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Temporal Assemblage and Distribution of Ephemeroptera in Lata Janggut, Jeli, Kelantan.

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Abstract. Lata Janggut is one of the popular recreational rivers with waterfall in Jeli, Kelantan. The lotic river characteristic at Lata Janggut create a suitable habitat for aquatic insect especially Ephemeroptera. Recreational activities may disturb the river ecosystem especially aquatic insects, Ephemeroptera in particular. Therefore, this study targets to determine the temporal assemblage and distribution of Ephemeroptera at Lata Janggut, Jeli from March till August 2019. Ephemeroptera collection was conducted monthly from March to August 2019 using Surber net for three replicates at three stations. In total, 1260 individuals with five (5) families (Ephemerellidae, Baetidae, Heptageniidae, Neophemeridae, and Leptobiilidae) and nine (9) genera were collected and recorded. The most abundant Ephemeroptera found is Baetidae and Ephemerellidae. However, the result shows the different composition for monthly abundance for those families. Meanwhile, the distribution of those families at all station also shows a different composition. This indicates there are microhabitat exists between the stations and the physical characteristic of the river has change monthly.

1. Introduction

Ephemeroptera (Mayflies) is one of the sensitive benthic macroinvertebrates for freshwater. It is about thirteen (13) family usually found in Malaysia such as Baetidae, Caenidae, Ephemerellidae, Ephemeridae, Heptageniidae, Leptophlebiidae, Neophemeridae, Oligoneuridar, Polymitarcyidae, Potamanthidae, Prosopistomatidae, Teloganodidae and Tricorythidae [1]. This order found mostly in shallow, cool and clean freshwater streams. These organisms were famous for their short-lived adult without mouth by ecologist and called as mayflies or day flies in Indonesia [2]. Each families of this order have different feeding and moving behaviour to suits their morphology such as burrowing, flattened swimming and creeping [3]. Ephemeroptera is easy to differentiate from others order with their three threadlike tails at the end of their abdomen [1,4,5]. Baetidae was the most common Ephemeroptera found in most running water streams known as small minnow mayflies. Besides that,



Baetidae is the smallest Ephemeroptera that has flattened swimming behavior. They also the most less sensitive comparing to other families which can be easily found compare the other families [6]. At headwater and streams with wide distribution of pebbles and cobble substrates, Heptageniidae is the most Ephemeroptera found [6]. This family has flattened shape body that helps them to crawl on the surface of the substrate and makes people name them as flat-headed mayflies.

Most Ephemeroptera has a variety of gills at side by side abdomen segments except Caenidae, Neoephemeridae, Teloganodidae, Tricorythidae, Ephemerellidae and Prosopistomatidae. Caenidae, Teloganodidae, Tricorythidae have operculate gills that look like an insect wearing skirt [1,5]. Therefore, Caenidae was called as small squaregills mayflies, Tricorythidae known as Little Stout Crawler Mayflies as it has stout shape body compared to Caenidae. By naked eyes, Ephemerellidae (spiny crawler mayfly nymph) is also looks-like Caenidae as their body shape is quite similar. However, these family of ephemeroptera has no operculate gills at segment 2, where their gills is located side by side of abdomen start from segment 3 and looks likes small operculate. Contrary, Prosopistomatidae has distinct body shape which looks like a small horseshoe crab with big round body. This family is the rarest ephemeroptera found in Malaysia as not much research paper highlights this family composition as less family found [7,8].

Other families of ephemeroptera such as Potamanthidae (Hacklegill mayflies), Leptophlebiidae (Prong-gilled mayflies) and Ephemeridae (Common burrowing mayflies) have fork gills [1,5]. However, Hacklegills mayflies and Common burrowing mayflies has tusk at head where, Hacklegills mayflies has a lateral process which no present in common burrowing mayflies. Leptophlebiidae can be differentiated from those families with its rectangular head without a tusk or lateral process.

Lata Janggut is one of the tourism spots for headwater in Jeli, Kelantan located at Sungai Long, Batu Melintang [9]. However, aquatic insect composition in this river is not widely explored. Therefore, this paper will discuss on the temporal assemblage and distribution of Ephemeroptera at Lata Janggut, Jeli.

2. Methodology

2.1 Study area

This study was carried out on Lata Janggut Stream, located in the Jeli, Kelantan. Sample was collected once a month from March to August 2019 at three stations. Station 1 is located at recreational activities occurs (5°40'15.9"N; 101°46'13.6"E) and the other two point is the upper stream located in the middle of nearest village. Station 2 is located at 5°39'54.8"N; 101°46'00.4"E and Station 3 at 5°39'47.4"N; 101°45'58.3"E).

2.2 Sampling field

Ephemeroptera larvae collected for three samples replicates per stations. The samples were taken from the different substrate variety present including sediment, rock and sand at each station. Surber net sized 30 cm X 30 cm X 40 cm high with a net size 0.3 mm mesh used to collect Ephemeroptera larvae. The Surber net was placed across water flow while the substrates located in Surber frame were disturbed to dislodge Ephemeroptera larvae at the substrates and wash it into the net by water flow.

2.3 Laboratory analysis

Ephemeroptera were sorted out from other dislodged benthic macroinvertebrates or small substrates collected in surber net. Sorted Ephemeroptera were identified up to genus level [1, 5, 10]. The sample was preserved in 15ml universal bottle with 75% ethanol.

3. Results

In total 1260 individuals of Ephemeroptera found at all stations. Table 1 shows the monthly composition of Ephemeroptera at all stations. Station 1 and Station 3 is the highest abundant record of

Ephemeroptera is on March. However, all station shows lessening of Ephemeroptera on May and only Station 3 shows increasing of Ephemeroptera on July and keep increase till August. Meanwhile, the most abundance of nine genus from five families found at Station 2 where *Cinygmima sp.* and *Potamanthellus sp.* are absent at Station 1 and Station 3. Figure 2 shows the most abundant genus found is *Nigrobaetis sp.* followed by *Crintitella sp.*, *Cincticostella sp.* and *Platybaetis sp.* respectively. The most Heptageniidae found is *Thalerosphyrus sp.* and the only Leptophlebiidae found is *Isca sp.* Figure 2 also shows the most abundant Ephemeroptera found were at Station 2 and Station 3. Figure 3 and 4 show the monthly pattern for each genus at each station. These results show different pattern of composition each genus at different station within six months.

In overall, May 2019 is the lowest abundant of Ephemeroptera at all station which is the end of dry season. According to [11], adults Ephemeroptera is abundant in wet season compared to dry season, where they also found high abundance of adult Ephemeroptera in May 2008 compared to April 2008 at tropical forest stream. This shows that, May is month for adult emergence. Therefore, it may be the factors for the composition of Ephemeroptera immature on those months is depleted. It is believed that the increase of temperature can influences the growth of immature Ephemeroptera [11, 12]. As mentioned by [12], higher diversity recorded in dry season. In Kelantan, months from March till May are considered dry season where March is the month after rainfall perturbation period for river ecosystems. Therefore, most of Ephemeroptera recorded highest in March and April 2018. However, the most noticeable different pattern of composition is for *Nigrobaetis sp.* The highest *Nigrobaetis sp.* found at Station 1 is in March, June at Station 2 and August at Station 3. Station 2 (April, June and August) and Station 3 (March, June and August) shows the three times peak composition of this genus compared to Station 1 only has two peaks composition (March and June). Station 3 has a more fluctuation pattern of composition compare to other station. The composition of all genus were decreasing from March till June except for *Isca sp.*, while the composition of *Crintitella sp.*, *Platybaetis sp.* and *Thalerosphyrus sp.* was increasing in July when other genus shows decreasing in their composition). In addition, the composition of *Nigrobaetis sp.* and *Cincticostella sp.* also found an increase in June while other compositions were decreased. However, the pattern shows the changes in peak abundance may change around one till three months interval duration. This shows most Ephemeroptera is easy to emerge into adult during end of dry season and start to increase once enter the wet season or while the rainfall occurs frequently. This supported by [13] as they concluded that temporal variation of aquatic insects abundance in lotic area influenced by regional climate seasonality, slope and substratum stability as its can influence the temperature, water discharge, river characteristics and substrates compositions. This indirectly can influence the compositions and distributions of immature Ephemeroptera as it can change the microhabitat formation in the river.

Table 1. Composition for each families and genus of Ephemeroptera within 6 months

Ephemeroptera (taxon) Station	Month																	
	March			April			May			June			July			August		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Ephemerellidae																		
<i>Cincticostella sp.</i>	16	9	51	6	53	7	0	0	1	0	0	12	0	3	9	3	18	14
<i>Crintitella sp.</i>	8	44	33	18	31	11	2	8	6	0	6	0	2	7	29	3	19	7
Baetidae																		
<i>Platybaetis sp.</i>	19	5	27	10	13	6	0	3	2	5	22	4	7	9	5	5	12	35
<i>Nigrobaetis sp.</i>	70	15	46	13	44	6	2	10	3	21	88	16	12	27	9	7	61	71
Heptageniidae																		
<i>Thalerosphyrus sp.</i>	7	4	9	5	1	1	0	0	1	6	0	0	0	1	3	0	4	0
<i>Cinygmima sp.</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Asionurus sp.</i>	5	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Neophemeridae																		

Ephemeroptera (taxon) Station	Month																	
	March			April			May			June			July			August		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Potamanthellus sp.	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leptobiilidae																		
<i>Isca sp.</i>	0	0	0	0	0	0	0	0	13	9	0	0	0	6	6	10	14	1
Total	127	81	173	53	144	34	5	23	29	42	118	35	22	55	64	29	131	131

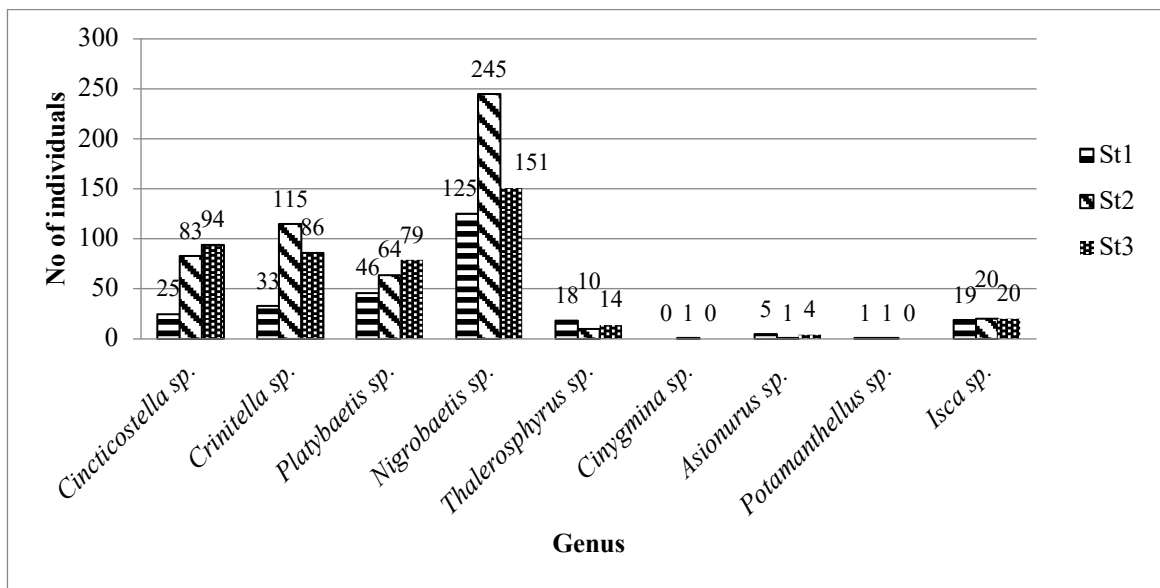


Figure 1. Genus of Ephemeroptera compositions for three study area

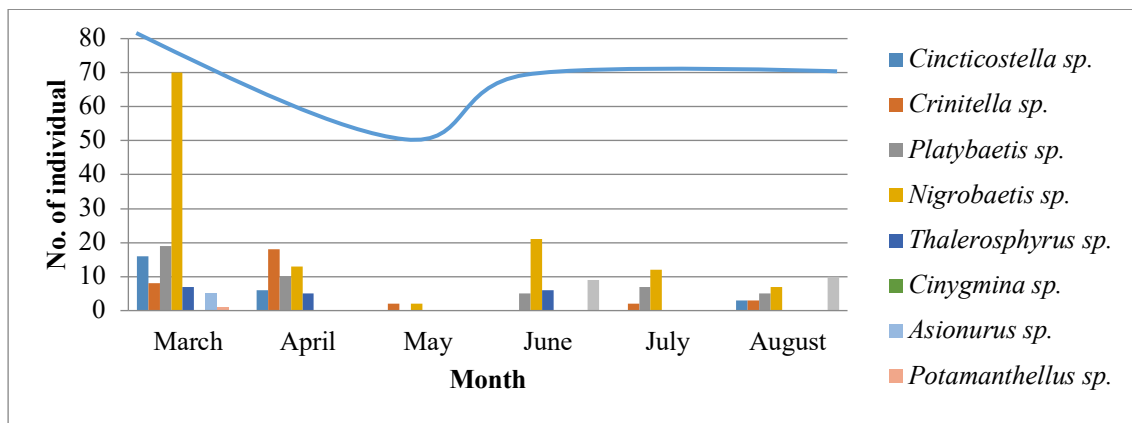


Figure 2. Monthly samples collection for genus at Station 1

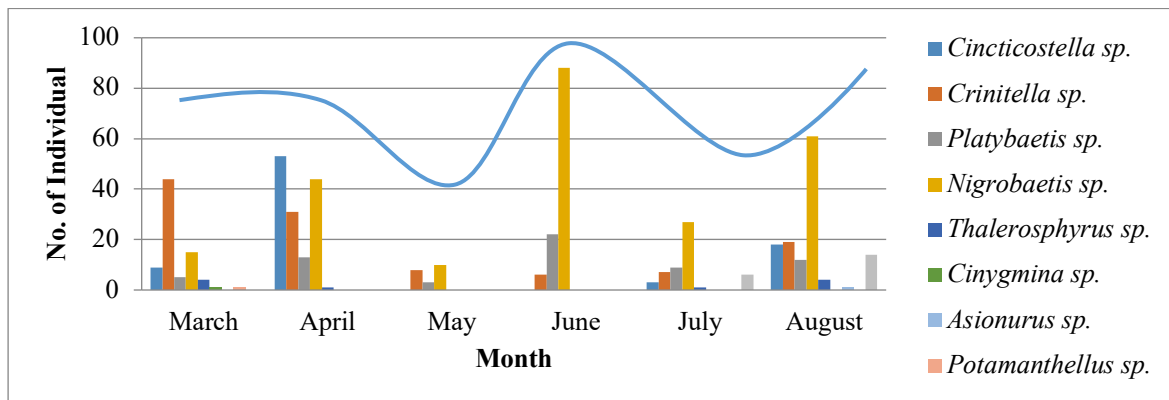


Figure 3. Monthly samples collection for genus at Station 2

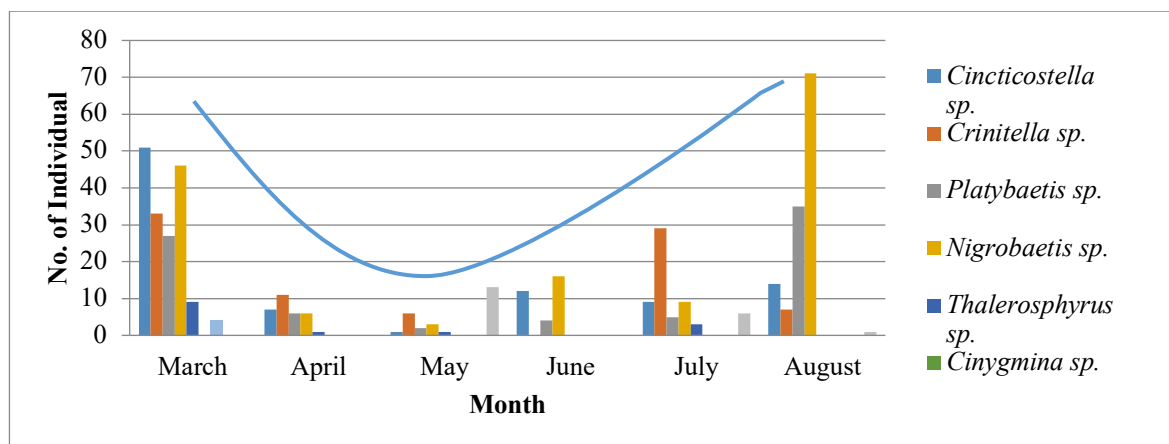


Figure 4. Monthly samples collection for genus at Station 3

4. Conclusion

In conclusion, the Ephemeroptera were starting to colonize the area after rainfall perturbation period (March) and start to decrease as the season getting dried that can lead them to be emergence as adult (May). They were also starting to increase its abundance on August 2018 which is after 3 months from dry season end. Therefore, further research can be carried out to ensure the effect of weather conditions on Ephemeroptera habitats and what their contribution in the ecosystem at Lata Janggut. Besides, the monthly abundance of Ephemeroptera shows that several genera have different monthly pattern appearance with different in month of abundance peak especially for *Cincticostella sp.*, *Crinitella sp.* and *Nigrobaetis sp.*. This shows the abundance of Ephemeroptera at Lata Janggut in overall can changes around one to three months in period.

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