



Entomoparasitic trends in cockroaches: Monthly gregarine load in *P. Americana* and *S. Longipalpa*

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Abstract

Host-parasite relationships play a vital role in shaping ecological and evolutionary processes. *Periplaneta americana* i.e. American cockroach and *Supellalongipalpa* i.e. brown-banded cockroach are often infected by gregarine parasites. These tiny organisms live in the cockroach's intestines and can impact its health, behavior, and population. This study looked at how gregarine infections change month by month in *P. americana* and *S. longipalpa* across different areas of Chhatrapati Sambhajnagar district in Maharashtra. A total of 591 *P. americana* samples were collected and examined under a microscope. About 55.32% of them were found to be infected. While a total of 308 *S. longipalpa* samples were collected and examined under a microscope. About 32.46% of them were found to be infected. We noticed that infection rate changed with the seasons. Some months showed high parasite levels especially from monsoon and moderate from winter, while others had fewer cases i.e. from summer. This suggests that weather and environmental conditions might play a role in how the parasites spread. These findings give us new insight into how gregarines affect cockroach populations. They could also help improve pest control by using natural parasites as part of an eco-friendly strategy. More research is needed to understand why infections rise and fall with the seasons and how climate change might affect this pattern.

Keywords: *Periplaneta americana*, *supellalongipalpa*, gregarine parasitism, monthly prevalence, seasonal variations

Introduction

Gregarine parasites, a group of apicomplexan protozoans, are commonly found in the digestive tracts of insects, including cockroaches, where they can influence host physiology and ecology. Among cockroach species, *Periplaneta americana* (American cockroach) and *Supellalongipalpa* (brown-banded cockroach) are significant as urban pests and potential vectors of pathogens, making their parasitic infections a topic of interest for both entomological and public health research. Studies have documented varying prevalence of gregarines in *P. americana*, with infection rates ranging from 4.35% in wild populations in Malaysia by Yahaya *et al.*, (2017) [12] to approximately 40% in urban settings in Egypt by Zohdy & El-Sherbini, (2010) [13]. In contrast, *S. longipalpa* often exhibits lower or no gregarine infections, potentially due to its smaller size and distinct ecological niche, as noted in host specificity studies by Clopton & Gold, (1996) [5] and Smith & Cook (2008) [10]. High prevalence in *P. americana* has been linked to environmental factors and dense populations, with reports of significant gut infections in Iraq by Al-Mayali & Al-Yaqoobi, (2009) [2] and in Thailand by Chamavit *et al.*, (2010) [3]. Gregarines may also impact cockroach fitness, as observed in developmental studies by Tsai & Chi, (2007) [11]. The study by Fotedar *et al.*, (1991) [6] and Hassan *et al.*, (2013) [7] suggest that the parasites found in *P. americana* raises concerns about their role in pathogen transmission. According to Bell & Adiyodi, (1982) [4] although less data exists for *S. longipalpa*, its inclusion in broader surveys underscores the need to understand gregarine dynamics across cockroach species. Shaikh *et al.*, (2018) [9] carried a survey of protozoan and nematode parasites in American cockroach from Marathwada region of Maharashtra and observed that the infection is more abundant during monsoon and moderate during winter and summer. Rafael *et al.*, (2017) analysed the prevalence of

protozoan parasites in German cockroach and found that 64.5% hosts were infected with gregarine parasites. The study by Al-Badrani *et al.* (2024) [1] focuses on isolating and diagnosing parasites from the American cockroach, *P. americana*, in Mosul City, Iraq and found that 72% of samples were infected with protozoan parasites. They also observed that the cockroaches collected from households are more infected as compare to those collected from schools. Therefore suggested avoidance of food contamination with cockroaches due to the parasites they carry causing various diseases.

Methods and Materials

Insects are collected time to time from their natural habitats like Residential buildings, Sewage drains, Garbage dumps and waste disposal sites, Cracks and crevices in walls and floors, Gardens and backyards from different localities of Chh. Sambhajnagar, Maharashtra. Along with hand collection, insect nets, sticky traps and jar or bottle traps are used to collect them. Insects are collected in ventilated plastic containers maintaining their natural environment. Provided with small amounts of food (e.g., bread crumbs or vegetable pieces) and moisture (wet cotton) to keep them alive until examination.

Then host is dissected and its gut is removed carefully. This fresh material placed on clean glass with a drop of distilled water. A thin film or smear was taken on slide covered with cover slip for examination of live protozoans under the light microscope. Live digital photography of observed parasites is done to record the prevalence of infection.

Results & Discussions

One-year study period was undertaken from January to December 2024 to observe the influence of seasonal variations on gregarine prevalence in *Periplaneta americana* and *Supellalongipalpa*.

1. Yearly Prevalence for *Periplanata americana*

- Total host examined: 591
- Positive for gregarine infection: 327
- Prevalence rate: 55.32%

During the study period month wise analysis of gregarine parasitism in *Periplanata americana*, showed the maximum percentage of prevalence during September 2024i.e. 70.45% and the minimum percentage of prevalence is in April 2024i.e. 44.11%.

Seasonal variations in occurrence of Gregarines in *Periplanata americana*-

a. Summer (February-May 2024)

- Total number of hosts examined: 163
- Number of hosts infected with gregarines: 75
- Prevalence: 46.01%

b. Monsoon (June-September 2024)

- Total number of hosts examined: 217
- Number of hosts infected with gregarines: 136
- Prevalence: 62.67%

c. Winter (January & October-December &2024)

- Total number of hosts examined: 211
- Number of hosts infected with gregarines: 116
- Prevalence: 54.97%

The prevalence of gregarines parasitism in *P. americana* was lowest in Summer (46.01%) from which it increases to highest in Monsoon (62.67%), and then decreased to moderate in Winter (54.97%). It indicates the effect of seasonal variations on gregarines parasitism in the hosts, with the highest prevalence occurring during the months of Monsoon and the lowest during the months of Summer.

2. Yearly Prevalence for *Supellalongipalpa*

- Total host examined: 308
- Positive for gregarine infection: 100
- Prevalence rate: 32.46%

During the study period month wise analysis of gregarine parasitism in *Supellalongipalpa*, showed the maximum percentage of prevalence during August 2024i.e. 41.66% and the minimum percentage of prevalence is in May 2024i.e. 23.80%.

Seasonal variations in occurrence of Gregarines in *Supellalongipalpa*-

a. Summer (February-May 2024)

- Total number of hosts examined: 96
- Number of hosts infected with gregarines: 25
- Prevalence: 26.04%

b. Monsoon (June-September 2024)

- Total number of hosts examined: 117
- Number of hosts infected with gregarines: 43
- Prevalence: 36.75%

c. Winter (January & October-December &2024)

- Total number of hosts examined: 95
- Number of hosts infected with gregarines: 32
- Prevalence: 33.68%

The prevalence of gregarines parasitism in *S. longipalpa* was lowest in Summer (26.04%) from which it increases to highest in Monsoon (36.75%), and then decreased to moderate in Winter (33.68%). It indicates the effect of seasonal variations on gregarines parasitism in the hosts, with the highest prevalence occurring during the months of Monsoon and the lowest during the months of Summer.

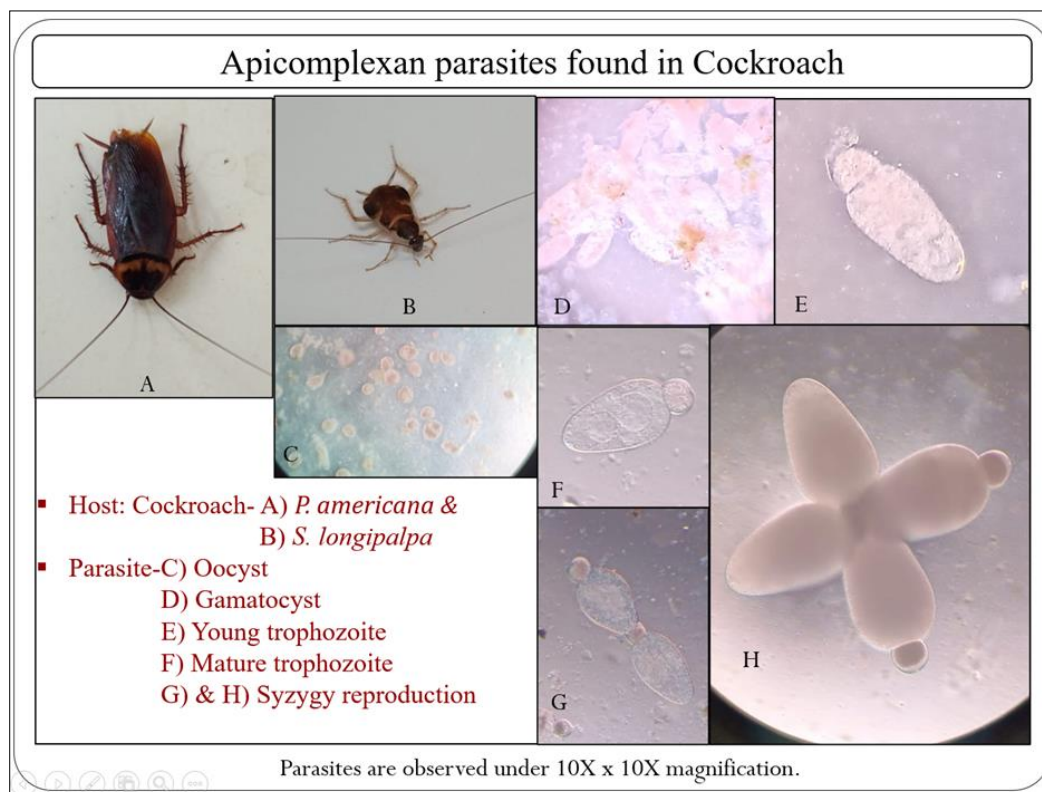


Fig 1: Different life cycle stages of gregarines parasitising *P. Americana* & *S. longipalpa*

Monthly Breakdown for Jan-Dec 2024

Table 1: showing the prevalence of gregarine parasites in *P. americana* (for Jan-Dec 2024)

Duration (month wise) 2024	Total no. of host examined	No. of host infected with gregarines	% prevalence
January- 2024	56	27	48.21
February- 2024	36	17	47.22
March- 2024	48	22	45.83
April- 2024	34	15	44.11
May- 2024	45	21	46.66
June- 2024	51	28	54.90
July- 2024	57	34	59.64
August- 2024	65	43	66.15
September- 2024	44	31	70.45
October- 2024	61	38	62.29
November- 2024	39	22	56.41
December- 2024	55	29	52.72
Total	591	327	55.32

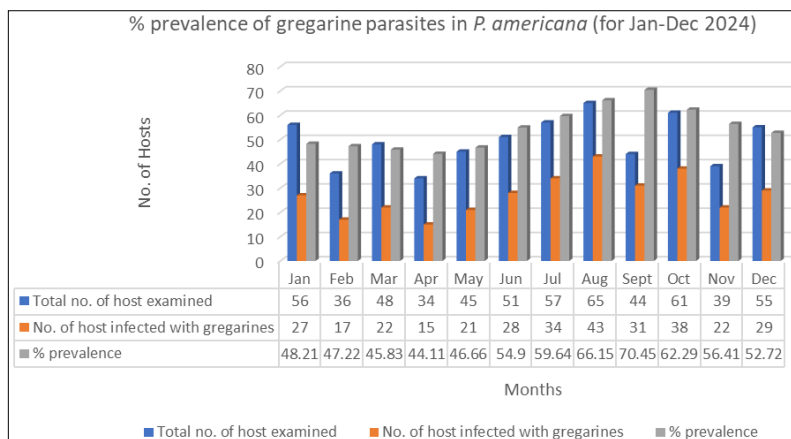


Fig 2: Showing the month wise prevalence of gregarines in *P. americana* (for Jan-Dec 2024)

Table 2: showing the prevalence of gregarine parasites in *S. longipalpa* (for Jan-Dec 2024)

Duration (month wise) 2024	Total no. of host examined	No. of host infected with gregarines	% prevalence
January- 2024	20	6	30.00
February- 2024	28	8	28.57
March- 2024	19	5	26.31
April- 2024	28	7	25.00
May- 2024	21	5	23.80
June- 2024	24	7	29.16
July- 2024	32	11	34.37
August- 2024	24	10	41.66
September- 2024	37	15	40.54
October- 2024	21	8	38.09
November- 2024	29	10	34.48
December- 2024	25	8	32.00
Total	308	100	32.46

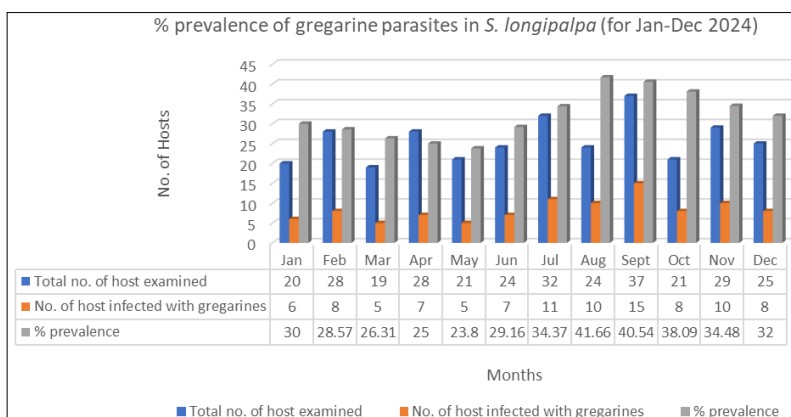


Fig 3: Showing the month wise prevalence of gregarines in *S. longipalpa* (for Jan-Dec 2024)

Conclusion

Cockroaches are some of the most common insects found in homes and buildings. While most people just think of them as pests, they actually have interesting relationships with tiny parasites called gregarines. These microscopic organisms live in the guts of cockroaches and can affect how they grow, behave, and even how many of them survive. In this study, we looked at two cockroach species: the American cockroach (*Periplaneta americana*) and the brown-banded cockroach (*Supellalongipalpa*), both found in the Chhatrapati Sambhajnagar district of Maharashtra. We wanted to see how often these cockroaches were infected by gregarines, and whether the number of infections changed with the seasons.

Over several months, we collected and examined hundreds of cockroaches under a microscope. We found that more than half of them were infected in case of *P. americana* while the rate of infection is less in case of *S. longipalpa*. It should be due to their differential habitat preference, feeding behaviour and morphology. Along with it the rate of infection was higher during the rainy and winter seasons compared to summer. Which is also supported by literature synthesis. This suggests that weather and environmental conditions might play a big role in how these parasites spread. Understanding these natural parasite-host relationships could help us find more eco-friendly ways to control cockroach populations i.e. possibly by using these parasites themselves as a form of natural pest control.

References

1. Al-Badrani SAS, Al-Rubaye FSI, Abbass LY. Isolation and Diagnosis of Parasites from Domestic Cockroach *Periplaneta americana* in Mosul City, Iraq. *J Life Bio Sci Res*, 2024, 5(2).
2. Al-Mayali HMH, Al-Yaqoobi MA. Parasites of cockroach *Periplaneta americana* (L.) in Al-Diwaniya province, Iraq. *J Thi-Qar Univ*, 2009;4(4):17–22.
3. Chamavit P, Sahaisook P, Niamnuy N. The majority of cockroaches from the Samutprakarn province of Thailand are carriers of parasitic organisms. *EXCLI J*, 2010;9:218–22.
4. Bell WJ, Adiyodi KG, editors. *The American Cockroach* (Chapter on Parasitology). London: Chapman and Hall, 1982.
5. Clopton RE, Gold RE. Host specificity of *Gregarina blattarum* among five species of domiciliary cockroaches. *J Invertebr Pathol*, 1996;67(3):219–23.
6. Fotedar R, Shrinivas UB, Verma A. Cockroaches (*Blattella germanica* and *Periplaneta americana*) as potential vectors of the pathogenic bacteria found in nosocomial infections. *J Commun Dis*, 1991;23(3):181–7.
7. Hassan MI, Al-Ahmed AM, Shaurub ESH. Parasites associated with cockroaches in Saudi Arabia with public health implications. *J Egypt Soc Parasitol*, 2013;43(3):641–50.
8. Martínez-Girón R, Martínez-Torre C, van Woerden HC. The prevalence of protozoa in the gut of German cockroaches (*Blattella germanica*) with special reference to *Lophomonas blattarum*. *Parasitol Res*, 2017;116(11):3205–10.
9. Shaikh TT, Shaikh UN. Survey of Protozoan and Nematode Parasites in American Cockroach *Periplaneta americana* (L.) from Marathwada Region (MS) India. *Uttar Pradesh J Zool*, 2018;38(3):95–105.
10. Smith AJ, Cook TJ. Host specificity and prevalence of gregarines in cockroaches. *Comp Parasitol*, 2008;75(2):258–63.
11. Tsai T-J, Chi H. The effects of gregarine parasitism on the development and longevity of *Periplaneta americana*. *Formosan Entomol*, 2007;27(3):211–20.
12. Yahaya ZS, Izzudin NAI, Razak AFA. Parasitic Gregarine blattarum found infecting *Periplaneta americana* cockroaches in a population in Pulau Pinang, Malaysia. *Trop Life Sci Res*, 2017;28(1):145–9.
13. Zohdy S, El-Sherbini GT. Prevalence of intestinal parasites in cockroaches in Cairo, Egypt. *J Egypt Soc Parasitol*, 2010;40(2):469–78.