

## FAUNISTIC COMPOSITION OF WILD BEES IN TASIK KENYIR, TERENGGANU

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### ABSTRACT

Wild bees (Hymenoptera: Apoidea) are important pollinator of angiosperms that play a vital role in the ecosystem. Due to the lack of research, a study on wild bees was conducted in order to determine the species richness and abundance of bees in Tasik Kenyir. Study was conducted in four localities represented by dipterocarp forests. Bees were sampled by active searching using aerial net along 1-2 km sampling transects, 20 baited traps, and four modified Pennsylvanian light traps. From the study, 205 individuals of bees represented by 21 species and two families of bee, Apidae and Halictidae were identified. Family Apidae was the most diverse family and stingless bee, *Tetragonula laeviceps* was the most abundant species recorded. The secreted resin from the dipterocarp trees are important for the stingless bee nest which contribute to the abundance of the species. Sungai Buweh has the most abundant bees recorded as the sampling was done during the flowering periods of some tree species. Meanwhile, Kenyir Research Station has the most diverse bee species collected due to the presence of some forbs species in the area. The presence of diverse plants species might attract different bee species to forage to the areas.

**Keywords:** Hymenoptera, Apoidea, species richness, abundance, Tasik Kenyir

*Received (31-January-2017); Accepted (27-July-2017);  
Available online (18-August-17)*

**Citation:** Adanan, N.A., Rosmidi, F.H. & Abdullah M.T. (2017). Faunistic composition of wild bees in Tasik Kenyir, Terengganu. *Journal of Wildlife and Parks*, **32**: 57-65.

## INTRODUCTION

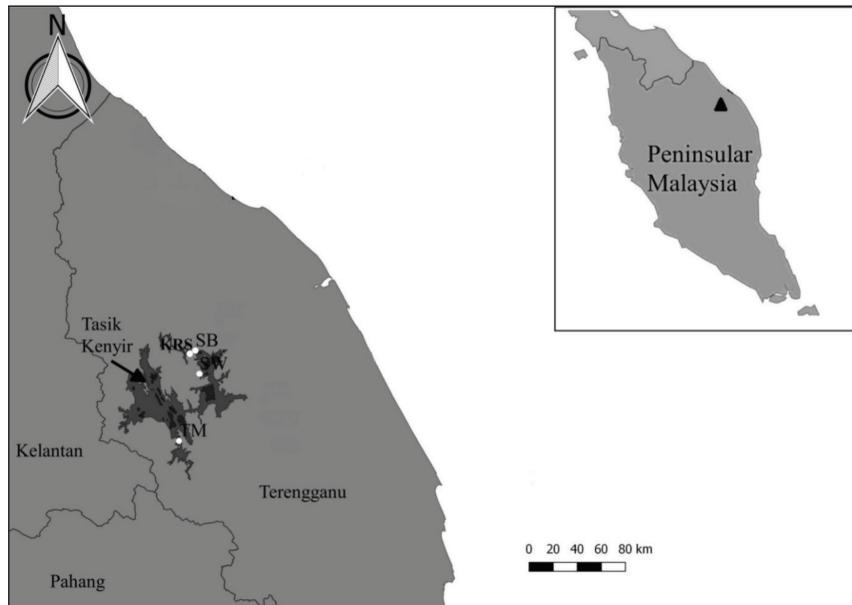
Bees are one of the important angiosperms pollinator (Klein *et al.*, 2007; Sirohi *et al.*, 2015) and classified in the same groups with wasps and ants from Order Hymenoptera. They are known to feed on pollen and nectar (Wilson & Carril, 2016) and can be found widely in different habitat and biogeographical regions with sufficient floral resources and the availability of the nesting sites (Westphal *et al.*, 2008). About more than 20,000 bee species had been described worldwide (Park *et al.*, 2015). Based on Wilson and Carril (2016), the largest bees in the world, *Megachile pluto* can be found in Malaysia.

However, the increasing human population has contributed to the high level of disturbances towards ecosystem, habitat loss, and fragmentation (Silva *et al.*, 2015). The level of forest disturbances will led to the loss of biodiversity including the declining in the biotic pollinator mainly bees (Sirohi *et al.*, 2015). Besides, bees also being threatened by invasive species, climate change, pollution and pesticides (Winfrey, 2010).

Studies on wild bees in Malaysia are still scarce despite the diverse and abundance of plant species. Most of the study that had been done in this country such as Eltz *et al.* (2003), Salim *et al.* (2012), Kelly *et al.* (2014) and Azmi *et al.* (2015) were focused mainly on stingless bees due to high honey productions. In order to highlight these gaps of knowledge, this study was conducted to study the species richness and abundance of bees in dipterocarp forest in Tasik Kenyir.

## METHODOLOGY

Bees were sampled from four localities; Tanjung Mentong, Sungai Buweh, Kenyir Research Station, and Saok Waterfall which located around Tasik Kenyir, Hulu Terengganu, Terengganu (Figure 1). This study was done from March 2015 until February 2016 with total of 28 sampling days (Table 1). All areas were represented by dipterocarp forest with abundance of large trees from a single family of Dipterocarpaceae. Some of the trees genera that can be found in the study areas are *Shorea*, *Vatica* and *Dipterocarpus*.



**Figure 1** Map of study areas in Tasik Kenyir, Hulu Terengganu, Terengganu. Bees were sampled from four study areas; Tanjung Mentong (TM), Sungai Buweh (SB), Kenyir Research Station (KRS), and Saok Waterfall (SW).

Bees were sampled by using aerial nets through active searching along 1-2 km sampling transects and done from 0900 hours until 1700 hours for each sampling days. Apart from that, the additional data on bees were also sampled from baited traps and light traps. A total of 20 baited traps were set up and rotten pineapples were used as bait. Meanwhile, four modified Pennsylvanian light traps were set up for the nocturnal bees. The collected bees were preserved as dry specimens and deposited in Centre for Kenyir Ecosystem Research collection room. Bees were identified based on Michener (2007), Inoka *et al.* (2008), Jalil and Shuib (2014), Wilson and Carril (2016).

**Table 1** The study areas in Tasik Kenyir, geographical coordinates and date of surveys.

Study areas	Geographical coordinates	Dates of surveys
Tanjung Mentong	4° 54' 7.78" N ] 102° 43' 28.78" E	7 - 13 Mac 2015
Sungai Buweh	5° 8' 52.02" N 102° 46' 8.53" E	20 - 26 Apr 2015
Kenyir Research Station	5° 8' 35.203" N 102° 45' 37.951" E	24 – 30 Aug 2015
Saok Waterfall	5° 5' 2.49" N 102° 46' 47.68" E	23 – 29 Feb 2016

The data recorded were pooled in order to construct a rank abundance curves. Rank abundance distribution aims to show the common, intermediate and rare species recorded from the overall sampling occasions done in Tasik Kenyir. Meanwhile, a rarefaction curve was constructed by using PAST Ver. 2.17 to identify and compare the species richness for each locality in Tasik Kenyir.

## RESULTS AND DISCUSSION

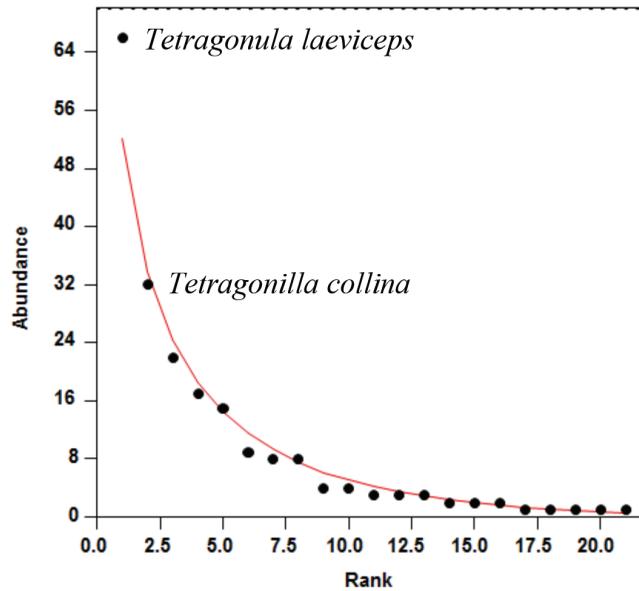
A total of 205 individuals represented by 21 species belonging to two families (Halictidae, Apidae), three subfamilies and four tribes were recorded (Table 2). Family Apidae was the most diverse family with 20 species and family Halictidae was the lowest in diversity with only one species recorded. Meanwhile, subfamily Apinae has the most tribes and species collected. According to Winfree (2010), bee communities mainly Apinae were found dominating the tropical regions. The abundance of these highly social species which are floral generalists had consumed most of the available floral sources. This situation might exclude the other bee species to use and consume the resources (Michener, 2007). Apart from that, the low number of Halictidae which are mostly ground nesting bees might be due to the climate. The wet tropical climate contributed to the fungal attacks to their larval nutrition supplies and the nests would flood due to high rainfall during monsoon season.

Based on the rank abundance distributions (Figure 2), the data showed that most of the bee species were accounted as rare species, where more than half of the recorded species were represented by less than 10 individuals. The abundance distributions shows that five species were represented by only one individual. *Tetragonula laeviceps* is the most abundant species with 66 individuals followed by *Tetragonilla collina* with 32 individuals. The species abundance of the bees

in Tasik Kenyir followed a log-series models where low number of abundant species are recorded and high number of rare species in a community. Abundance of dipterocarp tree species were found in the study area. Dipterocarps species are large trees which secretes resin for defense purposes against fungi, bacteria and animals. The secreted resin was then used by the stingless bees for their nest, food and chemical defenses (Salim *et al.*, 2012; Jalil & Shuib, 2014) and this factor might contribute to the abundance of the stingless bees species including *T. laeviceps* and *T. collina* in Tasik Kenyir.

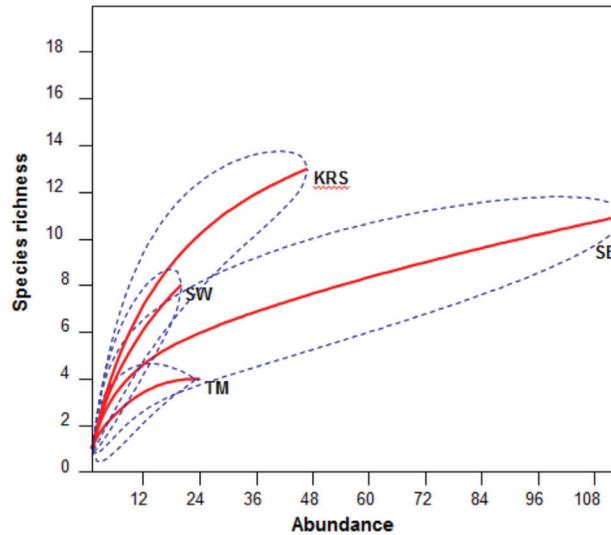
**Table 2** List of wild bee species recorded from four localities in Tasik Kenyir. (KRS: Kenyir Research Station, SB: Sungai Buweh, SW: Saok Waterfall, TM: Tanjung Mentong).

Family	Subfamily	Tribe	Species	TM	SB	KRS	SW	
Halictidae	Nomiinae	-	<i>Nomia strigata</i>	0	0	1	0	
Apidae	Xylocopinae	Xylocopini	<i>Xylocopa aestuans</i>	17	0	0	0	
			<i>Xylocopa caerulea</i>	0	1	0	0	
			<i>Xylocopa dejeanii</i>	0	1	0	0	
			<i>Xylocopa varipuncta</i>	3	0	0	0	
		Ceratinini	<i>Ceratina smaragdula</i>	0	1	1	0	
			<i>Ceratina</i> sp.	0	0	3	0	
		Apinae	Anthophorini	<i>Amegilla zonata</i>	0	1	2	1
				Meliponini	<i>Heterotrigona itama</i>	0	0	1
			<i>Homotrigona aliciae</i>		0	0	0	8
			<i>Geniotrigona thoracica</i>		0	2	7	0
	<i>Lepidotrigona terminata</i>		0		0	0	2	
	<i>Lepidotrigona ventralis</i>		0		1	0	0	
	<i>Tetragonilla atripes</i>		0		0	2	0	
	<i>Tetragonilla collina</i>		0		19	13	0	
	<i>Tetragonula laeviceps</i>		2		54	6	4	
	<i>Tetragonula melina</i>		0	0	0	1		
	<i>Tetragonula</i> sp.	0	4	4	0			
	<i>Tetrigona apicalis</i>	0	0	3	1			
	Apini	<i>Apis cerana</i>	0	12	3	0		
		<i>Apis dorsata</i>	2	18	1	1		



**Figure 2** The rank abundance distribution for the total wild bee community recorded in Tasik Kenyir. The log-series distribution model was the best fits to the curves compared to the other abundance models.

Figure 3 shows the rarefaction curves of the bee diversity in four study areas in Tasik Kenyir. Sungai Buweh has the most abundant bees captured with 114 individuals compared to the other localities. The most abundant species recorded in SB were represented by the Apidae species. Sampling was done during the flowering periods of some trees species, such as *Saraca thaipingensis*, *Scaphium* sp. and *Vatica cinerea*. Thus, the abundance of floral resources in the closed canopy forest contributed to the high number of individuals captured compared to the other localities.



**Figure 3** Rarefaction curve (solid line) of wild bees recorded at 95% confidence interval (dashed line) from four study sites in Tasik Kenyir. (KRS: Kenyir Research Station, SB: Sungai Buweh, SW: Saok Waterfall, TM: Tanjung Mentong).

However, Kenyir Research Station has the most diverse bees species with 13 species recorded compared to Sungai Buweh, Saok Waterfall and Tanjung Mentong. The obvious plant phenology occurred during the field sampling in Kenyir Research Station was leaf flushing and some undergo fruiting where this situation contribute to the low abundance of bees recorded. Nevertheless, small parts of the area are represented by abundance of forbs species such as *Melastoma malabathricum*, *Mimosa pudica*, and *Stylosanthes gracilis*. The diverse plants species had attract different species of bees such as sweat bee, *Nomia strigata* and small carpenter bee, *Ceratina* spp. to forage in the areas. The curves are still increase and show no indication to reach asymptote indicate that the sampling are not complete yet. Thus, sampling efforts need to be increased by prolonging the sampling days in order to record more bee species and reach asymptote.

## CONCLUSION

As a conclusion, the bee species in Tasik Kenyir is diverse and more species are expected to be discovered if more efforts and extensive inventory were carried out in the area. We hope the data obtained could provide a baseline data on bee species in Tasik Kenyir and might help in conservation and management planning for the area.

## ACKNOWLEDGEMENT

Thanks to Universiti Malaysia Terengganu and Kenyir Research Institute for the financial supports, Geopark Grant (GEOPARK/2015/53167) and Trans-disciplinary Research Grant Scheme (TRGS/2014/59373) awarded to Prof. Mohd Tajuddin Abdullah. Lastly, thanks to everyone who directly and indirectly involved throughout the research.

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