Tiwari (1990) has reported predation of birds by the fivestriped squirrel but there is no report of it as a predator of *Helicoverpa armigera* Hb.

At Gujarat Agricultural University, Anand (22° 32' N and 73° E) Gujarat, the soil is sandy loam. Paddy *Oryza sativa* is grown as a monsoon crop, with the gram crop being raised in this paddy land in the winter. The soil becomes very hard after the first irrigation. A population of fivestriped squirrel occurs here.

4-5 squirrels were observed regularly visiting the gram crop. The squirrels were observed digging out the soil and feeding on larvae and pupae of *Helicoverpa.*

We also kept a squirrel in a cage of 9" x 9" x 9", and studied its food preference and feeding capacity under laboratory conditions.

The squirrel was provided with 25 each of large 5th and 6th instar larvae, medium sized 3rd and 4th instar larvae, small sized 1st and 2nd instar larvae, and pupae of *Helicoverpa,* larvae of rice grain moth *Corcyra cephalonica* Stainton, wet gram seeds and green pods of gram simultaneously in separate petri dishes on two consecutive days during the morning. The sequence of consumption of each item was noted to determine preference.

The squirrel was kept hungry overnight (12 hrs) and then offered the pre-weighed 50 number of different items to determine its feeding capacity. Feeding capacity was estimated on 4 different days using different food items and time taken to consume each item was recorded.

To determine predation on pupae, 10 pupae of *Helicoverpa armigera* were buried 1 cm deep under moist soil in 9" x 9" area and covered with a cage having no bottom. The squirrel was put inside and within an hour dug out seven pupae using its forelegs, confirming its ability to search out pupae in the field.

Abbreviations used:

G_1 = *Helicoverpa* small sized larvae (1st and 2nd instar).
G_2 = *Helicoverpa* medium sized larvae (3rd and 4th instar).
G_3 = *Helicoverpa* large sized larvae (5th and 6th instar).
CL = *Corcyra cephalonica* Stainton larva
HP = *Helicoverpa* pupa
WGS = Wet gram seeds
GPG = Green pods of gram

TABLE 1
FEEDING CAPACITY OF THE FIVESTRIPED SQUIRREL *F. PENNANTI*

Date of study	Sr. No of offerings	Food items	Number offered	Number consumed	Wt. consumed (g)	Time taken (min)	Remarks
1st day (18.2.90)	1	G_3	50	50	15.80	6.50	
	2	G_3	50	00	00.00	-	
	1	CL	50	50	2.95	2.00	
	2	CL	50	50	2.95	2.00	
	3	CL	50	50	2.95	2.30	
	4	CL	50	50	2.95	3.30	
	5	CL	50	50	2.95	6.00	
	6	CL	50	46	2.71	15.00	Time increased with satiation
		Total	350	346	33.26	37.10	
2nd day (19.2.90)	1	G_3	50	50	15.80	5.35	
	2	G_3	50	34	10.74	18.00	
	1	G_2	50	50	8.50	3.00	
	1	G_1	50	12	1.03	20.00	
	1	WGS	50	1	0.36	-	Stopped eating and started moving around
	2	GPG	50	0	0.00	-	on satiation
		Total	300	147	36.44	46.35	
3rd day (20.2.90)	1	WGS	50	50	17.83	5.40	
	2	WGS	50	50	17.83	9.00	
	3	WGS	50	9	3.21	20.00	
	1	GPG	50	00	0.00		
		Total	200	109	38.87	34.40	
6th day (23.2.90)	1	HP	50	50	14.68	14.30	
	2	HP	50	38	11.16	22.00	
		Total	100	88	25.84	36.30	

Note: Weight of 50 numbers: G_1 = 4.300 g, GPG = 23.860 g.

It was observed that out of all the items made available to the squirrel, the first preference was for CL, probably due to its soft body. The second preference was for G_3 followed by G_2, HP and WGS. Only three G_1 were accepted, GPG were not taken when larvae were offered.

To determine the total weight of a particular item 50 numbers were weighed. All the experiments were conducted twelve hours after depriving the squirrel of food. It was provided with 100 G_3 (50 x 2) and 300 CL (50 x 6). It consumed 50 G_3 and 296 CL within 37.10 min. on the first day (Table 1). Thus, it consumed a total of 33.26 g animal food at a

stretch. Similarly, on the second day it consumed 147 *Helicoverpa* larvae including all the larval types except that G_1 was not eaten much. Out of 50 G_1 only 12 were accepted. It consumed a total of 36.44 g food including 0.36 g WGS. On the third day the squirrel was provided only WGS and it consumed 38.87 g within 34.40 min. The same squirrel was provided only HP on the sixth day. It consumed 88 (25.84 g) out of 100 HP within 36.30 min.

Body weight of the captive male squirrel was 127g, whereas another female weighed 101 g. Therefore, morning food consumption ranged between 20.3 to 30.6% of its own body weight.

The dead moths *Corcyra cephalonica* were discarded every morning. Several squirrels came regularly to feed on these *Corcyra* in the company of mynas *Acridotheres tristis* and *Sturnus pagodarum,* jungle babbler *Turdoides striatus* and house sparrow *Passer domesticus.*

Vegetarian food habits of the squirrel are well-known (Prater, 1974) and one would expect them to damage gram pods, but we found that insect food was preferred over vegetarian food when both were offered. In the absence of insect food, the squirrel subsisted on equal weight of gram seed. The weight of food consumed did not differ significantly over three subsequent days (33.26 to 38.86 g.) However, when the pupa of *Helicoverpa* was given alone, consumption was significantly low.

The squirrels prefer animal food, as against plant material when available in equal proportion. Predation on *H. armigera* Hb., regulates its population at larval and pupal stage, in gram crop at least and several other crops which are infested by *Helicoverpa.*

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