

# Bug Ball

Invertebrate Conservation & Information Network of South-Asia (ICINSA)

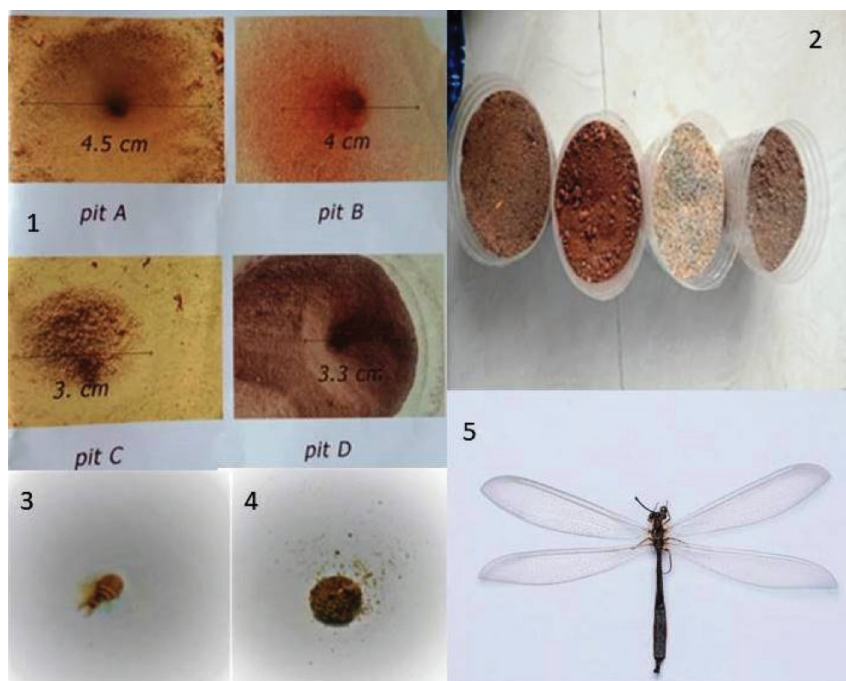
Newsletter of the

## Feeding activity of antlion of *Myrmeleon* sp. in different soil samples from Thrissur District, Kerala

The antlions or myrmeleontids are the largest and widespread family of the Order Neuroptera and constitute about 2,000 species (Mansell 1996). Their psammophilous larvae prefer dry, loose soil like sand and a few members among this group construct conical pit traps and employ sit-and-wait predation strategy (Mansell 1996; Devetak 2014). All the species under tribe Myrmeleontini use this strategy to capture incautious wanderers (Stange 2002).

The larva of Myrmeleontini capture the prey with pit traps, but the size of the prey should not exceed their conical pits (Heinrich & Heinrich 1984).

They remain at the bottom of the pit until the prey falls into the trap. There are



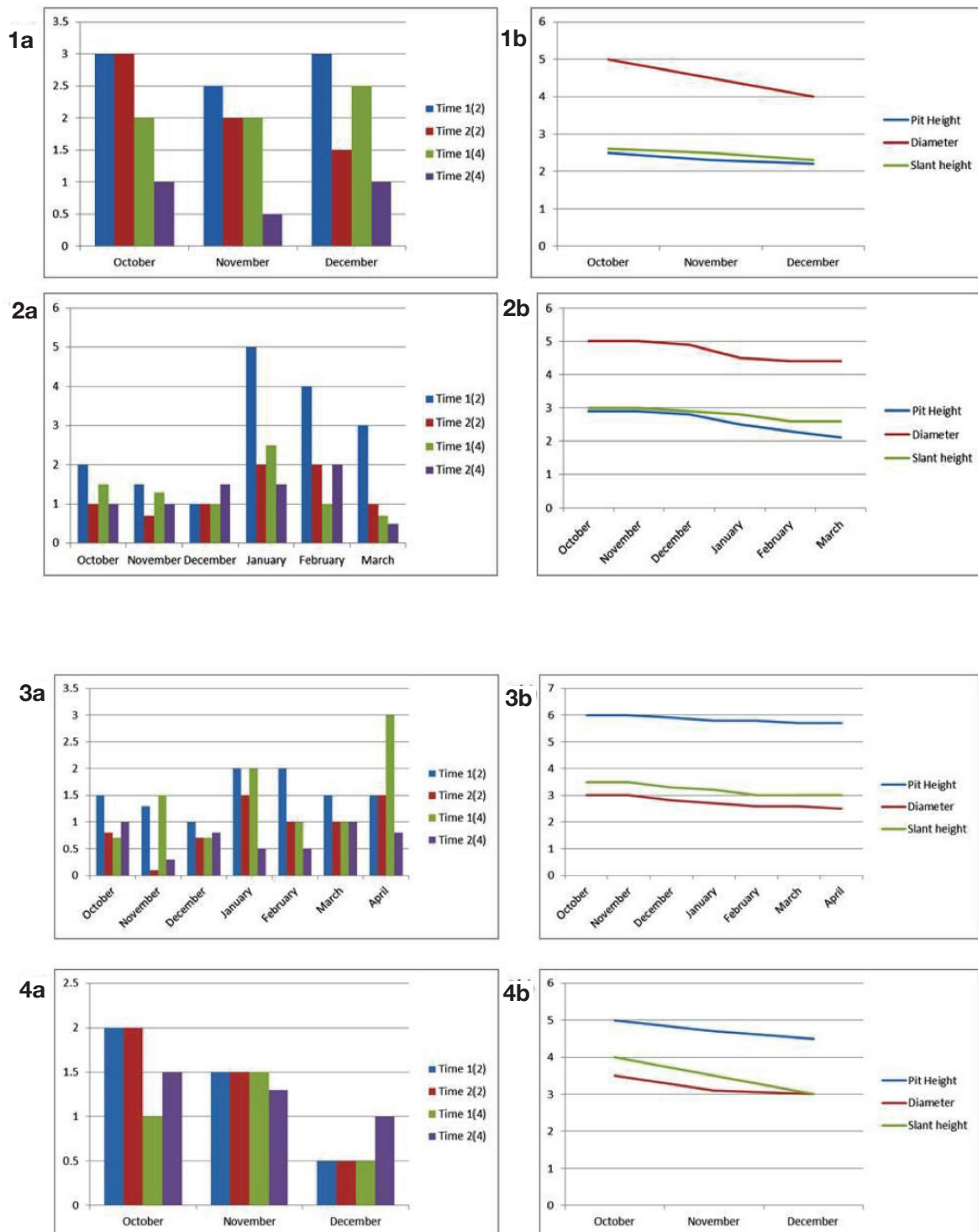
**Image 1. Soil samples with different types of pits. | Image 2. Different types of soil samples used in this study. | Image 3. Second instar larvae of antlion (*Myrmeleon* sp.). | Image 4. Pupal stage of *Myrmeleon* sp. | Image 5. Adult stage.**

three different larval instars for antlion, which differ in their head-width and body length (Arnett & Gotelli 1999). Sand tossing, prey beating, grasping and prey submersion are the foraging techniques used by the larva (Devetak et al. 2010).

They can sense arrival of prey excellently by the help of soil vibrations (Fertin & Casas 2007). All encounters with the prey need not be successful, while there are chances of escaping of prey from the pit. Preys like ants show defensive attack against the antlion larva

# Bugs Ball

Invertebrate Conservation & Information Network of South Asia (ICINSA)  
 Newsletter of the



**Fig. 1a, 2a, 3a and 4a:** Feeding activity of antlion in soil sample A, sample B, sample C and sample D, time 1 and time 2 represents the time taken by the ant trapped in the pit and time taken by the predator to capture the prey. (2) and (4) represents the activity towards the ant of length 2mm and 4mm respectively. **Graph 1b, 2b, 3b and 4b:** Represents the pit characters in soil sample A, sample B, sample C and sample D.

**Table 1. Activity of larva in different soil samples.**

Month	Size of food (ant) (mm)	Average time for dipping (min)				Average time for capturing (min)			
		A	B	C	D	A	B	C	D
October	4 2	2 3	1.5 2	0.7 1.5	1 2	1 3	1 1	1 0.8	1.5 2
November	4 2	2 2.5	1.3 1.5	1.5 72	1.5 1.5	0.5 2	1 0.7	0.3 0.1	1.3 1.5
December	4 2	2.5 3	1 1	0.7 1	0.5 0.5	1 1.5	1.5 1	0.8 0.7	1 0.5
January	4 2	SFA	2.5 5	2 2	SFA	SFA	1.5 2	0.5 1.5	SFA
February	4 2		1 4	1 2			2 2	0.5 1	
March	4 2		0.7 3	1 1.5			0.5 1	1 1	
April	4 2			3 1.5				0.8 1.5	

SFA - Stop Feeding Activity

which will cause severe injury and leads to the death of antlion (Lucas & Brockmann 1981). The prey with large body size is found difficult to kill and is not preferred by antlion. Thus, the successful predation and body mass of prey is negatively correlated (Scharf et al. 2010).

In this work, a comparison of the feeding activity of a *Myrmeleon* sp. was documented by growing its larva in different types of soil. The feeding habits and time for the emergence of the adult varied in different soil. The chemical composition of each type of soil is entirely different because they are collected from different habitats.

Dissimilarities in foraging and emerging behaviour among different soil sample give an idea regarding the adaptability of *Myrmeleon* sp. in different microhabitats. It also reveals the survival range of the species. This study helps to monitor the feeding and pit building behaviour and helps to observe the activity of predators towards different sized prey samples.

Single replications of four individuals of second instar larva (L2) of *Myrmeleon* sp. were selected as the working samples. Four different types of soil sample were collected from different places and marked, Sample A, Sample B, Sample C, and Sample D. [Sample A- moderately fine soil from Azhikode

# Bugs & All

Invertebrate Conservation & Information Network of South Asia (ICINSA)

Newsletter of the

**Table 2. Pit size variation in different soil samples.**

Pit character	Height (cm)	Diameter (cm)	Slant height (cm)
A	2.2-2.5	4-5	2-2.6
B	2.2-2.9	4.5-5	2-3
C	5-6	2-2.8	3-3.5
D	4.5-5	3-4	3-4

(original habitat of the species under study), Sample B- moderately coarse soil collected from Karupadanna, Sample C- fine-grained soil from Azhikode-Munakkal beach and Sample D- coarse-grained soil from Azhikode riverside (Image 2). Second instar larvae of *Myrmeleon* sp. (Image 3) collected from Azhikode were placed in the four plastic containers with four different soil samples (one larva per sample) and fed them with ants. Soil samples were tested and the sand characters like particle density, pH, pore size volume and mineral content (NPK) were measured. The study also evaluated the feeding efficiency and variation in pit making behaviour of *Myrmeleon* sp. in different soil samples.

The study was done over a period of six months starting from October 2018, when antlion larvae reared in four soil samples started feeding and ended in April 2019, when they stopped their feeding activity (antlions from Sample A and Sample D quit feeding after 3 months). Each soil sample was kept at a height of 10 cm in a container.

Two sizes of ants (2 and 4 mm) of different species were provided as the food in a controlled and regular manner. Dipping time, feeding time, pit forming behaviour, time for consuming the prey and duration for the emergence of adult etc. were systematically observed in all the four soil samples.

Characteristics of pits like pit height (in cm), diameter (in cm) and slant height (in cm) in each sample were noted separately. Nature of soil samples was estimated through soil tests conducted at Soil Science lab in KFRI (Kerala Forest Research Institute) for comparing their properties for evaluating soil type preference for efficient predation. Variation in the foraging time and pit making behaviour of the larva in each soil sample were compared and evaluated by graphical methods.

The foraging success of an antlion larva conceivably depends on where its pit is located, how well it is constructed, as well as on how the larva responds to prey in the pit and a possible change of prey availability through time. The activity of *Myrmeleon* larva in different soil samples are represented in the Table 1 and their pit size variation in Table 2. The feeding activity of larva and the pit characters in different soil samples are plotted.

Results of this work showed that pits built in fine-grained soil would be more effective in prey capture than those built in coarse-

# BUGS R ALL

Invertebrate Conservation & Information Network of South Asia (ICINSA)

Newsletter of the

grained soil. The efficiency of prey capture was influenced by different pit design features like depth, pit angle and diameter (Lucas 1982). The proportion of fine-grained particle in soil affects the dimension of pit diameter and depth, features that directly affect prey capture success. Pit dug in fine-grained soil was more efficient, bigger and deeper than the pit dug in coarse-grained soil (Farji-Berener 2003). Pit size decreased with increased particle density. Pit diameter and pit depth were negatively correlated with particle density and reduction in pit size can negatively affect prey capture success (Devetak et al. 2012). Feeding frequency also played a significant effect on pit size during the study. Result of the work showed that the pit height increased with the particle density of soil and fine-grained soil enhanced the prey capture success than that of other samples. Pit diameter decreased with increase in particle density of the sample.

The soil test revealed an alkaline pH of all soil samples which were greater than 7. The mineral contents especially the microelements like Ca, P, K, Mg, and N were estimated. Among them, N and P were found important, because its value and abundance determine the reproductive success and efficiency of antlion. It gives an idea about the nutrient value and fertility of the soil sample. In this study the NPK values of each sample are; sample A: N-137.80, P-67.26,

K-399.84, sample B: N-211.99, P-172.26, K-208.32, sample C: N-53.00, P-12.13, K-28 and sample D: N-63.60, P-21.46, K-40.32. This indicates soil samples selected are the ideal growing medium for antlion. Soil characters act as the main variables and limiting factor in this study.

In the whole study, larger-sized ant species (4 mm) fell as prey to antlion easily than the smaller species (2 mm). The maximum duration of feeding recorded for seven months (October 2018 to April 2019) in sample C, and minimum for three months in sample A and sample D.

During the experiment, features of the pit, like its height and diameter decreased with the growth of antlion larva (mainly after December month) and pit making were ceased at the stage of pupation and after seven months pupa emerged to an adult. A positive correlation was observed between pit characters like slant height and pit height with the particle density of the sample. A negative correlation was observed between pit diameters with particle density so that the soil samples like moderately fine soil from Azhikode (Sample A) and moderately coarse soil from Karupadanna (Sample B) were having their pit diameter more than usual (5 cm). Soil samples with more value of particle density and porosity were seen in fine-grained soil from Azhikode Munakkal

# Bugs R All

Newsletter of the Invertebrate Conservation & Information Network of South Asia (ICINSA)

beach (Sample C) and coarse-grained soil from Azhikode riverside (Sample D). Thus, the study revealed that the characteristics of soil is crucial in feeding efficiency of antlion.

## References

- Arnett, A.E. & N.J. Gotelli (1999).** Bergmann's rule in the antlion *Myrmeleon immaculatus* DeGeer (Neuroptera: Myrmeleontidae): geographic variation in body size and heterozygosity. *Journal of Biogeography* 26(2): 275–283.
- Devetak, D. (2014).** Sand-borne vibrations in prey detection and orientation of antlions, pp. 319–330. In: Cocroft, R.B., M. Gogala, P.S.M. Hill & A. Wessel (eds). *Studying Vibrational Communication, Animal Signals and Communication* 3. Springer, Heidelberg, 462 pp.
- Devetak, D., S. Lipovšek & M.A. Pabst (2010).** Morphology and biology of the antlion *Myrmeleon yemenicus* Hölzel, 2002 (Neuroptera, Myrmeleontidae). *Zootaxa* 2531(1): 48–56. <https://doi.org/10.11646/zootaxa.2531.1.5>
- Devetak, D., T. Novak & F. Janžekovič (2012).** Effect of substrate density on behaviour of antlion larvae (Neuroptera: Myrmeleontidae). *Acta Oecologica* 43: 1–7. <https://doi.org/10.1016/j.actao.2012.05.010>
- Farji-Berener, A.G. (2003).** Microhabitat selection by antlion larvae, *Myrmeleon crudelis*: effect of soil particle size on pit-trap design and prey capture. *Journal of Insect Behaviour* 16(6): 783–796. <https://doi.org/10.1023/B:JOIR.0000018320.99463.ee>
- Fertin, A. & J. Casas (2007).** Orientation towards prey in antlions: efficient use of wave propagation in sand. *The Journal of Experimental Biology* 210: 3337–3343. <https://doi.org/10.1242/jeb.004473>
- Heinrich, B. & M.J. Heinrich (1984).** The pit-trapping foraging strategy of the ant lion, *Myrmeleon immaculatus* DeGeer (Neuroptera: Myrmeleontidae). *Behavioural Ecology and Sociobiology* 14(2): 151–160.
- Lucas, J.R. (1982).** The biophysics of pit construction by antlion larvae (*Myrmeleon*, Neuroptera). *Animal Behaviour* 30: 651–664.
- Lucas, J.R. & H.J. Brockmann (1981).** Predatory interactions between ants and antlions (Hymenoptera: Formicidae and Neuroptera: Myrmeleontidae). *Journal of the Kansas Entomological Society* 54(2): 228–232.
- Mansell, M.W. (1996).** Predation strategies and evolution in antlions (Insecta: Neuroptera: Myrmeleontidae), pp. 161–169. In: Canard, M., H. Aspöck & M.W. Mansell (eds). *Pure and Applied Research in Neuropterology*. Sacco, Toulouse, 341 pp.
- Scharf, I., E.Z. Barkae & O. Ovidia (2010).** Response of pit-building antlions to repeated unsuccessful encounters with prey. *Animal behaviour* 79: 153–158. <https://doi.org/10.1016/j.anbehav.2009.10.017>
- Stange, L.A. (2002).** Family Myrmeleontidae, pp. 275–289, 433–446. In: Penny, N.D. (ed.). A guide to the Lacewings (Neuroptera) of Costa Rica. *Proceedings of the California Academy of Sciences* 53(4): 161–457.

**Acknowledgements:** The authors are grateful to the principal, Christ College (Autonomous), Irinjalakuda, Kerala for providing the facilities for undertaking this work. The corresponding author offers sincere gratitude to CSIR, Government of India, for financial support in the form CSIR junior research fellowship (08/376(0010)/2019-EMR-I). Many thanks to Ms. Anila for providing literature support.

## A.M. Misiriya<sup>1</sup>, T.B. Suryanarayanan<sup>2</sup> & C. Bijoy<sup>3</sup>

<sup>1-3</sup> Shadpada Entomology Research Lab, Department of Zoology, Christ College, Irinjalakuda, Thrissur, Kerala 680125, India.  
Email: [suryantb1995@gmail.com](mailto:suryantb1995@gmail.com) (corresponding author)

**Citation:** Misiriya, A.M., T.B. Suryanarayanan & C. Bijoy (2021). Feeding activity of antlion of *Myrmeleon* sp. in different soil samples from Thrissur District, Kerala. *Bugs R All* #220, In: *Zoo's Print* 36(12): 29–34.

Bugs R All is a newsletter of the Invertebrate Conservation and Information Network of South Asia (ICINSA) published with the financial support of Zoological Society of London.  
For communication, Email: [zp@zooreach.org](mailto:zp@zooreach.org)

