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Seasonal Abundance and Temperature Tolerance Test of the Stripe Albatross Butterfly Species *Appias libythea* (Fabricius, 1775)

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Abstract: The present study worked out of the peak and fall of the population size of *Appias libythea* during the study period from July 2016 to May 2017 at four different study sites around Yangon Environs. The temperature tolerance test was conducted in the laboratory of Zoology Department, Yangon University. The study showed that the population size peaks were in February and March (Hot period) when the host plants foliate and the decline of the population size was in June and July (monsoon period) when the host plants defoliate. This finding is in accordance with the data obtained for temperature tolerance test. The temperature range is between 30°C and 35°C in the hot period. The survival rate of larvae was recorded to be highest within the temperature range recorded in the hot period. Successful rearing of butterfly species entirely depends on systematically handling of the larvae and hygienic conditions of the rearing boxes including the places where they are kept.

Key words: Stripe Albatross Butterfly · Seasonal Abundance · Peak And Fall · Temperature Tolerance

INTRODUCTION

Kunte [1] stated that butterflies are the indicator species for the diversity representing particular vegetation of habitat and sensitive to changes in their respective habitats usually caused by climatic changes. This ultimately leads to the peak and fall of the population size related to the seasons. Butterflies play pivotal role in the process of pollination while gathering pollen and nectar as their source of food. Many butterfly species, both common and rare are easily and reliably recognizable in the natural environment if one is familiar with the species. Butterflies are also amongst the better-studied groups of organisms with availability of field guides. Furthermore, their diversity and community composition are dependent on that of plants, as their larvae have strict dependence on specific host plants by Monastyrskii & Devyatkin [2] and Klots [3].

Butterflies are indicating the climate of environment. These are an importance group for studying the climate change because they are cold blood animals and their life activities, lifecycle, distribution and diversity depend on environmental temperature and humidity [4].

Many butterfly researchers in Myanmar work on the taxonomic aspect of butterfly species. The depth into the life of a butterfly species is scarce though each butterfly species possesses unique characteristics and interesting behaviours.

The species *A. libythea* commonly known as Striped Albtross, one of the members of the family Peridae which is widely distributed throughout in Southeast Asia including Myanmar by Bingum [5], Talbot [6]. This enhances to undertake the present work into the depth of the life of this species with the following objectives.

- To analyze temperature tolerance of the larvae of the studied butterfly
- To relate temperature tolerance with seasonal abundance of the butterfly species of this study.

MATERIALS AND METHODS

Study Period and Study Sites: The studied period lasted from June 2016 to May 2017. Bahan (16°49′ N, 96°9′ E), Kamaryut (16°50′ N,96°7′ E) and Hlaing Township

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(16°49′ N, 96°8′ E) of Yangon Region were chosen as natural study sites as the host plant species of the studied butterfly species are mainly abundant in these areas.

Field Surveys: Weekly field surveys to the selected study sites were occurred throughout the study period. Ten host plants were randomly marked to record the developmental stages in the life cycle of the butterfly of this study.

Temperature Tolerance Test in Laboratory of Zoology Department: Twenty-five eggs from the same batch of eggs were separated into five groups and each group was placed in separate rearing boxes to provide sufficient space for the larvae. The boxes were then simultaneously reared under varying temperatures (10°C, 15°C, 20°C, 25°C, 30°C, 35°C and 40°C). Temperatures 10°C and 15°C were controlled in a refrigerator and the temperatures, 20°C, 25°C and 30°C were controlled in an air-conditioned room. Temperature tolerance test with 35°C was conducted by keeping the tested boxes in room temperature. Temperature of 40°C was created under room temperature of 35°C by inserting a 5-wart bulb in a box with the experimented larvae. The survival rates and sex ration were recorded from the emerged adults under the tested temperatures.

Seasonal Abundance: Seasonal abundance of the studied species was analyzed based on the recorded data in captivity and weekly data recorded in nature.

Statistical Analyses: Statistical analyses were conducted according to Pearson's Correlation Coefficient test and Student's t-test. Statistical Package for Social Science (SPSS) software was used for the tests.

RESULTS

Seasonal Abundance of *A. libythea*: The study species is recorded throughout the year though seasonal peak and fall exists in the breeding cycle. The peak of the breeding period falls in February and March (hot season) while the population size declined in June and July (monsoon period) based on the abundance of adults and developmental stages.

The seasonal variations of the developmental stages showed positive correlation with maximum temperature. The seasonal variation of all stages showed negative correlation with high relative humidity. The number of the developmental stages increased in low relative humidity. Regarding rainfall negative correlation was recorded. The developmental stages dominate in the natural habitat when the recorded rainfall data was low. The recorded data of all developmental stages were low when the rainfall data was high.

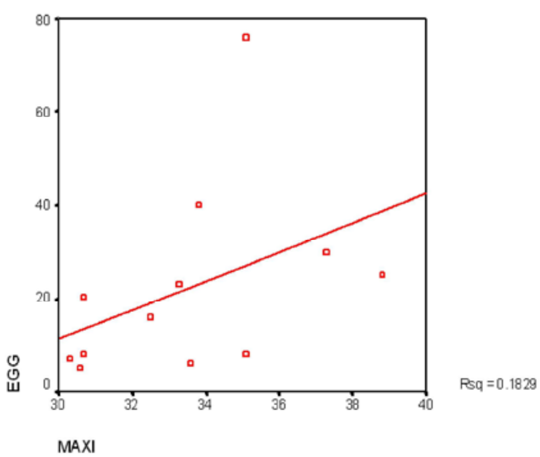

Fig. 1:

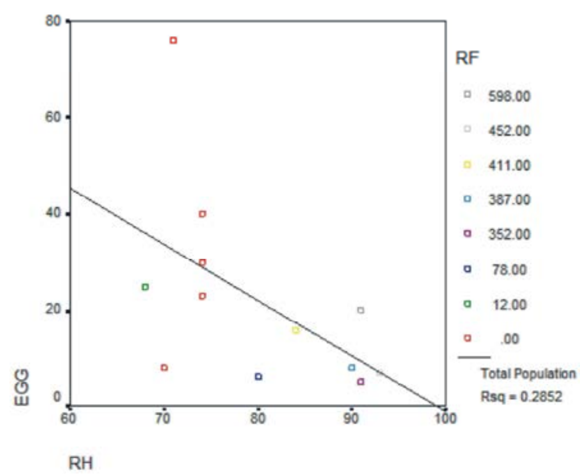

Fig. 2:

MAXI – maximum temperature (°C), RH- relative humidity (%), RF – rainfall (inches)

Fig. 1: Regression correlation with number of collected eggs and environmental maximum temperature

Fig. 2: Regression correlation with number of collected eggs and relative humidity and rainfall

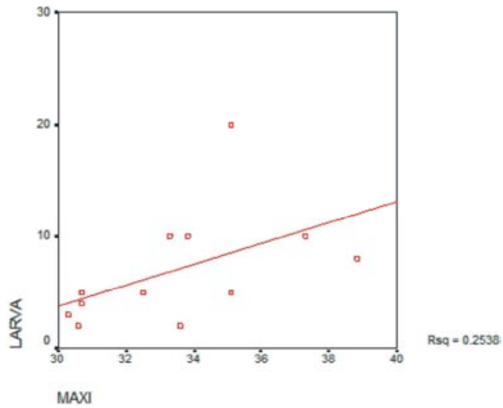

Fig. 3:

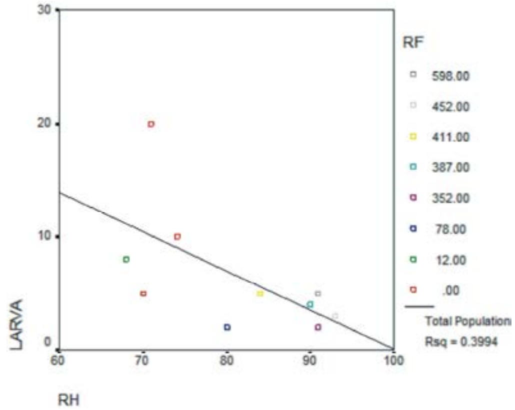

Fig. 4:

MAXI – maximum temperature (°C), RH- relative humidity (%), RF – rainfall (inches)

Fig. 3: Regression correlation with number of collected larvae and environmental maximum temperature

Fig. 4: Regression correlation with number of collected larvae, relative humidity and rainfall

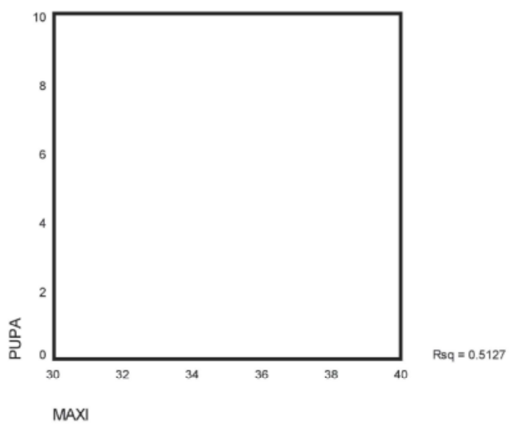

Fig. 5:

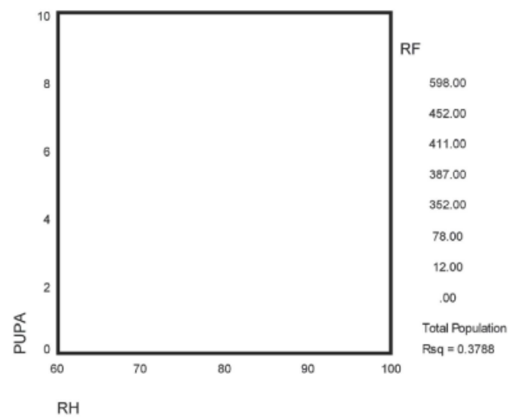

Fig. 6:

MAXI – maximum temperature (°C), RH- relative humidity (%), RF – rainfall (inches)

Fig. 5: Regression correlation with number of collected pupae and environmental maximum temperature

Fig. 6: Regression correlation with number of collected pupae, relative humidity and rainfall

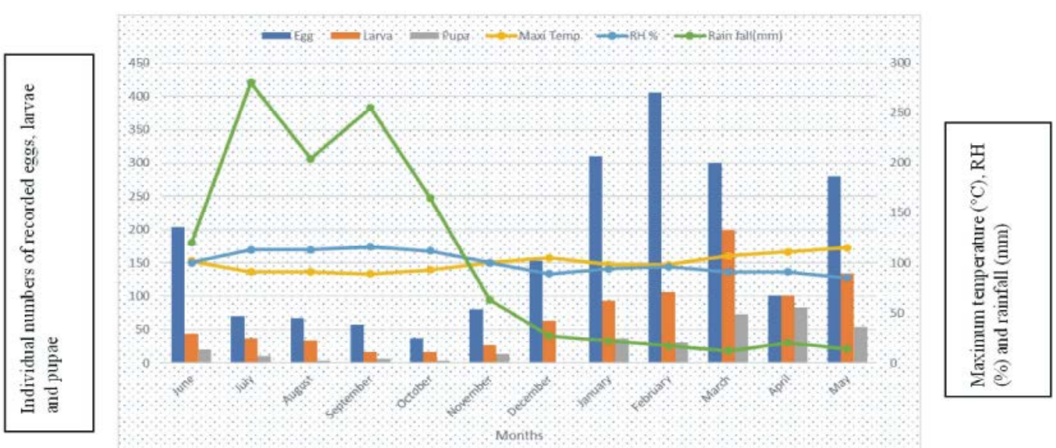

Fig. 7: Seasonal variation of individual number of recorded eggs, larvae and pupae during study period at all study sites

Table 1: Correlation between weather parameters and recorded eggs, larvae and pupae during the study period from all study sites

Stages	Maximum Temperature (°C)	Relative humidity (RH%)	Rain fall (RF) mm
Mean ±SD	33±2,52	84±6.23	248±252.15
Eggs	r = .576	r = -.596*	r = -.438
larvae	r = .757**	r = -.758**	r = -.492
pupae	r = .745**	r = -.750**	r = -.635**

Table 2: Number of individual and weather parameters were recorded in all study sites during 2016-2017

Months	June	July	August	September	October	November	December	January	February	March	April	May
Egg	203.3	70	66.6	56.6	36.6	80	153	310	405.6	300.3	100.4	280
Larva	43.3	36.6	33.3	16.6	16.6	26.6	63.3	93.3	105.6	200	100.6	133.3
Pupa	20	10	3	6	3	13	.23.3	36.6	30	73.3	83.3	53.3
Maxi Temp	102	91	91	89	93	100	105	98	98	107	111	115
RH %	100	113	113	116	112	100	89	94	96	91	91	85
Rain fall(mm)	120	280	204	255	165	63	27	22	17	12	20	14

Table 3: Effect of temperature on the development from egg to adult of *Appias libythea*

Temperature °C	No. of eggs	1st larva	2nd larva	3rd larva	4th larva	5th larva	Pupa	Adult
10	25	-	-	-	-	-	-	-
15	25	-	-	-	-	-	-	-
20	25	6	6	6	6	6	6	6
		24%	100%	100%	100%	100%	100%	100%
25	25	18	18	18	18	18	18	18
		72%	100%	100%	100%	100%	100%	100%
30	25	25	25	25	25	25	25	25
		100%	100%	100%	100%	100%	100%	100%
35	25	25	25	25	25	25	25	25
		100%	100%	100%	100%	100%	100%	100%
40	25	-	-	-	-	-	-	-

Temperature Tolerance: The fertilized eggs of *A. libythea* reared under varying controlled temperatures of 10°C, 15°C, 20°C, 25°C, 30°C, 35°C and 40°C respectively showed that the tested fertilized eggs did not hatch in the temperatures of 10°C, 15°C, 20°C and 40°C. The temperatures 30°C and 35°C were recorded to be suitable temperatures since all the stages in the life cycle underwent normal development in these temperatures (Table 3).

DISCUSSION

Population size based on the number of developmental stages on the host plants in the study sites and the abundance of adults recorded associated with the varying seasons indicated the peak to be in February and March coinciding with the hot period of the year and the decline of the population size in June and July. This finding is related to the foliating and defoliating periods of the main host plant, Kadet. This host plant foliates in the hot period and defoliate in the monsoon period of the year. Kunte [7] stated that the life stages of butterfly species were depend on food availability and consequence of temperature changes. He also mentioned the number of larvae and adults were depended on microclimatic changes.

Temperature also confirmed this statement since survival rate of the larvae was recorded to be the highest at 30°C and 35°C. The temperature usually ranges from 30°C to 35°C in the hot season based on the annual recorded data from Department of Meteorology, Kaba Aye, Yangon Township.

The present finding was agreed by Roy *et al.* [8]who showed that the butterfly species were positively correlated with temperature. The number of butterfly species include family Pieridae were increase associated with warm, dry summer in his study period.

According to Malabika Kakati, *et al*. [9], the diversity pattern of butterfly species in Eastern Himalayas was peak in monsoon period. They mentioned the recorded butterfly species different between various habitats which depend on broad geographical distribution.

Population size in nature is controlled by natural enemies such as spiders, ants, lizards and birds. In addition to these, there are parasitoids that attack the larvae and the pupae of butterfly species. The fertilized eggs reared in captivity, if scientifically and hygienically undertaken would ensure the survival of the butterfly species. However, when in nature, the developmental larvae would not only encounter the natural enemies but would also have to face the natural hazards caused by abrupt changes in the environment and climatic conditions.

Graceful flights of adult butterflies are of interest to nature lovers, especially while visiting one flowering plant after another while gathering pollen and nectar as their sources of food. Most people however would not realize that these interesting creatures are benefiting the plants in the process of pollination while in search of their food source. The depth into the complex life of the butterfly would always be an ongoing research as it is time consuming to record each complex fact involved in the life of the butterfly. Successful rearing of the butterfly in captivity enhances the establishment of a butterfly breeding farm not only for scientific works but also to serve as pleasant recreation site for the public. This could also promote public awareness on the complex life of the butterfly.

The knowledge on the host plant species is of utmost important factor to rear the butterfly species in captivity. Many people throughout the world are interested in tropical butterfly species. Successful rearing of butterflies could therefore be a source of economic value to the country. The data obtained in this work on *A. libythea* would thus be part of the contributions towards economy of the country.

CONCLUSION

The present study showed the population of studied butterfly species high in warm or hot environment. The life cycle and hatching rate depend on high temperature, this finding was strongly supported by temperature tolerance test in laboratory condition. The negative correlation was recorded by population with rainfall and relative humidity data.

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