Identification of Potential Natural Predators of Cattle Fever Ticks Rhipicephalus microplus in Selected Areas in Nueva Ecija

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Abstract: Use of chemical acaricide for tick control has been reported to cause environmental pollution and food contamination. The biggest challenge in the control of ticks, such as cattle fever tick (CFT), *Rhipicephalus microplus*, is the development of resistance in ticks to common acaricides. Hence, this study aimed to identify possible predators of CFT as potential biological control agent to complement the existing integrated tick management strategy. Natural predators were collected in Sitio Lomboy and Zone 9 of Barangay Tayabo, San Jose, Nueva Ecija by using pitfall traps. Preserved samples were brought to the laboratory for identification and determination of their potential ecological role. Out of fifty-two (52) species of insects and other arthropods collected, only fifteen (15) species have been identified as possible CFT predators. Two (2) species are recommended for feeding efficiency test on CFT. Several species of spiders belong to Family Lycosidae: *Pirata* sp., *Wadicosa birmanica, Pardosa sumatrana*, *Traposa annulata* and *Pardosa* spp. Other species of spiders were *Oxyopes javanus* (Oxyopidae), *Heteropoda* sp. (Spassidae), and *Cyclosa wulminsis* (Araneidae). Four species of ants collected belong to Family Formicidae, namely *Solenopsis geminata*, *Tetramorium* sp., *Monomorium* sp., *Technomyrmex* sp. Other insect species identified as potential predators were *Euborellia philippinensis* (Dermaptera: Anisolabididae) and *Chlaenius* sp. (Coleoptera: Carabidae). Natural enemies of CFT needs to be identified and evaluated for their efficiency as biological control agents, and using them for pest management could lessen the burden on the increasing cost of acaricides and the detrimental effect of acaricides on human health and the environment.

Key Words: Cattle fever ticks; biological agents; tick management; natural enemies; predator;

1. INTRODUCTION

Cattle Fever tick (CFT), *Rhipicephalus microplus,* is a hard tick that is considered as one of the most important bovine blood-sucking ectoparasites (Polar, et al., 2005; Soneshine and Roe, 2013). They parasitize on ruminant animals but mainly feeds on cattle. CFT infestations have major economic impact on livestock and agricultural sector as they hamper their development and sustainability (Perez de Leon, et al., 2012). It is responsible for many major economic losses due to cattle mortality, poor production of meat and milk, losses in leather production. *R. microplus* also acts as vector of *Babesia bigemina* and *Babesia bovis* causative agent of babesiosis or "cattle fever," thereby indirectly affects the economy due to monetary expenditure for chemical tick controlling agents (Perez de Leon, et al., 2012; Giles, et al., 2014).

Due to economic losses suffered by many countries and the lack of proper tick management practices of some small holder farmers, tick control is much needed. The most common way to control tick infestation is the usage of acaricides. However, the repeated usage of chemical acaricide in tick control has been reported to cause environmental contamination and pollution risk, animal toxicity, milk contamination (Becker, 2000; Onofre, et al., 2001). In some cases, it is ineffective due to the development of tick-resistance to acaricides (Piralo-Kheirabadi et al., 2007; Manjunathachar, et al., 2014). Development of alternative but sustainable control strategies, such as using CFT's natural enemies, is therefore needed. Biological control of ticks using natural enemies are slowly gaining widespread study to complement the existing integrated tick management strategy, this would depend on the compatibility of each strategy with each other, climatic condition and livestock management system in place. Samish and Rehacek (1991) discussed that ticks have numerous natural enemies but only few organisms have been evaluated as tick biocontrol agents.

This study was done to identify the possible predators already present in the chosen experimental sites. Data obtained in this study will serve as baseline data for the identification of natural predators in the Philippines.

2. METHODOLOGY

2.1. Sampling site

The experimental sites were located in Sitio Lomboy (15^{0}51'20.96" N 121^{0}01'22.01" E) and Zone 9 (15°49'54.06" N121° 1'52.80" E), Barangay Tayabo, Neuva Ecija. The area in Sitio Lomboy is an open area consisting of cattle pen, pasture area and chute.

2.2. Pitfall Trap Set-up

In each sampling site, eight pitfall traps were randomly set-up. Stainless cups were placed in a 3-4 inches digged soil. Plastic cups were then placed in each stainless cup. 15-20mL of diluted soapy water where added to each plastic cups. The cups were then covered with bibingka plates. Trap catches were collected twice a day, 6am and 6pm.

2.3 Collection and Identification of Samples

Trap catches were collected by filtering using a strainer. The samples were sorted and placed in a properly labeled plastic container filled with 70% ethanol. Samples were then brought to De La Salle University – Science and Technology Complex (DLSU-STC) for identification and determination of their potential ecological role.

3. RESULTS AND DISCUSSION

Out of fifty-two (52) species of insects and other arthropods collected, only fifteen (15) species have been identified as possible CFT predators (Table 1). Two (2) species are recommended for feeding efficiency test on CFT. Most of the identified potential CFT predators were collected from Sitio Lomboy, Barangay Tayabo, Nueva Ecija.

Natural enemies of ticks can be classified as pathogens, parasitoids and predators. Predators eat the tick, either those still attach to the host, or engorged females that have drop to the ground. Spiders are generalist predators and have long life span relative to their prey. Wolf spiders (Lycosidae) are one of the major group of arthropod predators. Wolf spiders are generalist and they forage in leaf litter increasing their chances to encounter host-seeking ticks (Carroll, 1995). Carroll (1995) reported that black-legged ticks, *Ixodes scapularis*, and adult American dog ticks, *Dermacentor variabilis*, were attacked by the wolf spider, *Schizocosa ocreata*, in petri dish bioassay.

Table 1. Identified potential ground dwelling natural enemies of cattle tick in selected area in Nueva Ecija using pitfall-trap technique.

Order	Family	Species name
Spiders (Araneae)	Oxyopidae (Lynx Spider)	*Oxyopes javanus*
	Sparassidae (Huntsman Spiders)	*Heteropoda* sp.
	Araneidae	*Cyclosa wulminsis*
	Lycosidae (Wolf Spiders)	*Pirata* spp.
		Pardosa spp.
		Traposa annulata
		Wadicosa birmanica
		Pardosa sumatrana
Ants (Hymenoptera)	Formicidae	*Solenopsis geminata*
		Tetramorium cannatum
		Monomorium sp.
		Technomyrmex sp.
		Anoplolepis sp.
Beetles (Coleoptera)	Carabidae	*Chlaenius* sp.
Earwigs (Dermaptera)	Anisolabididae	*Euborellia philippinensis*

Lynx spiders, specially of genus *Oxyopes*, are identified as cursorial hunters. They have highly developed eyesight and are non-web builder. *Oxyopes* sp. actively pursue their prey and seizes it with a leap. There are other studies reported the predation of some spiders on ixodid ticks. Carroll (1995) reported that wolf spider *Lycosa godeffroyi* preyed on engorged females of cattle tick, *Boophilus microplus* in Australia. Mwangi et al. (1991) reported that in Kenya, unidentified spiders killed engorged *Rhipicephalus appendiculatus* under laboratory conditions. Generalist spiders can make significant contribution on the biological control of pest (Carroll, 1995).

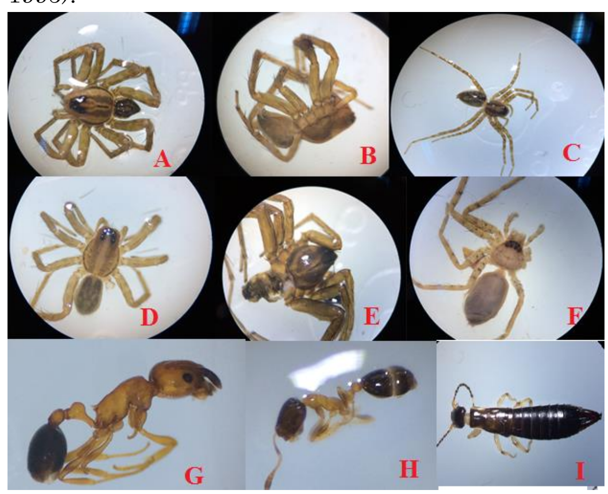

Figure 1. Photographs of some species collected that were identified as potential CFT predators: (A) *Traposa annulata*, (B) *Pardosa sumatrana*, (C) *Pardosa* sp., (D) *Pirata* sp., (E) *Wadicosa birmanica*., (F) *Heteropoda* sp., (G) *Tetramorium* sp., (H) *Monomorium* sp., (I) *Euborellia philippinensis.*

Ants are also known to predate on eggs and larvae of ticks. Ants from family Formicidae are known to be important generalist predators in agricultural system. *Aphaenogaster, Iridomyrmex, Monomorium, Pheidole,* and *Solenopsis* are the genera of ants know to prey on most tick genera (Samish and Rehacek, 1991). It has been reported that tropical fire ants (*Solenopsis geminata*) prey on *Amblyomma variegatum* in Guadaloupe, French West Indies. Tropical fire ants revealed to attack only engorged ticks (Samish and Rehacek, 1991). Mwangi et al. (1991) reported that *Solenopsis* *geminata* were responsible for the predation of engorged females of *Boophilus microplus*.

4. CONCLUSIONS

They are promising biocontrol agents because they are nontoxic to nontarget arthropods and typically safe to the environment. Identified potential predators were mostly ants and spiders which are classified as generalist predators. To determine the most common life stages of tick predators consume, feeding efficiency test is recommended.

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