

Studies on the Life History of a predatory Pentatomid Bug, *Andrallus spinidens* (Fabr.)¹

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(With seven figures in a plate & a text-figure)

Andrallus spinidens (Fabr.) is a predator on a wide range of insect pests of economic importance. Studies on the life history revealed that a single female laid from 11 to 1,084 eggs with an average of 370 eggs. The incubation period of eggs was 5.29 ± 0.96 days at room temperature ranging from 85 to 92°F and 7.63 ± 0.51 days in a constant laboratory maintained temperature of $80 \pm 2^\circ\text{F}$. No eggs hatched at relative humidity 20% and below. The maximum hatching was observed to be 95.09 per cent at 100% R.H. The nymphal durations was recorded to be 12.48 ± 0.50 days when the nymphs were reared in the laboratory at the average temperature of $87.09 \pm 3.89^\circ\text{F}$. When the nymphs were reared at constant temperature of $80 \pm 2^\circ\text{F}$, the nymphal duration was 21.98 ± 1.78 days. When the adults were provided with *Prodenia* larvae and lucerne leaves, the males and females survived for 43.62 and 49.33 days respectively.

INTRODUCTION

Andrallus spinidens (Fabr.), nymphs and adults were found associated with *Heliothis armigera* (Hb.) larvae infesting lucerne and redgram crops on various farms of the Institute of Agriculture, Anand. The nymphs as well as the adults were observed to attack the larvae and suck out the body contents. This predatory activity of the bug was quite interesting since *Heliothis* is a very serious pest of a variety of important crop plants. Studies were therefore taken up to determine the usefulness of this bug to regulate populations of its hosts in nature.

REVIEW OF LITERATURE

Andrallus spinidens was first reported from India in 1902 under the name *Audinetia spinidens* (Fabr.). A brief description of the species has been given by Distant (1902) and Ramakrishna Ayyar in *ICHTHOGRAPHIA INSECTORUM JAPONIORUM* (1956). In 1906, Bengroth transferred it to the genus *Andrallus* since the generic name *Audinetia* was preoccupied. Lefroy & Howlett (1909) reported the species as a rare insect feeding upon *Thermesia rubricans* larvae and other caterpillars which are found among herbage and low crops. Subsequently, Fletcher (1914) reported it from south India as feeding on caterpillars of *Chloridea obsoleta*. Ramakrishna

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Ayyar (1940) has mentioned the species as a predatory insect on caterpillars. Cherian & Brahmachary (1941) have briefly listed its distribution, seasonal incidence, hosts, life history and feeding habits. Nageswara Rao (1967) has mentioned this species as a predator on *Parnara mathias* Fb., commonly known as the rice skipper. The biology of this bug has not been studied in detail so far.

DISTRIBUTION AND HOST RANGE

A. spinidens is widely distributed and has been recorded from several islands of the Malay Archipelago; Fiji; Tahiti; E. Africa; Mexico; Pakistan; and Japan. In India, it has been recorded in Sikkim, Assam, Khasi Hills, Harnath, Bengal, Bihar, Orissa and Madras.

The bug attacks a number of insect pests of economic importance which include *Tarache nitidula* (Fabr.) *Earias fabia* (Stoll), *Orthaga* sp., *Spodoptera mauritia* (Boisd.), *Cirphis unipuncta* (Haw.), *Psalis pennatula* (Hb.), *Euproctis fraterna* (Moore), *Utetheisa pulchella* (Linn.), *Argira cribraria* (Clirck), *Hypsa sericea* (Moore), *Amsacta albistriga* (Wlk.), *Stomopteryx nerteria* (Meyr.), *Sylepta derogata* (Fabr.), *Tryporyza incertulas* (Wlk.), *Scripophaga* sp., *Papilio demoleus* Linn., *P. aristolochia* (Fabr.), *Acherontia styx* Westw., *Melanitis ismene* Cram., *Parnara mathias* Fabr., *Achaea janata* (Linn.), *Laphygma exigua* (Hb.), *Leucinodes orbonalis* Guen., *Prodenia litura* F., *Corcyra cephalonica* Staint and *Heliothis armigera* (Hb.).

MATERIAL AND METHODS

A. spinidens adults were found in association with *H. armigera* larvae infesting redgram (*Cajanus cajan*). The adults were held in glass containers 7.0 cm. in diameter and 3.5 cm. in height along with *Heliothis* larvae and host plant. Later they were provided with lucerne leaves and *Prodenia* larvae.

To study the effect of humidity on hatching, eggs were held in closed containers having different concentrations of sulphuric acid to maintain desired humidity. Calcium chloride and distilled water were used to maintain 0 and 100 per cent relative humidity respectively.

DESCRIPTION OF DEVELOPMENTAL STAGES

The eggs are small and cylindrical (Plate 1, Fig. 1) with broader top. The operculum is fitted into a raised rim ornamented with fourteen to twenty micropilar processes. They are creamy white in colour when laid. When the eggs are about to hatch, the colour changes to bright orange reflecting the colour of the nymphs under the chorion. The eggs

are laid in batches, usually in two or three regular rows. The eggs measured on an average 1.149 ± 0.083 mm. in height and 0.840 ± 0.0008 mm. in diameter. At hatching, the chorion ruptures around the margin of the operculum which is then pushed away by the nymph as it comes out.

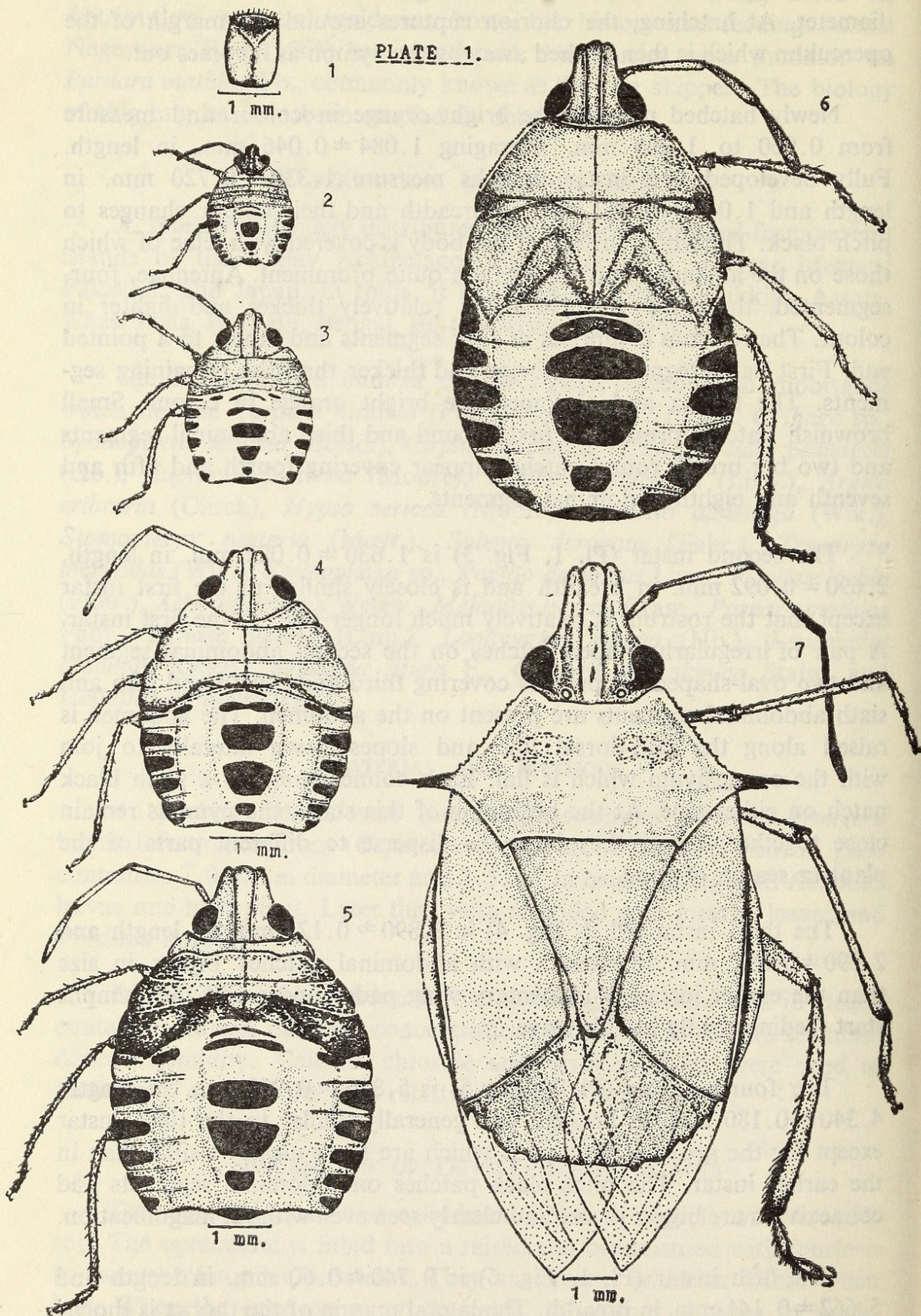
Newly hatched nymphs are bright orange in colour and measure from 0.960 to 1.200 mm. averaging 1.084 ± 0.046 mm. in length. Fully developed first instar nymphs measure 1.339 ± 0.720 mm. in length and 1.045 ± 0.063 mm. in breadth and their colour changes to pitch black. The whole surface of the body is covered with setae of which those on the antennae and the legs are quite prominent. Antennae, four-segmented, the distal segment being relatively thicker and lighter in colour. The rostrum comprises of four segments and tapers to a pointed end. First basal segment is shorter and thicker than the remaining segments. The thorax and abdomen are bright orange in colour. Small brownish patches present on first, second and third abdominal segments and two big brown round patches appear covering fourth and fifth and seventh and eighth abdominal segments.

The second instar (Pl. 1, Fig. 3) is 1.630 ± 0.082 mm. in length, 2.690 ± 0.092 mm. in breadth and is closely similar to the first instar except that the rostrum is relatively much longer than in the first instar. A pair of irregularly shaped patches on the second abdominal segment and two oval-shaped big patches covering third and fourth and fifth and sixth abdominal segments are present on the abdomen. The abdomen is raised along the mid-dorsal line and slopes down laterally to join with the connexivum which is flat. Each connexivum has a pitch black patch on either side. At the beginning of this stage, the nymphs remain close together. Later, they begin to disperse to different parts of the plant in search of food.

The third instar (Pl. 1, Fig. 4) is 2.890 ± 0.121 mm. in length and 2.690 ± 0.092 mm. in breadth with abdominal patches bigger in size than the earlier instar. Rudimentary wing pads appear and the nymphs start feeding avidly at this stage.

The fourth instar (Pl. 1, Fig. 5) is 5.820 ± 0.920 mm. in length, 4.340 ± 0.180 mm. in breadth and generally similar to the third instar except for the growing wing pads which are more clearly visible than in the earlier instar. The pitch black patches on abdominal segments and connexivum are bigger in size and clearly seen even without magnification.

The fifth instar (Pl. 1, Fig. 6) is 9.740 ± 0.60 mm. in length and 5.662 ± 0.141 mm. in breadth. The lateral margin of the thorax is thorny and the wing pads extend up to the second abdominal segment. The



Life history stages of *Andrallus spinidens* (Fabr.)

abdomen is bright orange in colour with black patches all over. There is a pair of black patches on the first abdominal segment, a black stripe and a 'spectacle' shaped patch on the second abdominal segment and four irregular black patches each covering two abdominal segments. On each connexivum, there is a pitch black patch on either side.

The newly transformed adult is yellow to light salmon in colour which slowly changes to pale brown or yellow with slight tinge of brown. The body is elongate and measures from 10.00 to 14.00 mm. in length and 6.40 to 7.00 mm. in breadth. The measurements recorded for 20 males and 20 females showed that females are longer and broader than the males. The average length and breadth are 10.85 ± 0.75 mm. and 6.48 ± 0.056 mm. for males and 13.20 ± 0.69 mm. and 6.70 ± 0.058 mm. for females.

The head is lobular and somewhat long with a blackish broad line on each side of central lobe. The lateral lobes are slightly larger than the central lobe. The head width varied from 2.24 to 2.40 mm. with an average of 2.341 ± 0.058 mm. Compound eyes are prominent and brick red in colour. A pair of bright red lustrous ocelli is present near the compound eyes. The antennae are five segmented measuring 6.40 to 6.88 mm. in length with an average of 6.520 ± 0.205 mm. Distal part of the third segment and fourth and fifth segments of the antennae are black. The rostrum averages 5.916 ± 0.162 mm.

The pronotum is deflected anteriorly and it bears a pale, smooth and lustrous band between the pronotal angles. The pronotal angles bear straight and pointed spines, the distance between them ranges from 7.68 to 7.92 with an average of 7.758 ± 0.063 mm. The scutellum is moderately long and slender. The posterior part of the scutellum in the middorsal region as well as its apex are pale yellow in colour. The costal margin of the wing in the corium region is also pale yellow in colour. The abdomen is 6.40 to 6.64 mm. in width, averaging 6.504 ± 0.072 mm. It is densely punctate and pale yellow with a slight tinge of brown.

LIFE HISTORY AND HABITS

After hatching, the nymphs form a cluster on or near the egg mass. This gregarious habit is very pronounced among nymphs for the first two days and the only movement noticed is for adjustment among themselves. They do not feed during this period and after moulting on the third day they move about in search of food and thus get scattered among the plants. In the second instar, the nymphs suck sap from lucerne leaves or join the older nymphs or adults in sucking the host larvae.

Beginning from the third instar, the nymphs suck plant sap as well as attack the host larvae of all stages.

When advancing to attack, both nymphs and adults follow the prey with the proboscis extended in front and when they are within reach, introduce the proboscis into the host body and anchor it so firmly that it is not taken out till feeding is over. If the host larva feigns death when attacked and tries to drop down, the victim merely remains suspended at the tip of the rostrum of the bug. On very slight disturbance, they hide under soil clods or plant parts. Since they also suck the sap from the foliage, the predatory nature of the insect is of less significance.

The sexes, male and female occur in 1:0.77 ratio and mate several times during their lives. The female usually lays her eggs on the leaves, but eggs have been found also on stem and cloth surface in the laboratory. The results of fecundity studied for 24 pairs of adults are given in table 1.

TABLE 1

FECUNDITY OF *Andrallus spinidens* (FABR.) FROM AUGUST TO DECEMBER 1965

Pair No.	No. of egg batches	No. of eggs in a batch			Total No. of eggs	Days in		
		Min.	Max.	Aver.		Pre-oviposition	Oviposition	Post-oviposition
1	20	26	83	54.2	1,084	15	49	1
2	7	18	68	28.6	200	27	24	4
3	7	43	111	74.0	518	15	22	7
4	6	29	68	50.0	300	16	22	22
5	8	36	91	52.0	416	13	18	2
6	6	16	98	54.0	271	17	20	2
7	10	20	122	70.1	709	14	24	5
8	10	9	64	30.2	302	19	64	1
9	11	15	76	43.2	475	28	38	1
10	4	17	54	34.5	138	13	14	2
11	6	26	61	47.0	281	22	8	2
12	3	41	60	51.0	153	12	9	8
13	2	17	94	55.5	111	58	1	2
14	8	30	121	59.4	475	11	39	12
15	4	13	95	46.7	187	39	18	7
16	5	29	83	65.2	326	32	23	3
17	11	15	111	70.0	769	20	27	2
18	1	11	11	11.0	11	38	1	16
19	5	14	64	46.4	232	30	21	4
20	1	53	53	53.0	53	10	1	25
21	2	38	39	38.5	77	7	6	1
22	12	25	104	68.3	819	12	43	2
23	13	21	137	71.3	927	10	79	2
24	1	46	46	46.0	46	6	1	8
Av.	6.79			54.47	370	20.12	23.83	5.87

The temperature in the laboratory varied from 78°F. to 104°F, with a mean of 81.07°F.

The results in the above table indicate that each female laid on an average 6.79 egg batches each having an average of 54.47 eggs. The number of eggs laid by a female varied from 11 to 1,084 with an average of 370 eggs per female. The pre-oviposition, oviposition and post-oviposition periods were 20.12, 23.83, and 5.87 days respectively.

The effect of relative humidity on the hatching percentage of eggs was determined by holding egg masses in airtight containers having different concentrations of sulphuric acid. The results obtained are given in table 2 and are graphically represented in text-figure 2.

TABLE 2

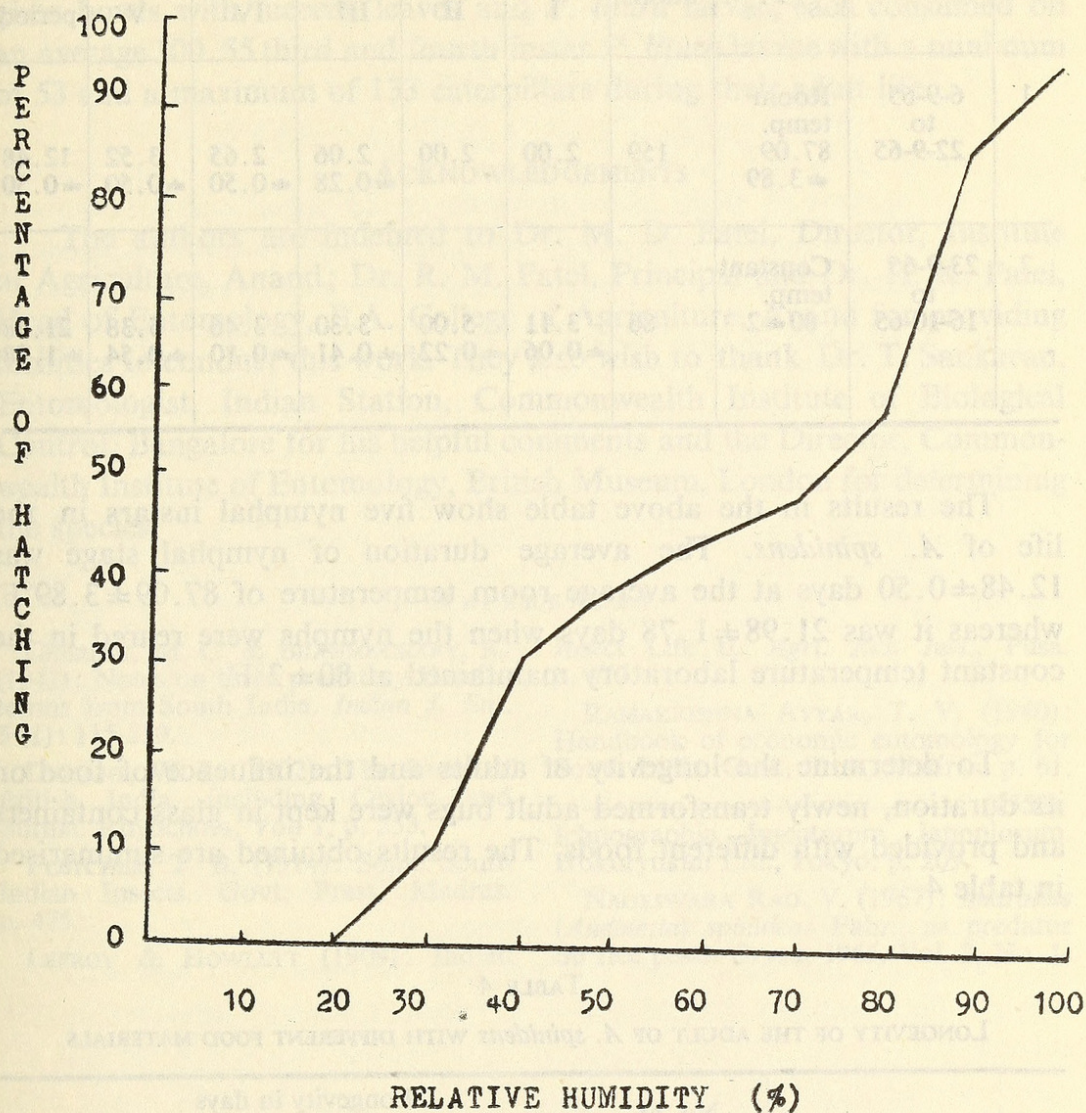
EFFECT OF RELATIVE HUMIDITY ON THE INCUBATION PERIOD OF EGGS AT $80 \pm 2^\circ \text{F}$.

S. No.	R.H. (%)	Period of study	No. of sets	No. of eggs kept for hatching	No. of eggs hatched	Time taken for hatching in days	Percentage of hatching
1	100	29-3-66 to 24-4-66	3	274	260	9	95.09
2	90	8-3-66 to 5-4-66	3	200	178	8	88.14
3	80	10-2-66 to 29-2-66	3	191	120	8	62.45
4	70	13-2-66 to 30-3-66	3	254	129	8	50.86
5	60	13-2-66 to 3-3-66	3	258	125	8	44.62
6	50	14-2-66 to 26-3-66	3	189	72	8	40.13
7	40	15-2-66 to 4-3-66	3	271	88	8	32.13
8	30	15-2-66 to 2-4-66	3	186	21	8	10.19
9	20	1-3-66 to 1-5-66	3	187	0	0	0

The results in the above table indicate a maximum of 95.09% hatching

at 100% R.H. No eggs hatched at 20% R.H. Between 20 and 100% R.H., the hatching percentage increased with the increase in R.H.

EFFECT OF RELATIVE HUMIDITY
ON HATCHING OF EGGS AT $80 \pm 2^{\circ}$ F.



The number and duration of nymphal instars were determined as indicated in table 3.

Instar	No. of nymphs		Duration (days)		Food consumed (mg)		Remarks
	Max.	Avg.	Max.	Avg.	Max.	Avg.	
1	24	24	11	10	43.02	14	1st instar
2	14	13	2	2	19.02	12	2nd instar
3	13	13	6	6	12.19	10	3rd instar
4	12	11	2	2	3.42	2	4th instar
5	12	12	2	2	3.00	2	5th instar



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