



THE INTRODUCTION IMPACT OF PREDATORY BIRD *Lanius schach* Linn. ON POPULATION OF LONG HORN GRASSHOPPER *Sexava nubila* Stal. AND LEAVES DAMAGE OF COCONUT

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ABSTRACT

The predatory bird *Lanius schach* Linn. (Passeriformes: Laniidae) was introduced from Yogyakarta in August 2011 for the control of long horn grasshopper *Sexava nubila* Stal. (Orthoptera: Tettigoniidae) in Salibabu Island, Talaud Islands Regency, North Sulawesi Province. Moronge Districts was chosen as the release site. Ten females and 30 males of the predatory bird were released in the district. The predatory bird was well established. The grasshopper populations and leaf damage of coconut were observed at one month before and 10 consecutive months after the release on the 120 sampled trees which were attacked by pest insect. Within 10 months after the release of predators, the *S. nubila* populations and the leaf damage intensity showed downward trend. Trend of declining population of *S. nubila* increasingly evident in the more severely damaged coconut. Introduction of the predator did not change the population structure of *S. nubila*. The mean population of *S. nubila* at 10 months after release (21.05 individuals/tree) was significantly lower than at one month before the release (23.65 individuals/tree). The intensity of light damage, moderate, and severe turned into light damage at one, three, and five months after the release of *L. schach*.

Keywords: *Sexava nubila*, coconut palm, *Lanius schach*, Salibabu Island.

INTRODUCTION

The long horn grasshopper *Sexava* spp. (Orthoptera: Tettigoniidae) is a major pest of coconut palms in North Sulawesi and North Maluku. The species of *Sexava* in Salibabu Island is *Sexava nubila* Stal. Besides eating the leaves, this pest eats the flowers and young fruits. The attack of *S. nubila* on coconut palms in Talaud was chronic and endemic since 1890. In 2009, widespread attack in the regency reached 401 hectares and caused losses of IDR 357, 624, 960.00. A year later the attack expanded to 1, 086 hectares with a loss of IDR 721, 791, 840.00 (Anonymous, 2011).

Various efforts of control have been done. For example, control of *S. nubila* in Talaud Islands Regency was done by trunk injection of a synthetic insecticide containing active ingredient of dimehypo. The problem was insecticide applications continuously for a long time resulted resistance and resurgence of pests (Haque *et al.*, 2002; Ratna *et al.*, the 2010), the destruction of natural enemies (Settle *et al.*, 1996; Bulduc *et al.*, 2005; Winasa and Rauf, 2005) and other useful insects as well as leave insecticide residue. Environmentally friendly control against this pest has been attempted by using the trap type "Coconut Research Institute MLA" and proved to be quite effective (Hosang and Alouw, 2010) and it is not harmful to natural enemies.

Introduction of Mynah bird (*Acridotheres tritis*) from India to Mauritius was successful to control of the red locust (*Nomadacris septemfasciata*) (De Bach, 1974). Biological control technology against the grasshoppers by introduction of the predatory bird was adopted to control *S. nubila* in Salibabu Island. In Indonesia there are many different species of insectivorous birds; one of them is *L.*

schach. The *L. schach* is very potential as a predator of *Locusta migratoria manilensis*, the feeding rate to the locust adult reached 126 individuals/24 hours (Astuti *et al.*, 2009). Wagiman *et al.* (2011) introduced the predatory bird from Yogyakarta to Salibabu Island, Talaud Islands Regency, North Sulawesi Province for the control of *S. nubila* pest. This study aimed to evaluate the impact of the introduction of *L. schach* on population of *S. nubila* and leaves coconut palm damage intensity in Salibabu Island.

MATERIALS AND METHODS

The study was conducted in Moronge District, Talaud Islands Regency, North Sulawesi Province, Indonesia during 12 months from July 2011 until June 2012. Moronge Districts was chosen as the study location because in Salibabu Island the most severity damage of coconut palms due to *S. nubila* attacks was reported in this District (Anonymous, 2010).

Introduction, adaptation, and evaluation of *L. schach* establishment

The introduction was begun with the selection of *L. schach* in Yogyakarta, followed by packing, processing of animal health certificate documents in the Quarantine, and delivery. The 10 females and 30 males of *L. schach* were selected and delivered to the study location. The predatory bird was kept individually in a box sized 25x10x10cm³, then the boxes were packed in a bird cage measuring of 70x50x50 cm³ with a capacity of 20 birds/cage. Delivery of *L. schach* was conducted using aircraft with a travel time of six hours and continued by sea transport for 30 minutes. Upon arrival in Salibabu Island, the birds were acclimatized in the field laboratory



for two weeks. The predator bird *L. schach* were then released at four release sites (Table-1). Establishment of the predators was observed five times with two months

interval and started at second month after release. The establishment was indicated by their existence, new progeny, and dispersal.

Table-1. The place and time of release, number of released *Lanius schach*, and number of tree samples in Moronge District, Talaud Islands Regency.

Release sites	Release time (Day, date, time)	Predator number		Tree sample number
		Males	Females	
Moronge	Thursday, 08/16/2011, 09.00 am	7	3	30
Moronge Satu	Wednesday, 08/15/2011, 09.00 am	7	3	30
Moronge Dua	Wednesday, 08/15/2011, 09.00 am	8	2	30
Moronge Selatan Dua	Tuesday, 08/14/2011, 09.00 am	8	2	30
Total		30	10	120

Observations of *S. nubila* population and leaf damage of coconut palm

Numbers of *S. nubila* individuals were counted on 120 attacked-tree samples which were taken randomly in the four release sites. Each developmental stages of *S. nubila* were counted separately to determine the population structure. The measurement method of the Coconut Research Institute Manado (1990) was adapted to measure leaf coconut palm damage intensity. Category and criteria coconut leaf damage intensity were developed according to the economic damage threshold of 20% (Anonymous, 1990) and experiences of local farmers that 25% of coconut leaf damage can be tolerable (Yance 2011, personal communication). In this study the damage intensity was categorized as follows (Table-2).

Table-2. Score, category, and the coconut leaf damage intensity in Moronge District, Talaud Islands regency.

Score	Category	Damage intensity (%)
0	Healthy	0
1	Light	1- 25
2	Moderate	26 - 50
3	Heavy	51- 75
4	Very heavy	> 75

The observations of the *S.nubila* population and coconut leaf damage were done at one month before and

10 consecutive months after the release. Differences of *S. nubila* population before and after release of the predatory bird were analyzed using *paired-sample t test* and developmental trend of *S. nubila* population was analyzed using simple linear regression.

RESULTS AND DISCUSSIONS

The predatory bird *L. schach* was introduced from Yogyakarta well established in Salibabu Island. Three months after the release, 20 out of the 40 individuals of the predatory bird were rediscovered in around of release sites. New progeny of the predatory bird's as many as two individuals was discovered within nine months after release. The predatory birds have been dispersed as far as 6-15 km from the of release sites.

Impact of *L. schach* introduction on population of *S. nubila*

a) Population structure of *S. nubila*

The population of *S. nubila* consisted of male adult, female adult, old nymph, and young nymph at which their proportions were different significantly i.e. 38.37, 26.46, 18.60, and 16.19 percent, respectively (Table-3). Very low coefficient of variance showed that population structure of *S. nubila* at one month before the release and 10 consecutive months after the release of predators it remained relatively unchanged. Thus the introduction of predatory bird had no effect on the population structure of *S. nubila*.

**Table-3.** Population structure of *Sexava nubila* before and after release of predatory bird *L. schach*.

Month	Total (individuals/120 trees)	Composition stadia (%)			
		Male adult	Female adult	Old nymph	Young nymph
July 2011	2838	37,54	26,29	19,98	16,19
August 2011	Release of predatory bird				
September 2011	2709	37,32	26,93	20,41	15,34
October 2011	2667	35,63	27,76	20,27	16,34
November 2011	2685	36,83	25,73	20,61	16,83
December 2011	2580	38,34	25,86	19,36	16,43
January 2012	2457	40,86	26,48	16,67	15,99
February 2012	2430	41,63	26,80	16,05	15,51
March 2012	2421	41,26	27,73	15,85	15,16
April 2012	2595	38,35	25,32	19,24	17,09
May 2012	2526	39,37	25,16	18,51	16,95
June 2012	2526	39,11	26,99	17,60	16,30
Average	2584,91	38,37a	26,46b	18,60c	16,19d
S.D.	130,58	1,92	0,89	1,79	0,65
C.V.	5,05	4,95	3,35	9,59	3,98

b) Population density of *S. nubila*

Introduction of predatory bird *L. schach* had significant impact on population decline of *S. nubila*. The average population of *S. nubila* at 10 months after release (21.05 individuals/tree) was significantly lower than at one month before the release (23.65 individuals/tree) Table-4. Laboratory studies revealed that *L. schach* as a potential predator on the long horn grasshopper. The *L. schach* was

able to prey 35 adults of *Sexava* spp. within 24 hours and it was successfully to be introduced from Yogyakarta to South Bolaang Mongondow (Lala *et al.*, 2010). The predatory bird *L. schach* does not exhibit preference to certain *Sexava* spp. stages, it preys on all of *Sexava* spp., nevertheless it eats more on smaller nymphs. The morphology of prey will determine predator preference (Lang and Gsodl, 2001).

Table-4. The population average of *Sexava nubila* stages at one month before and at 10 months after release of predatory bird *Lanius schach* in Moronge District, Talaud Islands Regency.

Statistics	Population of <i>S. nubila</i> (individuals/tree)									
	Total		Female adult		Male adult		Old nymph		Young nymph	
	B-1	B+10	B-1	B+10	B-1	B+10	B-1	B+10	B-1	B+10
Average	23,65a	21,05b	5,73a	5,18b	10,05a	9,38b	4,35a	3,38b	3,53a	3,13b
S.D.	3,06	2,65	1,26	1,32	1,65	1,80	1,61	1,16	1,13	1,25
C.V.	12,94	12,60	22,07	25,51	16,41	19,21	37,06	34,37	32,05	40,13
N	120		120		120		120		120	
α 0,05; P	3,89E-11		9,45E-04		3,87E-05		4,54E-09		2,96E-03	

Remarks: B -1: one month before predator release; B +10: 10 months after predator release

c) Population decline of *S. nubila*

Trend of declining population of *S. nubila* increasingly is evident in the more severely damaged coconut. The trend of population decline had seen from

the negative value of regression equation. The higher population of *S. nubila* has increasingly significant differences with the observations time. This was evidenced by the value of (P) which smaller (Table-5).

**Table-5.** Trend of declining population of *Sexava nubila* on coconut with different levels of leaf damage intensity of which were released with predatory bird *Lanius schach* in Moronge District, Talaud Islands Regency.

Coconut leaf damage intensity at the time of predator release	The relationship between population of <i>S. nubila</i> (Y) with months of observation (X)	R ²	P
Light	$Y = - 0,036x + 18,944$	0,015	0,722
Moderate	$Y = - 0,175x + 20,310$	0,386	0,041
Heavy	$Y = - 0,467x + 24,580$	0,610	0,005

Impact of *L. schach* introduction on leaf damage intensity of coconut palm

The light, moderate, and severe damage intensities turned into light damage intensity within one, three, and five months after the release of *L. schach* (Table-6). In this study the control of *S. nubila* was just ongoing for 10 months since the release of *L. schach*. Although the process of controlling the pest insect was still in short time, *L. schach* had shown its impact on

reduction of coconut-leaves damage-intensity. Referring to the successfulness of control the red locust (*N. septemfasciata*) outbreak in Mauritius with the introduction of predatory bird *A. tritis* from India, it took place approximately within 8 years (1762-1770) (De Bach, 1974). Thus outbreak of *S. nubila* in Salibabu Island is expected to be controlled by the predatory bird *L. schach* in at least 7 years.

Table-6. The changes in the status of the leaf damage intensity of coconut palm due to *Lanius schach* introduction in Moronge District, Talaud Islands Regency.

Sample trees (n)	Leaf damage intensity (%)											
	Jul. 2011	Aug. 2011	Sep. 2011	Oct. 2011	Nov. 2011	Dec. 2011	Jan. 2012	Feb. 2012	Mar. 2012	Apr. 2012	May 2012	Jun. 2012
56	14.15 Light	Release of predatory bird	25.09 Moderate	22.19 Light	23.60 Light	22.14 Light	20.60 Light	19.48 Light	20.50 Light	22.53 Light	21.65 Light	20.40 Light
39	34.67 Moderate		27.02 Moderate	29.11 Moderate	26.01 Moderate	21.84 Light	22.40 Light	22.94 Light	20.20 Light	21.52 Light	20.80 Light	20.93 Light
25	57.66 Heavy		35.36 Moderate	31.62 Moderate	28.03 Moderate	27.79 Moderate	27.10 Moderate	24.43 Light	21.95 Light	20.65 Light	21.83 Light	24.00 Light

CONCLUSIONS

The mean population of *S. nubila* at 10 months after release (21.05 individuals/tree) was significantly lower than at one month before the release (23.65 individuals/tree). The intensity of light damage, moderate, and severe turned into light damage at one, three, and five months after the release of *L. schach*.

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