European Journal of Agriculture and Forestry Research, 12, (2), pp.1-6, 2024
Print ISSN: 2054-6319 (Print),
Online ISSN: 2054-6327(online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

Conservation of Forest Plantation by Reduviid Predator, *Acanthaspis Megaspilla* (Hemiptera: Reduviidae) Against *Odontotermes Obesus* (Isoptera: Termitidae), a Bark Pest of Teak, *Tectona Gradis*

M. Anto Claver and Suresh Yadav*

Department of Zoology, St. Andrew's College, Gorakhpur -273001, Uttar Pradesh, India
*Department of Zoology, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur 273009;
sureshyadav273165@gmail.com

doi: https://doi.org/10.37745/ejafr.2013/vol12n216 Published May 04, 2024

Citation: Claver M.A. and Yadav S. (2024) Conservation of Forest Plantation by Reduviid Predator, Acanthaspis Megaspilla (Hemiptera: Reduviidae) Against Odontotermes Obesus (Isoptera: Termitidae), a Bark Pest of Teak, Tectona Gradis, *European Journal of Agriculture and Forestry Research*, 12, (2), pp.1-6

ABSTRACT: *Predatory bug A. megaspilla in each prey densities could prey on O. obesus and was exhibited type II functional response. The number of O. obesus consumed by female predator A. megaspilla can be expressed in Hollings' disc equation [y'= 0.009 (12-6.20) x]. The maximum predation rate (k= 6.77) were recorded at higher prey densities. Hence, this bug utilized as termitiphagous.*
KEYWORDS: ecofriendly, conservation, forest, short-duration functional response, odontotermes obesus, tectona gradis.

INTRODUCTION

Forest is an ecosystem characterized by a more or less dense and extensive tree cover; often consisting of stands varying in characteristics such as species composition, structure, age class, associated processes and commonly meadows, streams, fish and wild life (Chakaravarty et al., 2021). The teak, *Tectona gradis* Linn. (Verbenaceae) is an important plantation species in Kushmi forest ecosystem. Teak, *T. gradis* has the highest capacity for carbon sequestration among tree in india (Kaushik., 2016). Termites (Isoptera: Termitidae) are also known to be pests, especially in agricultural/forestry settings, although the damage that they do is hard to estimate (Cowie et at., 1989 and Jungueira et al., 2018). Fast growing teak, *T. gradis* wood plantations are known to be one of the agricultural linds copes that are vulnerable to termite attack (Fajar et al., 2021). *O. obesus* is a wide spread species in Pakistan, Bangladesh, and India (Akhtar., 1972, 1975; Chhotani., 1981). It feed on wood, surface debris such as twigs, bark fragments, dry leaves, grasses, and dried vegetable matter (Rasib et al., 2014). Termite of the genus *Odontotermes* are, fungal growers, normally consuming a wide variety of plant material and wood including

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Eucalyptus, Poplar, Shisham, Pine, Wattle trees cotton and Maize (Uy's, 2002). They are also feeding on bark, sap and hard wood of teak, *T. gradis*. The Chloromicotinyl insecticide imidacloprid is widely used insecticide in the world, based on a unique combination of characteristics (Elbert et. al., 1990; Elbert et. al., 1991; Kagabu, 1997; Cox et. al., 1997; Cox et. al., 1998). The development of imidacloprid for termite control began in the late 1980s (Zeck; 1992). However, with growing environmental concern over pesticides, biological control measure using plants, microbes, predators, and parasitoids, become important.termites have wide variety of predators. The reduviid predators having adaptive features to feed on termites in large number (Mc Mahan, 1983, Sahayaraj, 2018). They exhibit preference on termite, ants, and bees (Hwang and Weirauch, 2012). *A. megaspila* (Hemiptera: Reduviidae) are widely distributed in the kushmi forest. They were found inside bark of teak, *T. gradis* in adult stage whereas under the fallen leaves, pit, and soil in nymphal stages observed. Both nymph as well as adult male and female are termitiphagous i.e. they were feed on each members of termite *O. obesus*. The functional response refers to the change in the number of prey consumed per unit time in relation to prey density (Solomon, 1949, Hassell, 1978). Functional response of *A. megaspilla* against two pests, bark beetle *Gonocephalum macleaye* and termite *O.obesus* was studied in laboratory (Claver and Balasubramanian; 2010). To quantify the pest suppression efficiency of this reduviid predator by short-durational functional response study an awarding exercise. Therefore, an attempt was made to find out short-duration functional response of this predator, *A. megaspilla* to *O.obesus.*

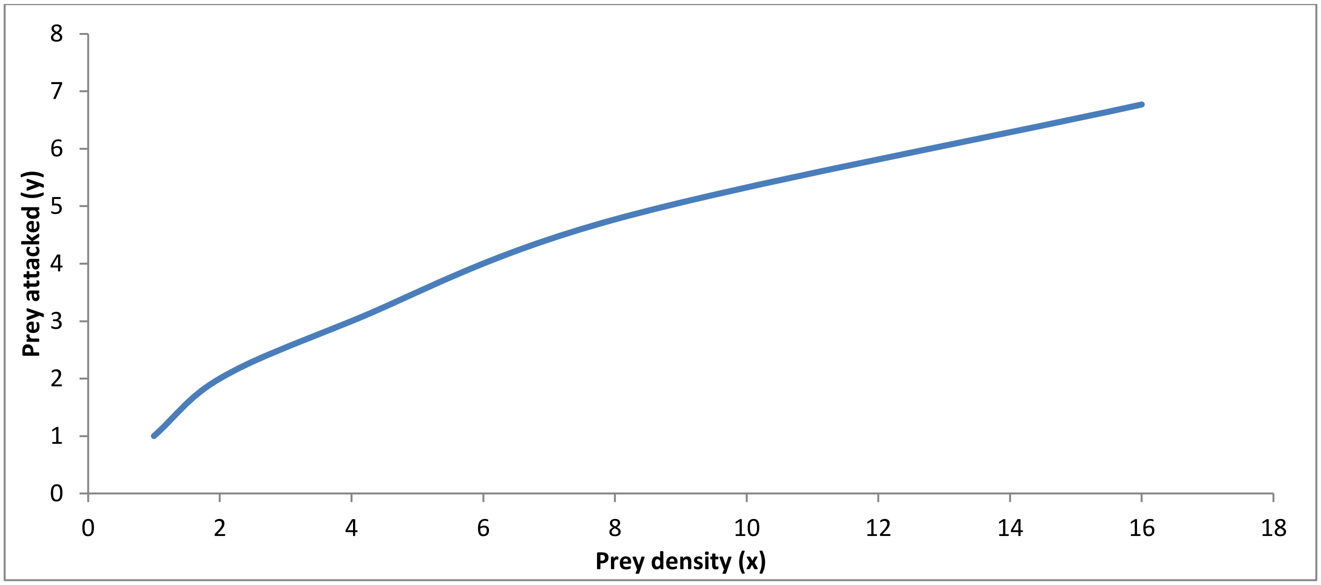
Material and methods: Nymphs and adults of *A. megaspilla* were collected from bark of teak, *T. gradis* , beneath fallen leaves, and between dirt particles in Kushmi scrub jungle of Gorakhpur (26º45'32"N , 83º22'11"E) district, Uttar Pradesh, India, and were reared in laboratory under optimal conditions (temp. 25±1ºC, relative humidity 70% - 80%, photophase 13 hours) on *Corcera cephalonica* (Stainton), and the different members of prey, *O. obesus*. The newly emerged and 36 hours starved adult female of *A. megaspilla* were utilized for short duration functional response experiment at five prey densities condition, namely 1, 2, 4, 8, and 16 in the laboratory. The prey, *O. obesus* was first introduced into container (diameter- 10.5cm and height- 7.5cm) along with moist termite moulds to prevent mortality in prey due to unfavourable condition and was allowed to settle for 20 minutes, followed by the introduction of single female predator in each container. The prey, *O. obesus* also creat an new termitarium in container and hide inside it. The experiment was replicated 12 times. After two hours the total number of prey, *O.obesus* consumed by predator were counted and recorded. Prey, *O. obesus* number were maintained by live ones after death record in each container. Similar number of termite prey, *O. obesus* also maintained for assessing natural mortality of termite. The functional response was estimated by the using of Hollings' disc equation [y'= a (Tt – by)x]. The observations were carried out for 12 days.

Result and discussion: The evaluated functional response of *A. megaspilla* was presented in table (1). The number of termites consumed by *A. megaspilla* at different densities was shown in figure (1) and properly described by the Hollings' curve linear functional response. The different functional response types can produce diverse effects upon the population dynamics of interacting predators and prey (Begon et al., 1990). The type II functional response is found in most studies involving predatory Insects, including *Acanthaspis* reduviids (Ravichandran and Ambrose 2006, Claver et al., 2003, Sahayaraj and Ambrose 1994, Balakrishnan et al., 2011). The result shown that, *A. megaspilla* could prey upon each prey densities of *O. obesus*. Both soldier and warker termites take part in the defensive actions by vomiting thick brownish saliva content. The number of *O. obesus* consumed (y') by *A. megaspilla* can be expressed in Hollings' disc equation [y'= 0.09(12-6.20)x]. Similar type of Hollings' disc equation was given by Claver and Balasubramanian (2010) in *A.megaspilla* against *O.obesus* and *G. macleaye*. The regression statistics and ANOVA values indicated that short term functional response of *A. megaspilla* to *obesus* provided significant variation category (multiple R= 0.977, R square=0.956, Standard Error= 1.475, regression significance F= 0.0039, intercept P value = 0.111 and X variable P value = 0.0039) for the adult female of *A. megaspilla*. The days searching 'Ts', attack ratio y/x, and rate of discovery 'a' were decreased as prey densities increases. Similar types of results were also reported by Manimuthu et al., (2011) in *A. pedestris*. The prey attack 'y' is increased as prey densities increases. Therefore, Female of *A. megaspilla* can be utilized as natural termitiphagous agents to conserve forest plantation such as *T. gradis*. Fan and Zhao (1988) pointed out, however, that studies of functional response in the laboratory could be used to infer basic mechanisms underlying natural enemy – prey interactions. Such studies provide valuable information for biological programmes.

Table-1. Functional response of *Acanthaspis megaspilla* against *Odontotermes obesus*.

Prey density (x)	Prey attack (y)	Max k	Days/y b=Tt/k	Days all Y's (by)	Days searching Ts=Tt-by	Attack ratio y/x	Rate of Discovery y/x/Ts=a	Disc equation Y'=a(Tt-by)x
1	1.0			1.77	10.23	1.0	0.09	
2	2.0			3.54	8.46	1.0	0.11	
4	3.0	6.77	1.77	5.31	6.69	0.75	0.11	Y'=0.09(12-6.20)X
8	4.77			8.44	3.56	0.59	0.16	
16	6.77			11.98	0.02	0.42	00	

Fig. 1. Functional response of *Acanthaspis megaspilla* to different denisties of *Odontotermes obesus*



Acknowledgements: The authors are thankful to Prof. CO Samuel, Principal and Secretary, St. Andrew's College for providing laboratory facilities and encouragement. The junior author is acknowledged to his Ph.D. advisory committee members Prof. Veen Batra Kushwaha and Prof. Keshav Singh for their great concern and encouragements.

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