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FLIGHT INTENSITY OF TWO SPECIES OF STINGLESS BEES *HETEROTRIGONA ITAMA* AND *GENIOTRIGONA THORACICA* AND ITS RELATIONSHIPS WITH TEMPERATURE, LIGHT INTENSITY AND RELATIVE HUMIDITY

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ABSTRACT

Information on flight intensity of stingless bees is important in pollinator management programs. However, the flight intensity of local stingless bees especially for *Heterotrigona itama* and *Geniotrigona thoracica* is poorly known. Investigations into the pattern of activity of various species of meliponinae, in different parts of the world, reveal a lot of variations. Hence, this study was designated to determine the effect of daytime and climatic factors on the flight of stingless bees. This study was conducted at Orchad 10, Universiti Putra Malaysia, Serdang, Selangor and the flight intensity of bees was determined by counting the numbers of bees leaving and returning to their nest for ten

minutes observations. Counting was done in six colonies which had similar strength. It was done five times per day at 8.00 am, 10.00 am, 12.00 pm, 2.00 pm and 4.00 pm for six days. The peak number of bees that exited and returned was recorded around 8.00 am to 10.00 am for both species. The number of *Geniotrigona thoracica* exited from the entrance had a positive correlated to air temperature, relative humidity and light intensity. Meanwhile for *Heterotrigona itama*, their flight activities were affected by temperature and light intensity. Hence it is advisable to save stingless bees by not applying insecticide to crops at times of day when their flight intensity is highest.

Keywords: *Heterotrigona itama, Geniotrigona thoracica,* Stingless bees

ABSTRAK

Maklumat kebolehterbangan kelulut amat penting dalam program pengurusan pendebungaan. Namun begitu, keboleh terbangan kelulut, *Trigona itama* dan *Geniotrigona thoracica* kurang diketahui sedangkan corak aktiviti spesies Meliponinae ini berbeza-beza. Oleh sebab itu, kajian ini dijalankan untuk mengenal pasti kesan hari, masa dan cuaca terhadap kebolehterbangan kelulut. Kajian ini dijalankan di Kebun10, Universiti Putra Malaysia, Serdang, Selangor serta kebolehterbangan kelulut dikenal pasti dengan mengira kelulut yang pergi dan balik ke sarang selama 10 minit. Pengiraan dijalankan untuk enam koloni dengan kadar kekuatan penerbangan yang sama. Pemerhatian dilakukan sebanyak lima kali setiap hari iaitu pada 8.00 pagi, 10.00 pagi, 12.00 tengah hari, 2.00 petang, dan 4.00 petang selama 6 hari berturut-turut. Kedua-duas pesies kelulut paling banyak keluar dan masuk sekitar pukul 8 hingga 10 pagi. Bilangan *Geniotrigona*

thoracica yang keluar berkorelasi secara positif dengan suhu udara, kelembapan relative dan keamatan cahaya. *Heterotrigon aitama* pula berkorelasi secara negatif dengan suhu dan keamatan cahaya. Oleh itu, penyemburan racun serangga harus dielakkan pada waktu pagi kerana kadar aktiviti penerbangan kelulut berada pada paras yang maksimum pada waktu tersebut.

Kata kunci: *Heterotrigona itama*, *Geniotrigona thoracica,* lebah tidak bersengat.

INTRODUCTION

Flight intensity of bees is influenced by internal conditions of the colonies and environmental surrounding, Hilario *et al*., (2000). The influence of abiotic factors on foraging activities has been studied in several eusocial bee species as reported by several authors given various result of influence by the environmental factors (Iwama, 1977; Fowler, 1978; Kleinert-Giovannini and Imperatriz-Fonseca, 1984). These study report that weather conditions like light intensity, relative humidity and temperature are important factors that influence the flight intensity of stingless bee. In this study, we report the differences of flight intensity of *Heterotrigona itama* and *Geniotrigona thoracica*, with the influence of time, relative humidity, air temperature and light intensity. The influence of abiotic factors on the flight intensity of these bees would be paramount importance for people who work with bees in pollinator management programs, for them to know the activity of their bees so that they can work with them with appropriate times.

MATERIALS AND METHODS

Studied species and study area

In order to conduct the study, we selected six colonies of bees from Meliponini belonging to two different species which had

similar strength; three colonies of *Heterotrigona itama* and three colonies of *Geniotrigona thoracica* from a bee keeper at the Mardi, Serdang. This two species were chosen based on their availability and had a varied abundant in Malaysia and many bee keepers have these two species for collection of honey and pollination for their farm. The experiment was performed at the Orchad 10, Universiti Putra Malaysia, Serdang, Malaysia. The study area has a variety of fruit trees like starfruit, guava, mango, longan and mangosteen and coconut palms. It is suitable habitat for these bees to survive.

Flight activity and abiotic data collection.

Flight intensity of the bees was observed at the entrance of each colony by counting the bees that entered the nest with pollen or without pollen on the corbiculae and exited the nest using the methodology described by Oliveira (1973). Observations and activity counts were conducted twice a month in three months (June, July, and August 2014), at 0800, 1000, 1200, 1400 and 1600 hours. Each observation was considered as a treatment and was conducted in ten minutes.

Data analysis

Statistical analyses were carried out using SPSS 16^{th}. Kruskal-wallis was used to compare the number of bee exiting with the number of bee returning per day. Spearman's correlation was used for relating the flight intensity to abiotic factors.

RESULT AND DISCUSSIONS

This study noted as hours per day had a significant effect to the flight intensity of stingless bees. Table 1 showed the peak in the number of bees exiting and returning was observed between 10.00 am to 12.00 pm for *Heterotrigona itama*. Meanwhile *Geniotrigona thoracica* showed peak number of flight activity at 8.00 am and 10.00 am. The highest mean temperature (36.23^0C) was recorded at 2.00 pm to 4.00 pm, while the lowest

temperature (24.5^0C) at 8.00 a.m. Both colonies showed the same flight activity patterns. Early in the morning higher pollen collection was based on the peak foraging activity of both species. At noon, general flight intensity for both colonies was reduced. This may be associated with the high temperature and low relative humidity and also the scarcity of pollen resources.

Table 1. Effect of hours per day on flight intensity of *Heterotrigona itama* and *Geniotrigona thoracica.*

	Heterotrigona itama		*Geniotrigona thoracica*	
Time	Bee return	Bee exit	Bee return	Bee exit
8.00 am	40.97	47.92	52.64*	55.50*
10.00 am	50.47*	49.81*	44.67	43.00
12.00 pm	56.67*	51.17*	45.75*	46.97*
2.00 pm	43.31	40.44	42.97	40.86
4.00 pm	36.08	38.17	41.47	41.17
S.E.	84.15	55.08	122.297	97.128
p	0.139	0.465	0.743	0.416

Pierrot and Schlindwein (2003), reported *Melipona scutelaris* (Apidae, Meliponini) in Brazil were actively forage early two hours in the morning due to the high resource of food. Table 2 showed abiotic factors had a significant effect on the flight intensity of *Heterotrigona itama* and *Geniotrigona thoracica*.

Flight activity of *Heterotrigona itama* and *Geniotrigona thoracica* were significant affected by temperature, relative humidity, moderate light intensity and hours of treatments. Ferreira Junior *et al*., (2010), also reported five colonies of *Melipona bicolour schencki* in southern Brazil were influenced by temperature, hour of the day, atmospheric pressure and light intensity.

Table 2. Spearman's correlation between flight intensity of both species and abiotic factors. Temp-temperature, Rh-relative humidity, BE-bee exit, BR- bee return, Li-light intensity and Time-hours of treatments. (*) correlation significant at the P =0.01.

	Heterotrigona itama						*Geniotrigona thoracica*					
	Temp	Rh	BE	BR	Li	Time	Temp	Rh	BE	BR	Li	Time
Temp	1.00	0.00*	0.69	0.73	0.00*	0.00*	1.00	0.00*	0.05*	0.20	0.00*	0.00*
Rh		1.00	0.75	0.49	0.00*	0.00*		1.00	0.07	0.29	0.00*	0.00*
BE			1.00	0.06	0.98	0.14			1.00	0.00*	0.38	0.11
BR				1.00	0.67	0.39				1.00	0.99	0.22
Li					1.00	0.00*					1.00	0.00*
Time						1.00						1.00

CONCLUSIONS

Time of the day and abiotic factors had a significant effect on the flight intensity of stingless bees. More knowledge on the climatic preferences of stingless bee is required in order to understand and applying this bee to crop pollination. Thus, the long term collection of baseline data on flight intensity varying with abiotic factors and climatic conditions is important to evaluate the effect of surrounding environmental to the behaviour of stingless bees. The influence of abiotic factors on the flight intensity of these bees would be paramount importance for people who work with bees in pollinator management programs, for them to know the activity of their bees so that they can work with them with appropriate times.

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