International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758, Impact Factor: RJIF 5.24
Received: 22-01-2021, Accepted: 23-02-2021, Published: 29-03-2021
Volume 6, Issue 2, 2021, Page No. 157-160

Efficacy of perch (*Anabas testudineus*) as biocontrol agent of home invading nuisance pest, *Luprops tristis*

Jerin George, Vineesh PJ, Aswini Sivadas C
PG and Research, Department of Zoology, St. Joseph's College Devagiri, Calicut, Kerala, India

Abstract
Luprops tristis is a litter dwelling detritivorous beetle abundant in rubber plantations in South India. Attraction of these beetles towards light, following overnight invasion into buildings is a frustrating nuisance for the residents. No efficient strategies for controlling the population buildup of *L. tristis* is available and its selection of rubber litter layers as breeding habitat and residential buildings as shelter during the rainy season makes insecticide-based control a tough task. The present study is to find out the predatory fish that feed *L.tristis*. Study reveals that *Anabas testudineus* prey upon L. tristis and hence act as a biocontrol agent. In group feeding and solitary feeding experiment, the feeding efficiency of *Anabas testudineus* in group feeding is higher than solitary feeding. Social influences affect feeding of *Anabas testudineus*.

Keywords: *Luprops tristis*, detritivorous, frustrating nuisance, *Anabas testudineus*

Introduction

Anabas testudineus bloch is widely distributed throughout India and also in the Southeast Asian countries. *Anabas testudineus* was abundant in rivers, streams, marshes, ponds, lakes, canals and estuaries [22]. Mostly feed on diatoms, green algae, blue green algae, cladocerans [12] shrimps, prawns, debris, insects [8]. Social influences affect behavior and feeding in the *Anabas testudineus*. In particular, this effect may be explained by learning and social copying [10] and by decrease of stress and other well-known phenomena accompanying the group mode of life in fish [7 9 14]. According to Alikunhi, *Anabas testudineus* young ones feed voraciously on micro-crustacea and insects, the adults are predominantly insectivorous [1].

Luprops tristis (Coleoptera: Tenebrionidae) is a litter dwelling detritivorous beetle abundant in rubber plantations in South India, commonly known as *Mupli vandu* or *Ola prani* or *Olachathann*. Litter stands of rubber tree the breeding and feeding habitat for *L. tristis*, with prematurely abscised leaves as the most preferred food resource, and a synchronized life cycle with the leaf phenology of rubber [18]. Effect of photoperiod, temperature, humidity, rainfall and moisture leads to annual migration of *Luprops tristis* from rubber plantations to shelters [18]. Post dormancy return of beetles coincide with the onset of annual litter fall in rubber plantations in early December [18]. Presence of many alternate host plants in addition to rubber indicates that it has the potential to spread into non-rubber belts, their presence in the leaf litter of trees namely, cashew (*Anacardium occidentale,* Linnaeus 1753), mango (*Mangifera indica,* Linnaeus 1753), jackfruit (*Artocarpus heterophyllus,* Lamarck 1789), wild jack (*Artocarpus hirsutus,* Lamarck 1789), cocoa (*Theobroma cacao,* Linnaeus 1753), cassia (*Cassia fistula,* Linnaeus 1753), and sapota (*Manilkara zapota,* Linnaeus 1753) co-occurring in rubber belts led to the hypothesis that *L. tristis* may also feed on the leaf litter of these plants [19].

Attraction of these beetles towards light, following overnight invasion into buildings is a frustrating nuisance for the residents [16]**.** No efficient strategies for controlling the population buildup of *L. tristis* is available and its selection of rubber litter layers as breeding habitat and residential buildings as shelter during the rainy season makes insecticide-based control a tough task. Presence of defensive glands in the larval stage is the major reason for avoidance of larvae and adults by their natural enemies and their very high numbers in the litter of rubber plantations [19]. There is a critical need to develop environment friendly and economically viable control tactics by identifying the natural enemies and biopesticides that would enable regulation of its population build though not complete eradication [12]. Some natural predators are house lizards (*Hemidactylus frenatus,* Schlegel), huntsman spiders (*Heteropoda venatoria,* Latreille), domestic fowl (*Gallus,* Linnaeus) and weaver ants (*Oecophylla smaragdina,* Fabricius) that feed up on *L. tristis,* all except weaver ants are deterred by the defensive gland's secretions of the beetle [2 15]. *Megaselia scalaris* parasitizes resulting in the death of the *Luprops tristis* [6]. Howard experimented by the introduction of *O. niloticus*, mosquito densities immediately dropped in the treated ponds; fish caused a more than 94% reduction in both *Anopheles gambiae*s and *A. funestus* in the treated ponds [8]. With this background present work, *Luprops tristis* as a food resoruce for the selected fishes (*Pygocentrus nattereri, Channami cropeltes, Anabas testudineus, Rasbora daniconius, Heteropneustes fossilis, Clarias batrachus, Clarias gariepinus)*: verification of assumption that social factor influences the feeding efficacy of fishes upon *Luprops tristis*: feeding efficiency of *Anabus testudineus* in relation to weight.

Materials and methods

The experiment was carried out during August 2019 to January 2020 at Department of Zoology, St. Joseph's College, Devagiri, Calicut, Kerala. Beetles (*Luprops tristis*) were collected from rubber plantation by litter shifting and from residential building at Pathimangalam (11.3274°N, 758858°E) by handpicking were transferred to mesh topped clay vessels half filled with soil and freshly fallen rubber plantation litter and were reared in the lab.

Predatory fishes were listed out [1] and fishes of different ages and size were collected from Thengilakkadavu (11.2618° N, 75.9310° E), Calicut. Collected fishes are *Pygocentrus nattereri* (Red bellied Pirahna), *Channami cropeltes* (Giant snakehead), *Anabas testudineus* (Climbing Perch), *Rasbora daniconius* (Slender Rasbora), *Heteropneustes fossilis* (Stinging catfish), *Clarias batrachus*, *Clarias gariepinus*. In laboratory, fishes were placed in separate plastic basins filled with water and sand layered at the bottom provided with some aquatic plants. Screening experiments were carried out for 10 days in these fishes, by releasing a fixed number of live beetles (n=10) into each basin and the feeding ability of fishes were examined. From the collected fishes *Clarias batrachus* and *Anabas testudineus* only survived after 10 days feeding beetles other fishes not survived. Comparing *Clarias batrachus* and *Anabas testudineus* more numbers were fed by *Anabas testudineus* (t = 17.25; p<0.0001). So, beetle feeding efficacy was studied on *Anabas testudineus*, for it 10 fishes with different age were placed in 2sq.feet aquarium each weighed about 15gm±3gm kept for 10 days and released live beetles to study the group feeding. Same fishes were separated into separate aquarium, single fish occupied 1/5sq.feet aquarium and released a number of live beetles into the aquarium and examined the feeding ability. To study the feeding changes related to body mass, selected fish with different weight kept as singly in 1/10sq.feet aquarium and repeated for 10 days with fresh live beetles. Statistical data analysis based on feeding ability and body weight of *Anabas testudineus* were done by using PAST Software (Mean, Standard deviation, Spearman correlation, Wilcoxon paired t test) [7].

Results and discussion

Only *Anabas testudineus* and *Clarias batrachus* survive after 10 days feeding of *L. tristis* and other collected fishes (*Pygocentrus nattereri*, *Channami cropeltes*, *Rasbora daniconius*, *Heteropneustes fossilis*, *Clarias batrachus*, *Clarias gariepinus*) not survived. We have identified *Clarias batrachus* and *Anabas testudineus* are only efficient in feeding *Luprops tristis*, by comparing these two fishes more numbers are fed by *Anabas testudineus* (Table 1) (t = 17.25; p<0.0001). Abundance (Mean ± SD) of *Anabas testudineus* feeding efficiency in group feeding was high than solitary feeding (t=35; P <0.001) (Table 2). There is a low degree of positive correlation between weight of fish and number of beetles fed by them (r= 0.03, P<0.00001)

Fig 1: *(A) Clarias batrachus* and *(B) Anabas testudineus* feeding *L.tristis*

Table 1: Abundance (Mean±SD) of beetle taken by *Anabas testudineus* and *Clarias batrachus*

Day	*Anabas testudineus* Mean±SD	*Clarias batrachus* Mean±SD
Day 1	30.3±1.9	10.3±2.4
Day 2	19.5±6.4	14.1±1.9
Day 3	49.6±5.8	20±2.5
Day 4	39.9±3.7	20.4±2.7
Day 5	60±4	20.1±2.6
Day 6	39.5±5.3	20.3±3.7
Day 7	39.8±2.1	18.3±3.5
Day 8	60.4±4.2	16.7±3.7
Day 9	40.3±2.1	16.9±3
Day 10	20.3±5.4	14.2±1.9

Table 2: Abundance (Mean ± SD) of beetle taken by fish during group feeding and single feeding.

Experiment	Group Feeding		Single Feeding	
Days	Mean	SD	Mean	SD
DAY 1	27.3	4.2	20.5	3.8
DAY 2	31.1	3.7	25.0	3.1
DAY 3	31.9	2.4	24.9	4.5
DAY 4	33.6	4.4	23.8	1.5
DAY 5	27.4	2.8	28.6	4.8
DAY 6	26.4	5.4	25.3	3.8
DAY 7	26.2	3.9	23.2	3.0
DAY 8	25.3	3.2	24.0	2.5
DAY 9	28.1	3.2	23.3	4.2
DAY 10	26.7	4.3	22.7	3.5

Table 3: Table showing the abundance (mean±SD) of beetle taken by *Anabas testudineus* based on weight

Weight of fish in grams	Abundance
28	23.5±12.62
27	41.7±11.45
19	40 ±14.14
17	41.5±16.33
15	29.5±17.07
15	19.1± 8.96
14	23.5±12.48
13	37.2±14.12
13	17.9±11.17
13	29.7±12.59
8	25.3±13.19
7	25.1±14.49
6	26.1±13.08

Conclusion

The result obtained from present predatory experiments using *Anabas testudineus* indicates that *Clarias batrachus* and *Anabas testudineus* have feeding potentialities on *Luprops tristis*. Species wise comparison revealed that feeding rate of *Anabas testudineus* was higher than of *Clarias batrachus*. So, they can effectively be used *Luprops tristis* as food resource. Their active feeding and the non-deterrence by the gland secretion make them as a potential biocontrol agent to regulate the population of *Luprops tristis*.

Anabas testudineus, inhabitants of fresh and brackish water; mostly in canals, lakes, ponds, ditches, floodplains and swamps [22], bottom dweller and insectivorous fish possesses some peculiar features and adaptations. Due to its air breathing ability and tolerance to a wide range of adverse environmental conditions, the fish is being considered as a promising candidate species for culture in the water bodies where carps cannot be cultured. *Anabas* can be reared or cultured in large tanks or ponds to control aquatic insects and some weed fishes [10]. As the beetles are effectively preyed by *Anabas testudineus*, it can be used to control the population buildup of *Luprops tristis* in the rubber plantation belts. There are some advantages of raising fish in a rubber plantation fields by creating ponds.

As the Luprops beetles attract towards the light [17] there is possibility to trap it by using a bulb over the pond during the period of their return from dormancy period (early December), so beetles directly dip into water. Weaver ants are an efficient natural predator of *L. tristis*, and has the potential to be as an effective biocontrol agent to regulate the population buildup of *L. tristis* [3]. As their aggressiveness causes much difficulties to the rubber Labors, it's less likely welcomed by stakeholders. But the introduction of *Anabas testudineus* into rubber plantations does not cause any difficulties or obstacles to daily rubber tapping. There should be no problem with acceptance of this beetle control method since the fish is suitable for cultivation in ponds, reservoirs and rice fields [21]. Cultivation of Anabas in reservoirs or ponds will contribute as a source of food. Its high nourishing qualities and prolonged freshness may increase their demand for cultivation. *Anabas testudineus* is considered as a valuable item of diet for sick and convalescents [20].

Acknowledgments

Authors are grateful to St. Joseph's college Devagiri, Calicut, Kerala for infrastructural facilities. Financial assistance is provided by Council of scientific and industrial research (CSIR) is gratefully acknowledged.

References

1. Alikunhi KH. A study of fish culturein India. *Farm bulletin*,1957:(20**)**:53-63.
2. Aswathi P, Sabu KT. Weaver ant (*Oecophylla smaragdina*), Huntsman spider (*Heteropodavenatoria*) and House gecko (*Hemidactylus frenatus*) as potential biocontrol agents of nuisance pest, *Luprops tristis. Halteres*,2011:(3):56- 61.
3. Aswathi P, Divya T, Sabu K. Dormancy and host preference in *Luprops tristis* (Coleoptera: Tenebrionidae), Oriental insects,2012;46(3):270-274.
4. Aswathi P, Jobi MC, Sabu KT. Biocontrol of home invading rubber litter beetle, *Luprops tristis* with weaver ants *(Oecophylla smaragdina)*, Journal of Biopesticides,2012:(5):177-179.
5. Aswathi P, Sabu KT. Weaver ants and Biocontrol of the Nuisance Pest *Luprops tristis* (Coleoptera: Tenebrionidae), Basic and Applied Aspects of Biopesticides 2012; 215-224 https://doi.org/10.1007/ 978-81-322-1877-7_11.
6. Binisha P, Sabu KT, Justin Sunny. Biological control potential of the scuttle fly, *Megaselia scalaris loew (*diptera: phoridae), on the home-invading pest *luprops tristis* (fabricius) (coleoptera: tenebrionidae), The Coleopterists Bulletin,2020:74(2):1-6.
7. Budaev SV, Zworykin DD. Difference in shoaling behavior between ocellated (Symphodus ocellatus) and longstriped (S. tinca) wrasses and its relation with other behavioral patterns, Mar. Freshwater Behav. Physiol,2012:31(2):115-121.
8. Froese R, Pauly D**.** Fish base: World wideweb electronic publication,2014. Available at: http://www. fishbase.org.
9. Hammer O, Harper DAT, Ryan PD. Past: Paleontological Software Package for Education and Data Analysis, Paleontologia Electronica,2001:4(1):9.
10. Howard AFV, Zhou G, Omlin FX. Malaria mosquito control using edible fish in western Kenya: preliminary findings of a controlled study. BMC public health,2007:7(1):199.
11. Keenleyside MHA. Some aspects of the schooling behavior of fish Behaviour,1955:(8)1:183–248.
12. Kuldeep K, Kumar R, Damle D. Culture of Fresh water climbing perch, *Anabas testudineus,* Aquaculture Asia magazine,2012:17(3):27-28.
13. Leshcheva TS, Zhuikova, AYU. Obuchenie ryb: ekologicheskie iprikladnye aspekty (Fish Training: Ecological and Applied Aspects), Moscow: Nauka,1989.
14. Menon AGK**.** Checklist- freshwater fishes of India: records of the Zoological Survey of India: Miscellaneous publication occasional paper, 1999:175:366.
15. Nargis A, Hossain MA. Food and feeding habit of Koi fish, Anabas testudineus,1987.
16. Nirdev PM, Jobi MC, Sabu KT**.** Analysis of the predator reluctance and prey rejection of weaver ants with *Luprops* as single prey resource. Journal of

Biopesticides,2011:4(2):106-108.
17. Nirdev PM, Sabu KT, Wesley D. Semiochemicals from the aggregation site of home invading nuisance pest, *Luprops tristis* (Coleoptera: Tenebrionidae). *Entomon*,2014:39(2):77-84.
18. Radakov DV. Stainost' ryb kak ekologicheskoe yavlenie (Flocks of Fishes as Ecological Phenomenon), Moscow: Nauka,1972
19. Sabu KT, Merkl O, Abhitha P. A new *Lupropsspecies* from Western Ghats with redescriptions and identification key to the species of Indian Peninsula and Sri Lanka (Tenebrionidae: Lagriinae: Lupropini). Zootaxa,2008:1636(1):47-58.
20. Sabu KT, Vinod KV, Jobi MC. Life history, aggregation and dormancy of the rubber plantation litter beetle, *Luprops tristis*, from the rubber plantations of the moist south Western Ghats. Journal of Insect Science,2007:8(1):64
21. Sabu KT, Vinod KV, and Meehan T. Population dynamics of the rubber plantation litter beetle *Luprops tristis*, in relation to annual cycle of foliage phenology of its host, the para rubber tree, *Heveabrasiliensis.* Journal of Insect Science,2009:9(1):56.
22. Sabu KT, Greeshma M, Aswathi P. Host plant and leaf-age preference of *Luprops tristis* (Coleoptera: Tenebrionidae: Lagriinae: Lupropini): A home invading nuisance pest in rubber plantation belts. Psyche: A Journal of Entomology,2012. Doi: 10.1155/2012/ 232735.
23. Sabu KT, Nirdev PM, Aswathi P. The reproductive performance of the Mupli beetle, *Luprops tristis*, in relation to leaf age of the para rubber tree, *Hevea brasiliensis.* Journal of insect science,2014:14(1):12.
24. Saha A, Kabir MR. Breeding performance of Thaikoi, Anabas testidineus (Bloch, 1972) in different months of the breeding season under two sex ratios: Bangladesh research publication journal,2009:2:667-673.
25. Talwar PK, Jhingran AG. Inland fishes of India and adjacent countries, Oxford and IBH publishing company Pvt. Ltd. New Delhi,1991:2:996-998.
26. Vinod KV, Sabu KT**.** Dormancy- inducing factors of rubber litter beetle, *Luprops tristis* (Coleoptera: Tenebrionidae). Insect Science,2010:17(1):47-51.
27. Waseeh MA, Rahman AA, Khan NS. Effects of artificial food additives in Vietnam Koi, Anabus testudineus (Bloch, 1792) pond culture system. International Journal of Fisheries and Aquatic Research. 2020;5(3):50-4.