VNU Journal of Science: Natural Sciences and Technology, Vol. 32, No. 1S (2016) 135-141

The Study on Species Composition of Mayflies (Insecta: Ephemeroptera) in Cao Bang Province

Nguyen Van Vinh*, Nguyen Thi Anh Nguyet,
Duong Van Cuong, Pham Van Phu

Faculty of Biology, VNU University of Science, VNU 334 Nguyen Trai, Thanh Xuan, Hanoi, Vietnam

Received 17 May 2016
Revised 15 August 2016; Accepted 09 September 2016

Abstract: A field survey on species composition of mayflies in Cao Bằng province was conducted in December 2013. From the survey, we have identified 53 mayfly species, belonging to 30 genera and 11 families. Dominant families included Heptageniidae, Baetidae, and Ephemerellidae with 13, 11 and 9 species, respectively. Other families, Caenidae, Ephemeridae, Leptophlebiidae, Teloganodidae, Potamanthidae, Neoephemeridae, Vietnamellidae, and Isonychidae, were found with 1-5 species each. The quantitative comparison of mayfly communities between riffle and pool habitats shown that the average number of species and the average number of individuals at riffle habitat were higher than pool habitat ($\alpha = 0.1$).

Keywords: Ephemeroptera, Insecta, Cao Bằng province, species composition.

1. Introduction

Mayflies (Ephemeroptera) are a group of paleopterous insects. They have been known as one of the most abundant aquatic insects. They spend most of their lives as larvae in freshwater environment, such as streams, rivers, ponds, lakes, and other artificial or temporary habitats. Cao Bằng is a province in the Northeast region of Vietnam. It is bounded by Hà Giang, Tuyên Quang, Bắc Kạn, and Lạng Sơn provinces of Vietnam and shares the border with China in the North. The topography of the province is mostly mountainous, with many rivers and waterfalls. Cao Bằng has a subtropical climate. The average temperature is 25-28°C in summer and 16-17°C in winter. Generally, natural condition in Cao Bằng province facilitates the development of mayflies. Therefore, the main goal of this survey was to provide a basic data of mayflies in this area.

2. Materials and methods

Materials used in this study were larvae of mayflies, which were collected in 13 different sites (S1-S13) in Cao Bằng province in December 2013 (Figure 1).

The quantitative samples of mayflies were taken by using the Surber net (50cm x 50cm), one sample for riffle and one for pool in each site. Qualitative samples were taken by using hand nets. Specimens were identified to species based on the available references, such as Nguyen (2003), Nguyen & Bae (2003, 2004, 2005) [1-6]. All the materials were preserved in 70% ethanol and deposited in the Department of Invertebrate Zoology, Faculty of Biology, Hanoi University of Science (Vietnam National University, Hanoi).

* Corresponding author. Tel.: 84- 4-38582795
Email: vinhnv@hus.edu.vn

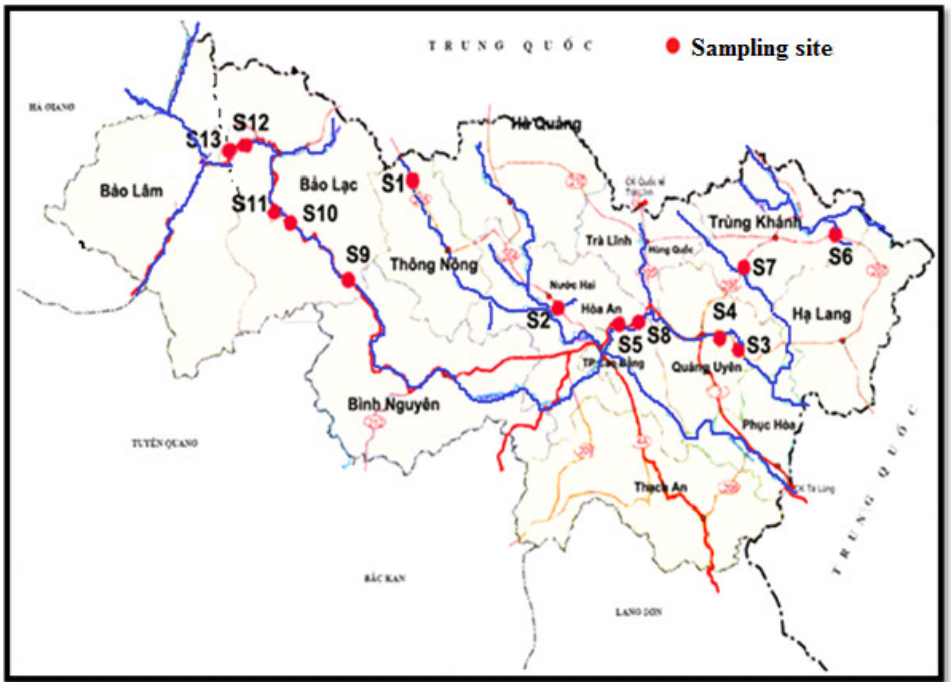

Figure 1. Sampling sites in Cao Bằng province.

3. Results

3.1. Species composition of Ephemeroptera in Cao Bằng

From the samples collected from Cao Bằng province, a total number of 53 species of mayflies, belonging to 30 genera and 11 families was identified. Among them, 39 species were determined to species. The taxonomic composition of mayflies in Cao Bằng is shown in Table 1.

In terms of species composition: in the studied area, the family Heptageniidae had the highest number of species with 13 species, accounted for 24.5% of total species number. The second richness family was Baetidae with 11 species, equal to 20.8% of total species number. The family Ephemerellidae was represented by nine species (19.4%), Caenidae was represented by five species (9.4%). The family Ephemeridae and Leptophlebiidae contained four species, each equal to 7.5% of total species number. Family Potamanthidae containedthree species (5.7%). The last four families: Teloganodidae, Isonychiidae, Vietnamellidae, and Neoephemeridae had the lowest number of species, each with only one species (1.9%) (Table 1).

In terms of generic composition: among 11 families found in the studied area, the family Heptageniidae had the highest number of genera with seven genera (accounting for 23.3% of total genus number). Two families, Ephemerellidae and Baetidae, each contained six genera, equal to 20.0% of total genus number. The families, Leptophlebiidae, Caenidae and Potamanthidae, each contained two genera (6.7%). The remaining families had the lowest number of genera, each with only one genus (3.3%) (Table 1).

3.2 Comparison of species and individual number of mayflies between riffle and pool habitats in main streams in Cao Bằng province

Along with qualitative samples to determining the presence of the species in the

studied area, we carried out quantitative samples in both riffle and pool habitats to investigate the distribution of mayflies according to the characteristics of the streams. Survey results are shown in Table 3.

As in Table 3, the number of mayfly species or individuals in riffle habitat was generally higher than that in pool habitat of the same sampling site. The exceptions were in sites S1, S2, S5 and S7, where the number of species in the riffle habitat was lower than that in pool habitat., and in sites S1, S2 and S7, where the number of individuals in riffle habitat was lower than that in pool habitat.

Overall, the average numbers of species in riffle habitat and pool habitat of 13 sites were 7.75 ± 2.38 and 4.75 ± 1.40 respectively, the average numbers of individuals were 71.67 ± 33.33 in riffle and 22.42 ± 8.08 in pool habitats. When using statistical means of spot-checking with $\alpha = 0.1$, we found that the differences in the average number of species and individuals between riffle habitat and pool habitat were statistically significant (t Stat > t Critical two-tailed test).

4. Conclusion

From the samples collected from Cao Bằng province, a total of 53 mayfly species, belonging to 30 genera and 11 families was identified. Among these 11 families, Heptageniidae was the richest family, with seven genera (23.3% of total genus number) and 13 species (24.5% of total species number).

The quantitative comparison between riffle and pool habitats shown that the average number of species and the average number of individuals in riffle habitat were higher than that in pool habitat with the statistics mean $\alpha = 0.1$.

Table 1. The taxonomic composition of mayflies in Cao Bằng province

No	Family	Genus		Species	
		Number of genera	Percentage (%)	Number of species	Percentage (%)
1	Baetidae	6	20.0	11	20.8
2	Caenidae	2	6.7	5	9.4
3	Ephemerellidae	6	20.0	9	17.0
4	Ephemeridae	1	3.3	4	7.5
5	Heptageniidae	7	23.3	13	24.5
6	Isonychidae	1	3.3	1	1.9
7	Leptophlebiidae	2	6.7	4	7.5
8	Neoephemeridae	1	3.3	1	1.9
9	Potamanthidae	2	6.7	3	5.7
10	Teloganodidae	1	3.3	1	1.9
11	Vietnamellidae	1	3.3	1	1.9
Total		30	100	53	100

The list of mayflies found in Cao Bằng province was presented in the Table 2 below.

Table 2. The species composition of mayfly in Cao Bằng province

No	Taxon
	I. Baetidae
1	*Acentrella* sp.1
2	*Acentrella* sp.2
3	*Baetis* sp.1
4	*Baetis* sp.2
5	*Baetis* sp.3
6	*Baetiella* sp.1
7	*Baetiella trispinata* Tong and Dudgeon, 2000
8	*Nigrobaetis* sp.2
9	*Platybaetis bishopi* Müller and Liebenau, 1980
10	*Platybaetis edmundsi* Müller and Liebenau, 1980
11	*Procloeon spinosum* Nguyen and Bae, 2006
	II. Caenidae
12	*Brachycercus* sp.1
13	*Caenis cornigera* Kang and Yang, 1994
14	*Caenis* sp.1
15	*Caenis* sp.2
16	*Caenis* sp.3
	III. Ephemerellidae
17	*Cincticostella gosei* (Allen, 1975)
18	*Cincticostella magnusa* Nguyen and Bae, 2013
19	*Cincticostella notata* Nguyen and Bae,2013
20	*Notacanthella perculta* (Allen, 1971)
21	*Epharacella commodema* (Allen, 1971)
22	*Hyrtanella grandipenis* Zhou, Su and Gui, 2000
23	*Torleya nepalica* (Allen and Edmunds, 1963)
24	*Teloganopsis jinghongensis* Xu, You and Hsu, 1984
25	*Teloganopsis oriens* Jacobus andMcCafferty, 2006
	IV. Ephemeridae
26	*Ephemera serica* Eaton, 1871
27	*Ephemera* sp.1
28	*Ephemera* sp.2

29	*Ephemera* sp.3
	V. Heptageniidae
30	*Afronurus mnong* Nguyen and Bae, 2003
31	*Afronurus meo* Nguyen and Bae, 2003
32	*Asinonurus primus* Braasch and Soldán, 1986
33	*Compsoneuria thienenmanni* Ulmer,1939
34	*Edyonurus cervina* Braasch and Soldán, 1984
35	*Epeorus bifurcatus* Braasch and Soldán, 1979
36	*Epeorus cariratus* Braasch and Soldán, 1984
37	*Edyonurus landai* Braasch and Soldán, 1984
38	*Epeorus tiberius* Braasch and Soldán, 1984
39	*Epeorus soldani* Nguyen and Bae, 2004
40	*Iron longitibus* Nguyen and Bae, 2004
41	*Iron martinus* Braasch and Soldán, 1984
42	*Thalerosphyrus vietnamensis* (Dang, 1967)
	VI. Isonychiidae
43	*Isonychia formosana* (Ulmer, 1912)
	VII. Leptophlebiidae
44	*Choroterpes proba* Ulmer, 1939
45	*Choroterpes trifurcata* Ulmer, 1939
46	*Choroterpes vittata* Nguyen and Bae, 2003
47	*Choroterpides major* Ulmer, 1939
	VIII. Neoephemeridae
48	*Potamanthellus unicutibius* Nguyen and Bae, 2004
	IX. Potamanthidae
49	*Potamanthodes formosus* Eaton, 1892
50	*Rhoenanthus* (*P.*) *magnificus* Ulmer, 1920
51	*Rhoenanthus* (*P.*) *obscurus* Navás, 1922
	X. Teloganodidae
52	*Teloganodes tristis* (Hagen, 1858)
	XI. Vietnamellidae
53	*Vietnamella thani* Tshernova, 1972

Table 3. The number of species and individuals in each sampling site

Sampling site	The number of species/0.25m^2		The number of individuals/0.25m^2	
	Riffle	Pool	Riffle	Pool
S1	6	7	15	27
S2	2	7	4	24
S3	13	2	217	6
S4	5	2	7	3
S5	8	11	46	31
S6	-	-	-	-
S7	0	2	0	19
S8	9	4	100	22
S9	7	5	76	19
S10	15	1	97	19
S11	16	7	151	26
S12	9	6	135	68
S13	3	3	12	5
Average	7.75±2.38	4.75±1.40	71.67±33.33	22.42±8.06

(Note: "-": quantitative samples not conducted)

Acknowledgments

This study is supported by Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 106.15-2012.69.

References

[1] V.V. Nguyen, Systematics of the Ephemeroptera of Vietnam, Ph.D. Thesis**,** Seoul Women's University, Korea (2003).

[2] V.V. Nguyen and Y.J. Bae, The mayfly family Leptophlebiidae (Ephemeroptera) from Vietnam,Ins. Koreana 20(3, 4) (2003) 453.

[3] V.V. Nguyen and Y.J. Bae, Biodiversity of Mayflies (Ephemeroptera) from Vietnam, Korean-Japan Join Conference on Applied Entomology and Zoology, Korean(2003) 105.

[4] V.V. Nguyen and Y. J. Bae, Larva of the Heptageniid Mayfly Genus Epeorus (Ephemeroptera: Heptageniidae) from Vietnam,J. Asia-Pacific Entomol7(1) (2004) 19.

[5] V.V. Nguyen and Y. J. Bae,Two Heptageniid Mayfly Species of Thalerosphyrus Eaton (Ephemeroptera: Heptageniidae) from Vietnam, The Korean Journal of Systematic Zoology 20 (2004) 215.

[6] V.V. Nguyen, Preliminary data on Ephemeroptera (Insecta) from Bavi National Park, Ha Tay Province, Proceeding of the 1st national workshop on Ecology and biological resource. Agricutural Publishing House (2005) 266.

Nghiên cứu thành phần loài bộ Phù du (Isecta: Ephemeroptera) ở tỉnh Cao Bằng

Nguyễn Văn Vịnh, Nguyễn Thị Ánh Nguyệt,
Dương Văn Cường, Phạm Văn Phú

Khoa Sinh học, Trường Đại học Khoa học Tự nhiên, Đại học Quốc gia Hà Nội,
334 Nguyễn Trãi, Thanh Xuân, Hà Nội, Việt Nam

Tóm tắt: Nghiên cứu thành phần loài bộ Phù du tại tỉnh Cao Bằng được thực hiện vào tháng 12 năm 2013. Kết quả đã xác định được 53 loài Phù du thuộc 30 giống, 11 họ. Trong đó các họ chiếm ưu thế là Heptageniidae, Baetidae và Ephemerellidae có số loài lần lượt là: 13, 11 và 9 loài. Các họ còn lại là: Caenidae, Ephemeridae, Leptophlebiidae, Teloganodidae, Potamanthidae, Neoephemeridae, Vietnamellidae, Isonychidae chỉ thu được từ 1-5 loài mỗi họ. Ngoài ra, kết quả so sánh định lượng giữa nơi nước chảy và nơi nước tĩnh cho thấy số lượng loài và số lượng cá thể trung bình của Phù du ở nơi chảy cao hơn so với nơi nước tĩnh, với mức ý nghĩa $\alpha = 0.1$.

Từ khóa: Phù du; côn trùng; tỉnh Cao Bằng; thành phần loài.