5-2018

Description and Diagnosis of Associated Larvae and Adults of Vietnamese and South Carolina Caddisflies (Trichoptera)

Madeline Sage Genco
Clemson University, maddiegenco@gmail.com

DESCRIPTION AND DIAGNOSIS OF ASSOCIATED LARVAE AND ADULTS OF VIETNAMESE AND SOUTH CAROLINA CADDISFLIES (TRICHOPTERA)

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Entomology

---

by
Madeline Sage Genco
May 2018

Accepted by:
Dr. John C. Morse, Committee Co-chair
Dr. Michael Caterino, Committee Co-chair
Dr. Kyle Barrett

ABSTRACT

Globally, only 868 trichopteran larvae have been described to enable species-level identification; that is only 0.05% of all caddisfly species. In the Oriental Region, almost none (0.016%) of the larvae are known. Continued work on describing larval species may improve the accuracy of water quality monitoring metrics. Genetic barcoding (with mtCOI) was used to associate unknown larvae with known or unknown adults. The morphology of the larvae was then described in words as well as in illustrations to aid species-level identification. Two new species also were described from adult males in the same manner.

DEDICATION

This text is dedicated to all girls and young women who are fascinated by “bugs” (and other things traditionally seen as unladylike) and all the wonderful men and women who encourage our enthusiasm and support us in our ambitions.

ACKNOWLEDGEMENTS

I would like to thank my parents and my brother for their unwavering love and support, and for instilling in me my love of science and the outdoors.

Dr. Jeff Heilveil, for introducing me to the world of aquatic entomology, and encouraging me to pursue graduate school. All of my fellow graduate students, lab-mates, and other professionals that lent me advice or helped with my field work, including C. Wrege, S. Muñoz, K. Murray, J. Xu, S. Qiu, L. Vasquez, A. Deczynski, Dr. M. Ferro, M. Green, Q. Lewis, Z. Burrington, Dr. X. Zhou, Dr. R. Holzenthal, T.M. Nguyễn, V.S. Mai, T.H.Y. Tô, V.H. Nguyễn, D.H Hugnh, Dr. T. Pham, and others.

I would like to thank my committee member, Dr. Kyle Barrett for his support and guidance, especially with consideration towards my career goals. My co-advisor Dr. Mike Caterino, for his support, guidance, and patience throughout the numerous office visits about molecular work and tree building questions.

Finally, thank you to Dr. John C. Morse, for your continued help and guidance. I feel blessed to have you as an advisor. You have gone above and beyond to help me reach my goals; from inviting me to Vietnam and helping me to collect, to correcting my spelling (I'm sorry), to advice about life, and everything in-between. You have strived to help me learn and become my best self. Thank you.

I would like to thank the Clemson University Entomology Faculty for awarding me the King Research Grant, which funded much of the molecular work, and the Nettles Grant which supported some of my travel to Vietnam and conferences.

PREFACE

This thesis "is not issued for public and permanent scientific record, or for the purposes of zoological nomenclature"; article 8.2 of the International Code of Zoological Nomenclature applies (ICZN 1999).

TABLE OF CONTENTS

Table of Contents (Continued)

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

There are 16,127 species of caddisflies (Morse personal communication 06 March 2018), making Trichoptera the 7th largest insect order with respect to species (Morse 2016). Globally, only 868 trichoperan larvae have been described to enable species level identification; that is only 0.05% of all caddisfly species. The greatest percentages of species known from larvae are those of the West Palearctic (Europe and Northern Africa) and the Nearctic (North America) Regions. However, the Oriental Region is the most speciose, as “it contains more than double the recorded species for each of the other regions, except the Neotropics” (de Moor & Ivanov 2008). According to the Trichoptera World Checklist there are now 5,788 trichopteran species known from the Oriental Region, yet larvae of only 91 (0.016%) of the species in that region of the world are known. In the southeastern United States there are 663 species of Trichoptera, yet of these, the larvae of only 309 (47%) have been described sufficiently to enable confident identification (Morse *et al.* 2017).

Aquatic insects and other freshwater macroinvertebrates are now commonly used as surrogates or sentinels to assess water quality in developed countries of the world and increasingly in developing countries (Morse *et al.* 2007). Because of their relative sensitivity to environmental change, Ephemeroptera, Plecoptera, and Trichoptera (EPT) are particularly important for use in water quality assessment and biomonitoring and can be informative about the health of the streams or rivers they inhabit (Lenat & Penrose 1996). Chemical tests may yield differing results based on fluctuation in environmental

conditions such as temperature and rainfall and so only show the instantaneous condition of the water at the moment a water sample is taken (Resh & Unzicker 1975). According to Miller 1988, pollution is any “Changes in the physical, chemical, or biological characteristics of water, air, or soil that can affect the health or activities of living organisms”. Unlike sporadic chemical tests, the long-lived biota in the stream are continuously, “sampling” it for harmful substances. Chemical tests can also be expensive compared to bioassesment, which requires fewer people and cheaper equipment. There are benefits to using aquatic macroinvertebrates over other organisms as well. Algae can also be used, but they are much more challenging than insects to identify to the genus or species level. Unlike fish, macroinvertebrates are very abundant, very diverse, relatively sedentary, and represent multiple trophic levels, thus reflecting more localized and cumulative effects of pollution in the water. Biological assessment using aquatic insects yields the best results when the species of the local area are known (Morse 2017).

Among Trichoptera, the family Hydropsychidae is especially common and with high species diversity in streams worldwide. Different genera of Hydropsychidae vary in their tolerance to pollution (Barbour *et al.* 1999). Within the Hydropsychidae, some genera, for example *Hydropsyche* have different tolerance levels among included species (Resh and Unzicker 1975). This is likely true for species of the large and ubiquitous genus *Cheumatopsyche* as well (J.C. Morse, personal communication). Because of the wide range of tolerance values reported among species in some genera, it has been suggested that species-level identifications may greatly improve water quality monitoring. “Of the 89 [North American] genera for which water quality tolerances have

been established for more than a single species, the competent species fell into different tolerance categories in 61 of the genera examined" (Resh & Unzicker 1975).

Resh & Unzicker (1975) and Morse *et al.* (2017) urged their readers to associate larvae and adults of aquatic insects and create diagnostic keys rather than continue to evaluate environmental impact using genus-level identifications. They argued that species-level identifications will greatly improve water quality assessments. In this thesis, it is my goal to associate yet-unidentified larvae of Trichoptera with their identifiable adults and to prepare illustrated morphological descriptions so that the newly described larvae will be identifiable to species. If successful, this could lead to future studies to assign tolerance values to the newly recognizable larval forms (e.g., Lenat 1993). Lenat's (1993) study included *Cheumatopsyche* only to the genus level, so that new species-level diagnoses for larvae of this genus in the southeastern United States could improve the precision of EPT and benthic macroinvertebrate studies and the use of these insects in water quality management in the United States.

Chapter 4 of <u>Larvae of Southeastern USA Mayfly, Stonefly, and Caddisfly Species</u> (Morse *et al.* 2017) includes a list of all the southeastern U.S. trichopteran species and indicates those with identifiable larvae, urging readers to associate yet-unknown caddisfly larvae with their adults. Morse *et al.* suggested three ways to do this: first by rearing the larvae, secondly by capture of mature pupae with their shed larval sclerites (metamorphotype method, Milne 1938), and thirdly by applying molecular techniques. Rearing can be time-consuming work and is often unsuccessful. Metamorphotypes of a given species are present for only a few days each year. Thus, I

used genetic barcoding to match undescribed caddisfly larvae with known and identifiable adults. Barcoding involves sequencing about 650 base pairs of the mitochondrial COI gene for each species. These sequences can then be compared to other sequences available in the data library, to show what species have the most similar sequences. The idea is that these "barcodes" can be used to match unidentified specimens with known species (Meier *et al*. 2006 and BOLD 2007). Neighbor-joining or phylogenetic analysis can be used to provide support to the associations. This technique has been used for Trichoptera with much success previously in Canada and the Smoky Mountains by Zhou *et al.* (2009, 2011) and Ruiter *et al.* (2013), and in China by Zhou *et al.* (2007) and Xu *et al.* (2017 and 2018). The phylogenetic methods of Caterino and Tishechkin (2006) on histerid beetle larvae were referenced in place of the neighbor-joining method used by the other authors. According to Huelsenbeck (1995), maximum likelihood analysis is more robust than neighbor-joining, it is more likely to "estimate the correct phylogeny even when the assumptions of the phylogenetic method are violated". This is especially important because "the idealized assumptions underlying phylogenetic methods are most likely violated with real data" (Huelsenbeck 1995).

The overriding question of this research was: How may the larvae of caddisflies be identified at the species level, making them more readily useful for ecological research and freshwater biomonitoring?

Hypothesis 1: Larvae and adults forming monophyletic groups belong to same species according to the Phylogenetic Species Concept (Eldridge & Cracraft 1980) that

is, the smallest aggregation of populations diagnosable by a unique combination of character states.

Null Hypothesis 1: Larvae and adults forming monophyletic groups are not the same species.

Hypothesis #1 is supported (and the null hypothesis rejected), if all trees (Parsimony, Maximum likelihood, and Bayesian) were similar, with the same larvae and adult specimens said to be the same species comprising a monophyletic group on all trees, and the larvae are nested within the adults or with less than 2% sequence difference from them. This 2% cut off was determined by comparing interspecific and intraspecific sequence percent differences between adult *Cheumatopsyche* species I collected as well as *Cheumatopsyche* sequences used from BOLD, but excluding *C. hardwoodi* and *C. enigma* as these seemed to be outliers, and I am not convinced that the species boundary for them is well defined.

Hypothesis 2: Larvae of the same species have objectively describable shared morphological characters distinct from similar or closely related species.

Null Hypothesis 2: Larvae of the same species are morphologically cryptic to other species.

Hypothesis 2 is supported (and the null hypothesis rejected) if for each larva of a given associated species, a hypothesized a set of diagnostic morphological characters consistently appears in each additional associated larva and consistently does not appear in larvae of similar and closely related species. Details of specific hypotheses and objective criteria for the character analyses are provided below under "Describing Newly

Associated Larvae”. If supported, Hypothesis #2 also gives additional support for Hypothesis #1; however, if species are cryptic and undiagnosible morphologically, Hypothesis #1 may still be supported.

First, I focused on species of the genus *Cheumatopsyche*, especially targeting those found in North and South Carolina. I chose to target this genus because it is fairly common, easy to find, and also has many species with undescribed larvae. Morse *et al.*’s (2017) list of southeastern U.S. Trichoptera includes 32 species of *Cheumatopsyche*—22 of these are found in North and/or South Carolina, but larvae of 11 (50%) of them have not been described. Many of those have been described only tentatively in morphotype groups, possibly containing multiple species. The only previous phylogenetic trees inferred that specifically focused on *Cheumatopsyche* were completed by Gordon (1974, based on adult morphology) and Burington (2011, based on morphology of larvae of a few species). In his work, Burington (2011) hypothesized several morphotypes, which Morse *et al.* (2017) incorporated into their book. I have referenced these works in order to hypothesize characters for the species I’ve associated.

Labs such as that of Dr. Zhou Xin in China are actively describing more of these species with the hope of building water quality monitoring programs similar to those here in the United States and other developed countries. However, other countries in the region are just starting to identify their fauna. Dr. Thai Pham of the Vietnam National Museum of Nature invited Dr. Morse and his laboratory to come to Vietnam in order to teach others how to collect and identify caddisflies. Of course, I accepted. If the

Vietnamese can learn to identify their local fauna, they hope to use this information in the future to begin their own water quality program.

In this study I have associated two Vietnamese larvae with two new species, one in the genus *Drepanocentron* (Xiphocentronidae) and one in *Hydromanicus* (Hydropsychidae). There are 41 species of *Drepanocentron* globally, all are from the Oriental Region; this study includes the first larval description for any species of the genus. There are 71 *Hydromanicus* species globally, 70 from the Oriental Region, of which the larvae of only 5 species were previously known.

In biomonitoring studies, it is common for habitat information and some water quality data to be taken along with the benthic macroinvertebrate samples. The Environmental Protection Agency (EPA) recommended gathering physical/chemical habitat data as part of their Benthic Macroinvertebrate Sampling Protocol, and stated, "an evaluation of habitat quality is critical to any assessment of ecological integrity and should be performed at each site at the time of the biological sampling" (Barbour *et al.*1999). The North Carolina Department of Environmental and Natural Resources also includes physical and chemical habitat data in their "Standard Operating Procedures for Benthic Macroinvertebrates Biological Assessment Unit." Thus, habitat assessment methods were adapted from Barbour *et al.* (1999) and used in conjunction with my collection of caddisflies in the USA.

CHAPTER TWO

METHODS

Sampling

A rite-in-the-rain® field notebook was used for taking notes in the field. For each stream, sampled data gathered was based on EPA Habitat Assessment and Water Quality Protocols. The "Physical Characterization/Water Quality Field Data Sheet" (Appendix A-1 form 1, Barbour *et al.*) was completed for each site. This includes data such as date, start time of sampling, names of all collectors, GPS coordinates of sampling site, detailed description of the site and sampled habitats, weather conditions, and other general ecological observations. Upstream and downstream photographs were taken at each site. For sampling sites in the United States, an *in-situ* water quality meter (YSI®) was used to obtain the water temperature, specific conductance, dissolved oxygen, and pH. The YSI was not used for Vietnamese Collecting sites; I did not bring the probe because I could not easily calibrate it overseas without access to a lab and was unable to transport the equipment and calibration fluids from the USA. State, County, town, nearest road intersection, and GPS coordinates were also be recorded (though not on the EPA's data sheet). The "Habitat Assessment Field Data Sheet" (Appendix A-1 forms 2 and 3, Barbour *et al.*) was also completed in order to gain a more detailed description and evaluation of habitat type, yielding a numerical rating corresponding to poor, marginal, suboptimal, and optimal.

A separate laboratory notebook was kept for the molecular work, descriptions, general notes, and as a diary of daily tasks performed. Larvae were collected using D-

frame dip nets, kick screens, and by examining rocks and debris. Adults were collected in battery-operated light traps consisting of a BioQuip black light tube laid over a shallow white pan filled with 95–100% ethanol. Light traps were operated starting approximately 20 minutes after sunset and ran for at least 1 hour or until the number of incoming insect specimens declined. Larvae and adults were preserved in the field in 95–100% ethanol.

Adult males and females were identified to species when possible; clearing the genitalia with lactic acid was often necessary for proper identification, using methods modified from those of Blahnik & Holzenthal (2004) and Blahnik *et al.* (2007). Female abdomens were cleared via the extraction process described below. If males were difficult to identify, or thought to be a new species, abdomens were cleared by submerging in 85% lactic acid at room temperature for several days until clear or by heating the lactic acid in a bath of glycerin for about 30 minutes. Lactic acid was chosen because it often causes the phallus to evert, aiding description and, unlike potassium hydroxide (KOH) is unlikely to overclear the cuticle (Blahnik *et al.* 2007). United States adult hydropsychid specimens were first sorted to morphotype and then to family or genus using a variety of sources (Schmid 1998, Ross 1944, and Wiggins *&* Currie 2008). Then *Cheumatopsyche* specimens were identified to species using the work by Gordon (1974). Vietnamese adult specimens were identified using the atlas by Malicky (2010) and primary literature published since 2010. The Trichoptera World Checklist was referenced to ensure that the names used are still valid, not synonyms. Larvae were identified to genus; for United States specimens the keys by Morse *&* Holzenthal (2008)

or Morse *et al.* (2017) were used; for Vietnamese specimens the reference by Morse *et al.* (1994) was used.

All specimens were sorted into glass screwcap vials. All United States specimens were databased with unique identification numbers and stored as vouchers in the Clemson University Arthropod Collection after completion of the project. Vietnamese specimens were vouchered and representatives will be returned to the Vietnam National Museum of Nature. Each voucher label is marked with the DNA extraction number. Only specimens included in this thesis and those for which I attempted to extract DNA were vouchered, not all specimens collected.

Molecular work

Representative adults of each species collected were barcoded using mtCOI. Larvae from each site collected were barcoded due to the assumed high likelihood that they could be the same species as adults collected at the same location. Even if the North American specimens were of a species that was tentatively known from (Morse *et al.* table 4), they were barcoded because many of these larval descriptions were poorly recorded or only tentatively identified, or multiple species were assigned to a morphotype group such that individual species were not sufficiently distinguished to separate them from others in the group. An excel spreadsheet was maintained to keep track of individual specimens and the steps in the molecular sequencing and analysis process that have been completed for each. Each specimen received a unique extraction number. Initials MG were used to indicate North or South Carolina specimens; VN indicates Vietnam, and JCM indicated the specimen was from John C. Morse. Throughout this

study I use the same extraction numbers to refer to specific specimens. These unique PCR numbers were also assigned because some extractions were run multiple times using different PCR methods in order to successfully amplify DNA.

Each extraction was performed using a body part from each specimen. For adult females the entire abdomen was used, as the extraction process conveniently cleared the genitalia, aiding identification. For most adult male specimens, only a leg was used for extraction, and broken in two places to expose muscle tissue. For large larval specimens the insect was cut in half between the thorax and abdomen, the anterior half was used for extraction. For very small adult and larval specimens the entire body was used for extraction. Dissections were performed under a dissecting microscope on a watch glass sterilized with 10% bleach between each specimen, or on sterile parafilm. Forceps were sterilized between each dissection with a flame, or by dipping them in 10% bleach, followed by deionized water, and then 95% ethanol. Dissected parts to be used in extraction were set on paper towels or Kimwipes® for a few minutes to dry before being placed into 1.5 mL centrifuge tubes. Initially a few samples were put into tubes while still wet and dried using a centrifuge for about 15 minutes or until dry; however, the paper towel method was more time efficient and used for the majority of samples.

Extraction protocols were modified from instructions provided in the Thermo Scientific® extraction kit. All reagents except ethanol and water were included in the kit. 180 µL of digestion solution and 20µL of proteinase K solution were added to each centrifuge tube and then mixed with a vortex mixer and placed into a water bath at 56°C. Samples were vortexed and spun with a mini centrifuge (to remove sample stuck to the

lid of the tubes) once or twice over the course of an hour and then left in the bath overnight. The next day 200 µL of Lysis solution was added to each tube vortexed for 15 seconds and then spun. Lysis solution (200 µL) was added to each tube, and then vortexed for 15 seconds and spun. Ethanol (400 µL of 50% ethanol) was added, vortexed, and spun again. Prepared lysate was transferred to filtered spin columns inserted into collection tubes. Spin columns were centrifuged for 1 minute at 6000 x g. The collection tubes were replaced with clean tubes. Wash buffer I (500 µL) was added to each column and centrifuged for 1 minute at 8000 x g. Liquid collected in the tube was discard and the tube placed back on the column. Wash buffer II (500 µL) was added to each column, and centrifuged for 3 minutes at greater than 12,000 x g. Collection tubes and liquid were discarded. Columns were placed into clean 1.5 mL centrifuge tubes, 200 µL of elution buffer was added to each column and allowed to incubate at room temperature for 2 minutes, then centrifuged for 1 minute at 8,000 x g. Purified DNA was used immediately, or stored in the freezer. Amputated body parts were placed in a 0.2 mL microcentrifuge tube, and placed back in the same vouchered specimen vial as the body.

A 25µL polymerase chain reaction (PCR) was conducted following extraction to amplify the DNA. An excel spreadsheet and PCR Form was created for each extraction to record the exact quantities used in the master mix for each specimen, as well as a unique extraction number associated with each specimen, and a unique PCR number associated with a specific extraction. The universal mtCOI primers (LC01490 and HC02198) were used for all PCRs. All master mix reagents (except taq) were thawed, vortexed, spun, and added to the master mix. Taq was then added and mixed into the master mix by pipetting

up and down. Initially Thermo Scientific's Platinum™ Taq DNA Polymerase was used in the master mix. Later I used Thermo Scientific's DreamTaq DNA Polymerase as a cheaper alternative. The master mix was adjusted in order to accommodate the suggested reagent amounts to go with each taq; other minor adjustments were made to the master mix to find what amounts provided the most successful results. Generally, I found the master mix formula shown in Table 1 to be most successful, (although I did not optimize this exhaustively). Tubes of sizes 0.5 mL or 0.2 mL were used for PCR; 24 µL of master mix was added to each tube, along with 1 µL of DNA.

Table 1. Master mix reagent quantities used for most PCRs run.

Master Mix Reagent	**Amount per Tube**
H_20	16.75 µL
Taq buffer	2.5 µL
dNTP mix	2.5 µL
Mg+	0 µL
Primer 1 (LC01490)	1 µL
Primer 2 (HC02198)	1 µL
Dream Taq	0.25 µL

Tubes were put into an Eppendorf Master® cycler nexus gradient PCR machine, and run using the parameters shown in Table 2.

Table 2. PCR Parameters used throughout study.

	Temp.	**Seconds**
Init.Den.	95	180
Denat.	94	30
Anneal	50	30
Extend	72	45
Final ext.	72	180
Cycles:	35	

Gel electrophoresis was conducted in order to determine if PCR was successful. Gel was made by mixing 0.45 g of agarose with 40 mL of 1XTBE buffer in an Erlenmeyer flask and microwaving for 30 seconds, swirling to mix, and then microwaving an additional 30 seconds or until all granules were dissolved into solution. When the microwave broke for a short period of time a hot plate was used. After the flask was cool enough to be touched, 1.5 µL of Thermo Scientific's SYBR Safe DNA gel stain was added and swirled into the mixture. Gel rig, tray, and combs were used to set the gel, gel was allowed to cool and solidify for 20 minutes or until firm. Samples were prepared on clean Parafilm® with 1.5 µL of loading dye and 3 µL of PCR product. Electrophoresis was run at 120–140 V for 40 minutes or until bands were about ¾ of the way through the gel. Gels were visualized under ultraviolet light using a VWR UV Transilluminator Gel Imager®. Photos were taken of each gel, and stapled into the laboratory notebook along with the corresponding PCR form.

PCR product from 82 specimens was sent to Macrogen USA (Rockville, MD) to obtain mitochondrial COI sequences. All sequences obtained will be uploaded to BOLD.

Describing Newly Associated Larvae

For each newly associated larva, I observed and hypothesized a set of morphological character states to distinguish each species from its congeners. Each character state must be distinct for its respective species, without intermediates. Larvae were compared to other larvae in this study, as well as to larval forms described in the literature.

After character analyses identified reliable diagnostic characters for a species, verbal and graphic descriptions of these characters were prepared. I chose to use illustrations instead of photographs for several reasons outlined by Holzenthal (2008): (1) The act of drawing helps the illustrator understand the morphology. (2) It allows the illustrator to choose to focus on diagnostically important characters, possibly preventing the viewer from seeing the wrong character in the image. (3) If specimens are damaged, the illustrator can use them to make a single composite image of a "perfect" specimen. Illustrations were created using methods modified from those of Holzenthal (2008), Holzenthal 2015, and Genco & Morse 2017, "Pencil templates for illustrations were prepared using a gridded eyepiece in a Wild® M5D (Wild Heerbrugg, Switzerland) dissecting microscope. Final drawings were prepared with Abode Illustrator® (versionCC2015; Adobe Systems, San Jose, California) and Adobe Photoshop® (version CC 2015; Adobe Systems)". For very small specimens a doubler objective and 20X eyepieces were also used.

Alternatively, for some illustrations a photograph was taken through a microscope lens using a smart phone camera, and then used as a template in Adobe Illustrator. The

specimen was maintained under the microscope for comparison while drawing. Setal brushes created for use in Illustrator by Dr. Ralph Holzenthal were used. For lateral drawings, as per convention in trichopterology, the left side was used for genitalia; the right side was used for all other structures unless it was damaged, in which case the opposite side was used and then the drawing was reflected in Adobe Illustrater® to show the conventional orientation.

Tree Building

Forward and reverse sequences for each specimen were aligned using Clustal Omega® (Sievers *et al*. 2011) to check that they were in agreement. Sequences from each primer were combined and checked/edited by hand in Geneious®. Each aligned sequence was put into a Nexus file using Microsoft Notepad (a simple text editor) along with its species name and the extraction number used to identify the exact specimen, and an "A" to indicate an adult specimen, "L" for a larva, "M" for male, and "F" for female. Two larval sequences did not align well; I used BLAST (Madden 2002) to compare these to other sequences available online. Finding that they matched with algae, likely representing contamination from the gut contents, these two sequences were removed from the analyses.

Outgroups from the Barcode of Life Database (BOLD) were added to the Nexus file and aligned with the rest of the sequences by hand. Process identifications were included (with the hyphen removed from before the last two digits) so that the exact sequences can be traced back to BOLD.

Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) j-model comparison tests (version 2.1.9) were run to choose the model that best fits the data and includes only necessary parameters. For both tests, the most complex model (GTR+I+G) was selected as the best fit.

Maximum Parsimony analysis was run with PAUP 4.0® (Swofford 2002), using random starting trees and 1000 replicates, and for branch swapping saving no more than 1000 trees for each replicate. The trees were rooted using *Rhyacophila* Pictet 1834, because Rhyacophilidae is sister to the rest of Trichoptera (Malm *et al.* 2013). The resulting trees were used to create a 50% majority rule consensus tree in PAUP (Fig. 1).

Maximum Likelihood analysis was performed in RAxML version 8.2.9 (Stamatakis 2014), using Mesquite's Zephyr package (Maddison and Maddison 2015). I used100 search replicates and 1000 bootstrap replicates were conducted to test congruence for the phylogenetic inference. The trees were rooted using *Rhyacophila*. The resulting trees were used to create a 50% majority rule consensus tree in Mesquite® (Fig. 2).

To create the trees using Bayesian analysis, the Nexus file was opened using Mesquite (Maddison and Maddison 2015) and exported for MrBayes . This file was then uploaded to MrBayes (http://mrbayes.sourceforge.net/) where the Bayesian analysis was run twice to ensure the best topology had been reached. The resulting trees were then opened using PAUP 4.0 (Swofford 2002). Trees were rooted with *Rhyacophila*. A majority rules consensus tree was created using only the post-burn-in trees (the first 25% of trees were discarded). Number of generations was 10,000,000. Sample frequency was

1,000. Number of chains was 4. A phylogram was created for using this consensus tree (also using PAUP®) (Fig. 3). This tree was edited using FigTree v1.4.3 to show posterior probabilities and increase text size and condense branches I don't discuss in this thesis. Illustrator® was used to adjust the placement of the posterior probabilities so that they do not overlap visually with the taxon names, to add color to some groups to aid discussion, and to make other minor adjustments.

CHAPTER THREE

RESULTS

Vietnamese Trichoptera

I attempted to extract DNA from 125 specimens from Vietnam, including at least 26 species. Of these, I was able to successfully extract and replicate DNA from 54 specimens. For 49 of these I was able to obtain mtCOI sequences, including at least 10 of those species.

The three majority rule consensus trees (from parsimony, maximum likelihood, and Bayesian analyses, respectively Figs. 1–3) are similar. Larvae and adults of the following Vietnamese species were each monophyletic on all 3 consensus trees. Specific specimens are referred to by their extraction numbers or BOLD process ID. If larvae are nested within a group of adults it is considered to be the same species. If larvae is sister to the rest of the monophyletic group, and has short branch lengths, it is considered the same species only if the sequence is less than or equal to 2% different from that of the adults.

- *Drepanocentron* n. sp.: 4 adult males and 3 larvae form a monophyletic group, with all of their sequences less than 0.16% different from each other, thus my data support the hypothesis that they are the same species. Adult male and larva are described below (Figs. 4 and 5). The larva was described from only two specimens as one specimen (corresponding to extraction number VN67) was destroyed during extraction. This is the first larva described in the genus, so I cannot compare it to other *Drapanocentron* species, to test characters or determine if it is or is not cryptic

with other more closely related species. However, I do provide characters to separate it from other larvae in the same family. (Fig. 3, orange).

- *Pseudoleptonema quinquefasciatum*: 4 adult males and 4 larvae formed a monophyletic group, with all sequences less than or equal to 0.312% different from each other, thus my data support the hypothesis that these larvae and adults are the same species. An adult male from BOLD (BHMKK141-12) is sister to these, but with a longer branch length in the phylogram created from the Bayesian analysis (Fig. 3). BHMKK141-12 is about 8% different from the rest of the monophyletic group. This could be due genetic differences of different populations, or possibly my specimens are a separate but closely related cryptic species. The adult and larval morphology of *P. quinquefasciatum* is already described, the morphology of BHMKK141-12 would need to be evaluated to determine if these are separate cryptic species. (Fig. 3, light green).
- *Pseudoneureclipsis* sp.: 3 larval specimens matched with 2 specimens from BOLD, one of *P. ramosa* Ulmer 1913 and one of *P. abia* Malicky & Chantaramongkol 1993. Two other specimens of *P. ramosa* from BOLD were included in the analysis, they came out in a different part of the tree, sister to the other *Pseudoneuoclipsis* specimens. Likely one of the two specimens from BOLD (KJTRI15213 or BHMKK12312) was identified incorrectly, but this can only be confirmed upon inspection of these specimens. Thus description of the larval species is not included here, and character testing was not conducted. However, the sequences of KJTRI15213 and BHMKK12312t are only 0.15% different, and the larvae that are

part of the same monophyletic group are only 0.15% to 0.31% different from these adults. Thus my data support the hypothesis that these larvae and adults are the same species. (Fig. 3, red).

- *Hydromanicus* n. sp: 3 adult males formed a monophyletic group with 4 larvae. Larval sequences are all between 0% and 0.15% different from adult sequences, thus my data support the hypothesis that they are the same species. My data tentatively reject the hypothesis that the species is cryptic with known *Hydromanicus* species. However, because there are only 6 oriental species for which the larvae have been described in the genus, I cannot compare to all possible *Hydromanicus* larval forms, and cannot eliminate the possibility that other undescribed larvae in the genus are cryptic with this larval form. Adult male and larva are described below (Figs. 6 and 7). One additional larva (VN120) appeared sister to the rest, with a longer branch length in the phylogram; its sequence is 16% to 17% different from the rest. The data suggest it is a different species in the same genus. (Fig. 3, dark green).

Cheumatopsyche of North and South Carolina

I attempted to extract DNA from 110 specimens of *Cheumatopsyche* comprising 8 species. Of these, I was able to successfully amplify DNA from 31 specimens, including 7 of the 8 species. I was able to obtain mtCOI sequences for 28 of these specimens.

Of the *Cheumatopsyche* specimens collected in North and South Carolina, I had several form monophyletic groups (listed below) consistent on all 3 consensus trees (Figs. 1–3). If larvae are nested within a group of identified adults it is considered to be the same species. If larvae are sister to the rest of the monophyletic group, and have short

branch lengths, it is considered the same species only if the sequence is less than or equal to 2% different from that of the adults.

- *C. enigma* Ross *et al.* 1971: 5 larvae (including one from BOLD) are monophyletic with 1 adult female plus 4 other adult specimens from BOLD. All sequences were less than 0.7% different, therefore my data support the hypothesis that these are the same species. (Fig. 3, brown)
- *C. harwoodi* Denning, 1948: 3 larvae are monophyletic with 2 adult females. These are sister to *C. enigma* in all the trees, with very short branch lengths in the phylogram (Fig. 3) and sequence differences between the two groups are less than 2%, thus my data support the hypothesis that these larvae and adults are the same species. However, all *C. harwoodi* added from BOLD came out monophyletic with each other, but not with my specimens of *C. harwoodi* and *C. enigma,* sequence differences between the two monophyletic groups up to 12%. I hypothesize that the specimens I identified as *C. harwoodi* are actually different morphotype of *C. enigma*, or a subspecies, or a hybrid between the two. (Fig. 3, blue).
- *C. pinaca* Ross, 1941: 1 larva, 6 adult females, and 1 adult male from BOLD form a monophyletic group, with all sequence differences less than 0.13%. Therefore, my data support the hypothesis that larvae and adults are the same species. (Fig. 3, pink). This larvae (MG65) is described and illustrated here without diagnosis (Fig 9).
- *C. oxa* Ross, 1938: 1 larva is monophyletic with 4 adult females, and 1 adult male. All *C. oxa* from BOLD appeared as 1 monophyletic group sister to the *C. oxa* I collected, forming one large monophyletic group, with very short branch lengths

separating the two groups. Sequence differences between all of these are about 2% or less possibly suggesting that they are likely the same species, just collected from multiple populations. (Fig. 3, purple). The larva of this species has never before been described in the literature, specimen VN20 is described and illustrated here without diagnosis (Fig. 8).

I have spent many hours looking for characters to separate the larval forms associated in my tree from each other and I have not yet found characters that can consistently separate them. I have focused on the frontoclypeus because several sources in the literature emphasize its use, such as MacKay (1978), Smith (1984), and Burington (2011). So far I have only compared these larvae to others from within this study, and to voucher specimens from Burington's thesis (2011). When attempting to use Burington's key to larval *Chumatopsyche* (as published in Morse *et al.* 2017) I have found the frontoclypeal notch to exhibit sufficient intraspecific variation in my known specimens to make Morse's couplet 72 (shown verbatim below) impossible to consistently apply.

72(69') Frontoclypeal notch shallow and narrow, with annuli of most-medial, brush-like setae (Fig. 4.223) at or posterior to level of notch (Fig. 4.224); pronotal margin with long, hair-like setae (Fig. 4.227); widespread, including all southeastern states (see also Elkins 1936) .... Morphotype D

(probably Cheumatopsyche analis, C. harwoodi, C. enigma, or C. richardsoni)

72’ Frontoclypeal notch deep and square, rounded or acute, with annuli of most-medial, brush-like setae anterior to base of notch (Figs. 4.225, 4.226, 4.228); pronotal margin with or without long, hair-like setae...73

When viewing Burington’s vouchers of Morphotypes D and G under a compound microscope to better see the frontoclypeus and annuli, the difference between 72 and 72’ was slight at best. When using this key some of my *C. enigma* specimens keyed to Morphotype D and some to G, indicating that this character does not hold up to species boundaries. I also key *C. pinaca* to Morphotype D, even though Burington listed it as morphotype G. I have revised his key below to remove the original couplet 72, and to combine morphotypes D and G. The characters Burington used to describe Morphotypes E and F are distinct enough that they are not affected by this revision. My vouchers *of C. oxa, C. pinaca, C. enigma,* and *C. harwoodi* are all encompassed by Morphotype D/G. Thus, my data tentatively fail to reject null hypothesis 2, and support the hypothesis that at least some larvae of *Cheumatopsyche* species may be morphologically cryptic with each other. Future evaluation of the setae viewed with cleared and slide mounted specimens as described by Schefter & Wiggins (1987) and Mackay (1978) may add momentum to the character search. Burington (pers. comm.) also suggested I try evaluating the anal prolegs, and other characters not as well discussed in the literature for this group. I am hopeful that given more time that a closer inspection of morphology of these larvae may yield characters to separate them.

KEY TO THE LARVE OF *CHEUMATOPSYCHE* OF THE SE UNITED STATES

Revised from Burington 2011 in Morse *et al.* 2017. The notation 'fig.', with a lowercase 'f ', indicates an original figure, Fig.' with a capital 'F' indicates an illustration provided in this Master's Thesis.

69(68')Frontoclypeus lacking notch, such that marginal brush-like setae (fig. 4.216) and scallops uninterrupted between primary head setae 3 (fig. 4.217) 70

69' Frontoclypeus with notch, such that marginal brush-like setae and scallops interrupted medially on frontoclypeal margin (fig. 4.218) 72

70(69) At least some abdominal microspines greater than 15 µm in length (fig. 4.219) 71

70' All abdominal microspines less than 15 µm in length (fig. 4.220); MB & ND to ME & QC, south to OK & AR and **AL**, **FL**, **GA**, **KY**, **NC**, **SC**, **TN**............ .... **Morphotype A (probably *Cheumatopsyche minuscula*)**

71(70) Pronotal margin with long, hair-like setae (fig. 4.221) longer than ¼ length of pronotum; NJ to LA, and **AL**, **FL**, **GA**, **MS**, **NC**, **SC** .... **Morphotype B (probably *Cheumatopsyche virginica*)**

71' Pronotal margin with short, hair-like setae (fig. 4.222) shorter than ¼ length of pronotum; MB to NB & QC, south to TX, LA and **AL**, **GA**, **MS**, **NC**, **SC**................................**Morphotype C (probably *Cheumatopsyche sordida*)**

72(69') Frontoclypeal notch various, but usually as in fig. 4.226, with concave posterior margin of notch; prosternum with 2 pairs of detached sclerites, 1 large and 1 minute (fig. 4.229); VA and **GA, NC, SC, TN**. ....**Morphotype E (probably *Cheumatopsyche etrona*)**

72' Frontoclypeal notch variable, similar to figs. 4.224, 4.225, or 4.228; prosternum with single pair of detached, minute sclerites (fig. 4.230)....................................73

73(73')Frontoclypeal notch with sides at acute angle with base, the most medial scallops overhanging the notch (fig. 4.228); mesonotal and metanotal anterior margins with crochet-like setae (fig. 4.231); **AL, FL, GA, SC** ....**Morphotype F** (**probably *Cheumatopsyche edista***)

73' Frontoclypeal notch with base and sides not at acute angles (similar to figs 4.225 or 4.224), never overhanging notch (fig. 4.225); mesonotal and metanotal anterior margins with short, hair-like setae (fig. 4.232); widespread, including **all southeastern states**. .... **Morphotype D/G (probably including: *C. campyla, C. pinaca* [Fig. 9] , *C. analis, C. harwoodi, C. enigma, C. richardsoni,* and *C. oxa* [Fig. 8])**

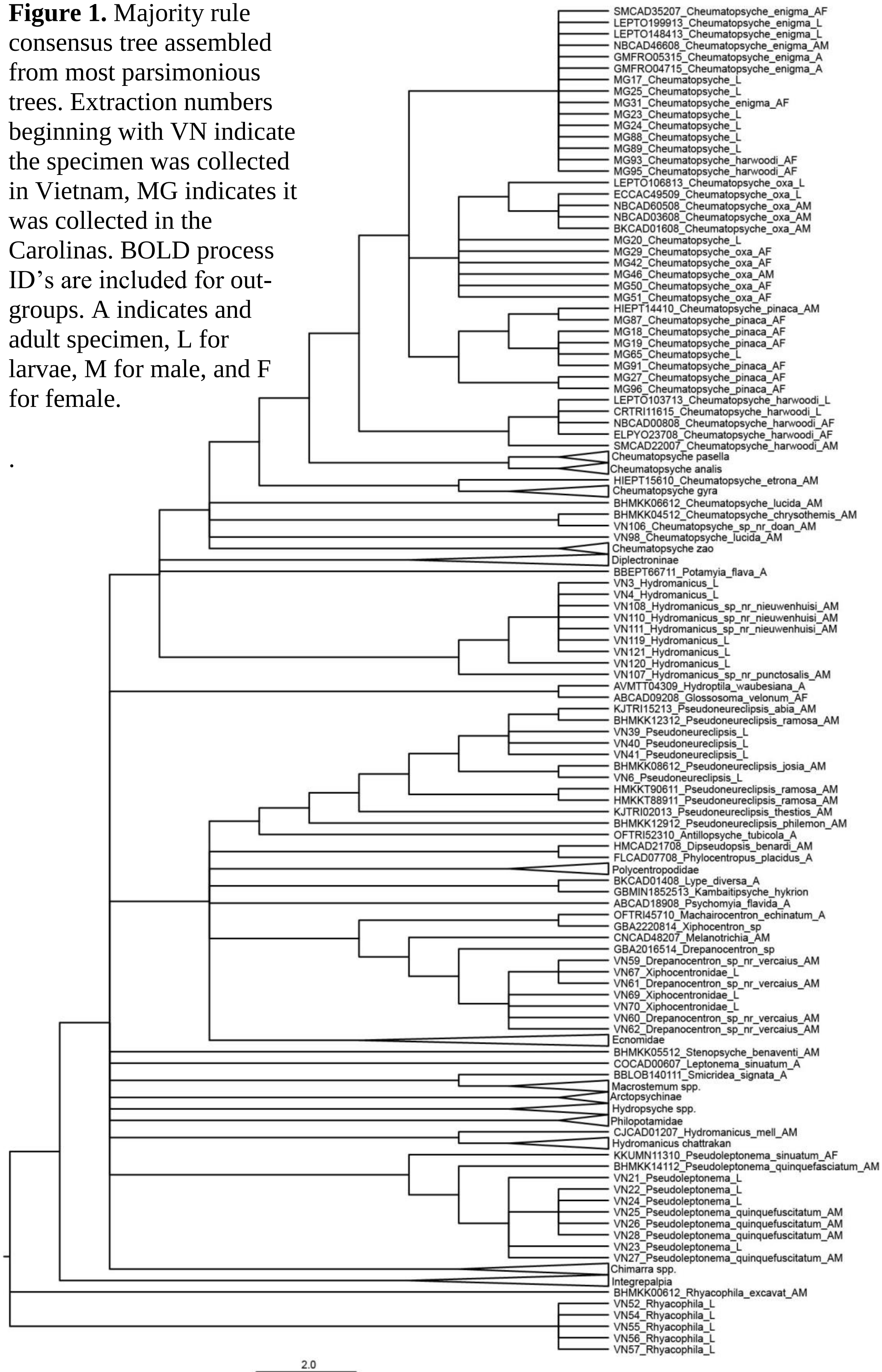


Figure 1. Majority rule consensus tree assembled from most parsimonious trees. Extraction numbers beginning with VN indicate the specimen was collected in Vietnam, MG indicates it was collected in the Carolinas. BOLD process ID’s are included for out-groups. A indicates and adult specimen, L for larvae, M for male, and F for female.

.

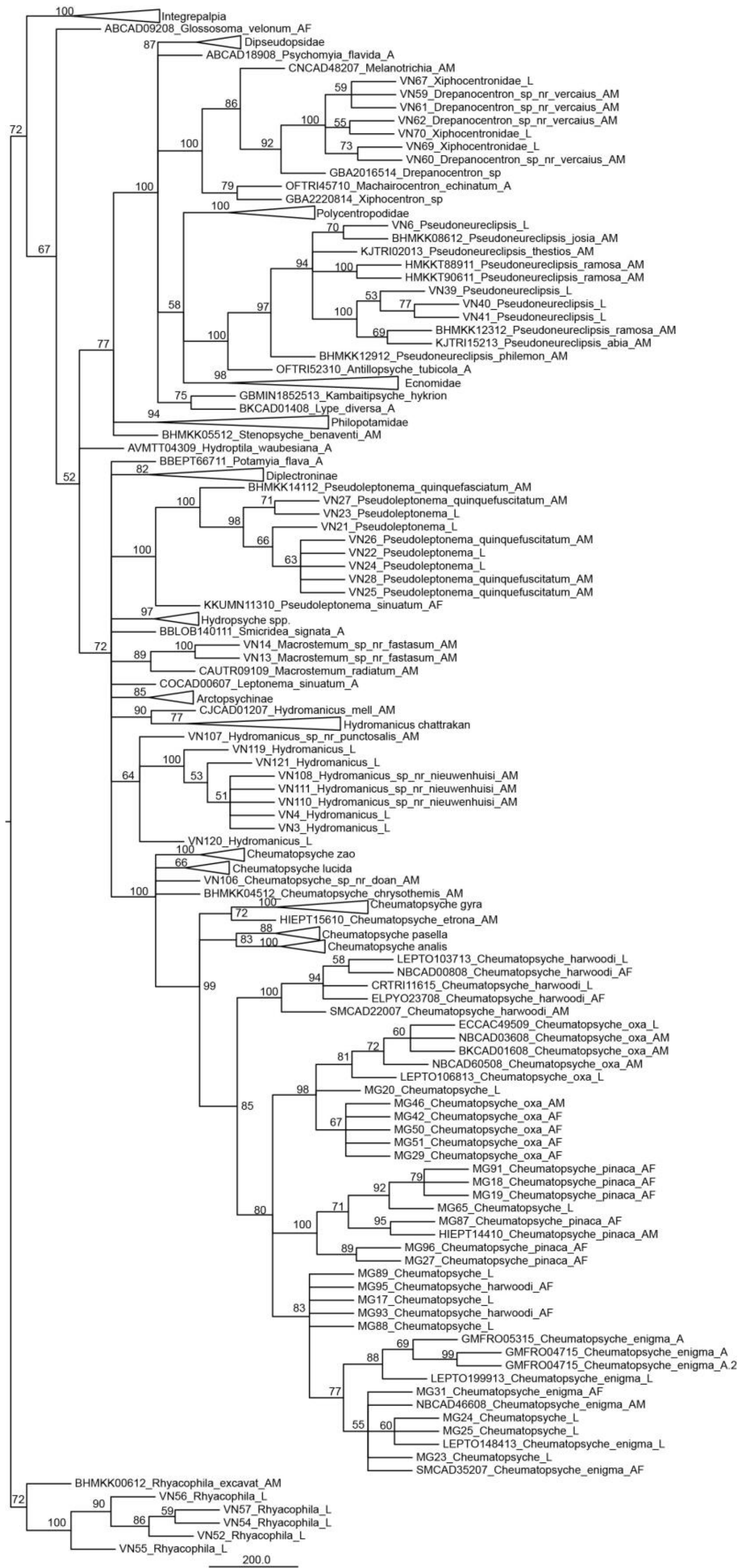


Figure 2. Majority rule consensus tree assembled from maximum likelihood trees. Bootstrap values are indicated on branches. Extraction numbers beginning with VN indicate the specimen was collected in Vietnam, MG indicates it was collected in the Carolinas. BOLD process ID's are included for out-groups. A indicates and adult specimen, L for larvae, M for male, and F for female.

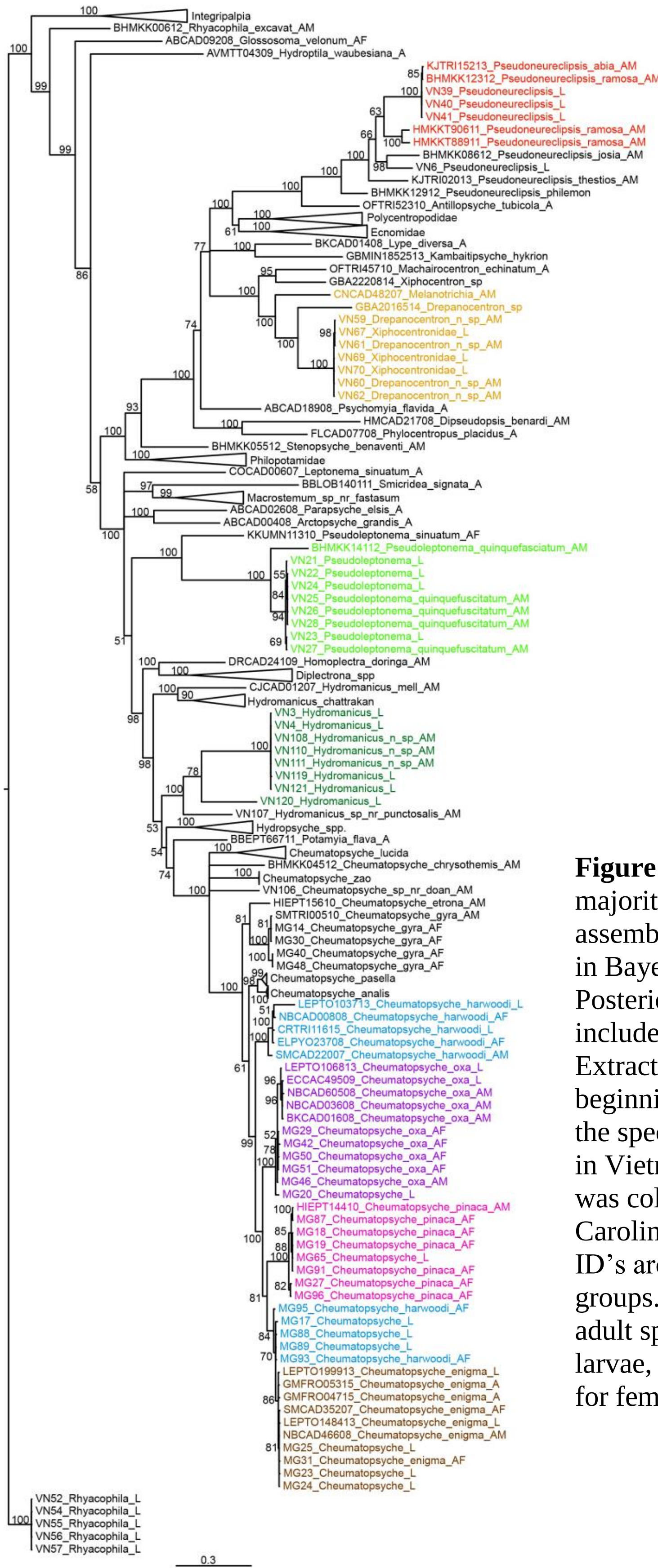


Figure 3. Phylogram of majority rule consensus tree assembled from post burn-in Bayesian Analysis. Posterior probabilities are included on branches. Extraction numbers beginning with VN indicate the specimen was collected in Vietnam, MG indicates it was collected in the Carolinas. BOLD process ID's are included for out-groups. A indicates and adult specimen, L for larvae, M for male, and F for female.

CHAPTER FOUR

SPECIES DESCRIPTIONS

In this chapter I describe the adult male and larvae of two new species, *Drepanocentron dentatum* (Xiphocentronidae) and *Hydromanicus calyx* (Hydropsychidae). I start by discussing the diagnosis of adults and larvae each family and genus, followed by the original species descriptions.

Xiphocentronidae Ross, 1949

Xiphocentronidae Ross, 1949: 1–7, figs. 1–12; type genus *Xiphocentron* Brauer, 1870. In his original description of this family, Ross (1949) add two new species to the monotypic genus *Xiphocentron*, described the family in detail, and provided a key to distinguish it from other then-known families of suborder Annulipalpia. Schmid (1982) revised the family, and included two subfamilies: Xiphocentroninae which included all genera (*Melanotrichia* Ulmer 1906, *Cnodocentron* Schmid 1982, *Machairocentron* Schmid 1982, *Xiphocentron* Brauer, 1870, *Drepanocentron* Schmid 1982, and *Abaria* Mosely 1948) except for *Proxiphocentron* Schmid 1982 which he placed in its own subfamily, Proxiphocentroninae. It is basal to other xiphocentronids and the body, wings, legs, and female genitalia were more similar to Psychomyiidae; however the male genitalia left no doubt that it belongs to Xiphocentronidae (Schmid 1982). Xiphocentronidae and Psychomyiidae are sister groups, and Dipseudopsidae sister to those (Kjer *et al.* 2016).

I include here the first larval description for a species in the genus *Drepanocentron*. Only 2 larvae of Xiphocentronidae have been described previously. The

larva of *Xiphocentron messapus* Schmid, 1982, was described by Edwards (1961, as *Xiphocentron mexico* Ross 1949, according to Wiggins, 1996). The larva, pupa, and adult male of *Cnodocentron yavapai* Moulton and Stewart, 1997, were described originally, observing that the larva is "morphologically indistinguishable" from Wiggins' (1996) description of larval *X. messapus*. However, upon review of these drawings, it appears that the pronotum of *C. yavapai* lacks the centralized setae and dark flat areas on the posterior margin seen in both *X. messapus* and *Drepanocentron* n. sp.

Diagnosis of adults:

Schmid (1982), suggested characters to separate the adults of this family. I have translated them here from French, and modified them to accommodate my new species: As a whole, the genitalia are greatly stretched horizontally. Tergum IX is reduced. The preanal appendages are very long and robust. Segment X is secondarily open dorsally, closed ventrally, and forming a cradle under the aedeagus [or is tube-like as in *D. verciaus* Malicky & Chantaramongkol 1992 and *D. dentatum* n. sp. with the phallus running through it]. The phallic apparatus is reduced to a very short phallotheca with an aedeagus formed as an extremely long and slender cylinder, but the endotheca is completely obliterated. The ventral closure of segment X is probably explained by the extreme length and delicacy of the edging that has required a downward support. The 2nd and 3rd characters are not exclusive to the Xiphocentronidae, but the development evolves to the extreme of trends present in some Psychomyiidae.

Diagnosis of larvae:

These larvae are most similar to those of Psychomyiidae, but without hatchet-shaped foretrochantins. I hypothesize that the expanded pillow-like maxillae, long spinneret, mesoplural lobe, and fused tibiae and tarsi are family-level characters for Xiphocentronidae, as they are present in all 3 species described thus far.

***Drepanocentron* Schmid, 1982**

Drepanocentron Schmid, 1982: 72–74, figs. 206–298; type species *Drepanocentron druhyu* Schmid (original designation).

Originally, Schmid (1982) included this genus in the nominotypical subfamily. Currently, the genus includes 41 species, all of which are known only in the Oriental Region (Morse personal communication). Females and immature stages of species in this genus have not been described previously.

Diagnosis of adults:

Schmid (1982) compared *Drepanocentron* to the rest of the subfamily (Xiphocentroninae) as follows (translated from French): *Drepanocentron* is one of the most specialized genera of the subfamily by the simplified edges of the two wings, the diversity of their scaly coating, the modifications of tergite VIII and its fusion with tergum IX, and the ventral tongue of sternum IX.

***Drepanocentron dentatum*, new species**

Figs. 4 and 5.

Holotype, male (VN62): VIETNAM: Bạch Mã National Park: Krem Stream, upstream of culvert at road (16.1958°N, 107.8490°E, elv: 1159 m) by J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., and Nguyễn V.H.; deposited in the Vietnam National Museum of Nature, Hanoi, Vietnam.

Paratypes: Three adult male specimens (VN59, VN60, and VN61) and two larvae (VN69 and VN70), same data as for holotype; VN69 deposited in the Vietnam Museum of Nature, Hanoi, Vietnam; all others deposited in the Clemson University Arthropod Collection, Clemson, South Carolina, USA.

Description of Adult Male:

Maxillary palps 5-segmented with dark setae on basal 3 segments. Labial palps 3 segmented. Pair of large kidney-bean-shaped warts anterior to antennae, and much smaller ovoid pair posterior to antennae. Medial wart on dorsum of head with rounded anterior margin and pointed posterior margin. Two pairs of elongate transverse warts posteriorly on head on either side of mesal line. Pair of prothoracic warts brown, bulbous, and touching medially. Mesoscutal warts large, brown, ovoid, flattened (plate-like) touching medially. Wings brown in alcohol. Spur formula: 2-4-3. Each pair of spurs of mesothorasic legs with mesal spur distinctly longer than the lateral spur. Distal tibial spur of each hind leg, much thicker than other spurs, similar in shape to that of *Drepanocentron vercaius* Malicky 1992, but much longer (about 4 times as long as wide), and with slender apical spine.

Description of Male Genitalia:

Tergite VIII overlapping base of segment IX and its acrotergite, and phallic shield, with 2 long setae in each posterolateral corner and 3 pairs on convex submesal portions of posterodorsal margin. Dorsum of segment IX shield like, with concave posterior margin, this concavity sometimes slight; its anterior acrotergite expanded with posterior margin convex submesally and concave mesally; pleural regions each consisting of very slender sclerotized connection between dorsal and ventral regions; ventrolateral portion on each side slender and extended internally as spine-like apodeme tapering anteriorly, and extending anteriorly beyond segment VIII; venter of segment IX with nearly parallel-sided posteromesal expansion (about twice as long as wide in ventral view, and concealing most or all of phallus, posterior margin round except for small notch. Phallocrypt membranous except for dorsal sclerotized shelf-like section (phallic shield) visible laterally, its anterior margin round in dorsal view. Cerci slender, nearly parallel-sided, gradually broader toward rounded apex, nearly reaching ends of inferior appendages. Segment X telescoped into segments VIII and IX, long, running beneath tergum VIII and beyond dorsum segment 9; tube-like, ventral margin of tube V-shaped in caudal view; 1 or 2 spines present basally on dorsal side of segment X beneath sternite VIII, and pair of spines at midlength beneath dorsum IX; segment X with longitudinal diagonal ridge on each side dorsolaterally, this ridge forming plate with concave ventral margin and convex posterior margin and with spine on apicolateral corner. Internally, slender rod (likely Schmid's (1982) phallotheca) longer than rest of genitalia, sclerotized

anteriorly, posteriorly inserted through segment X with diameter expanding and becoming indistinguishable from membranous remainder of phallus (Schmid's (1982) endotheca), exiting tubular segment X. Phallus subapically with scarcely apparent roughened portion and apically with pair of fleshy pointed lobes or rods. Inferior appendages each with anteromesal corner having single large hooked spine and group of smaller spines; middle portion cupped on mesal surface; black spines present along thin dorsal margin and dense patch of black spines subapicoventrally; apicodorsal margin extending as slender projection beyond rest of inferior appendage and bent dorsomesad. (Fig. 4).

Diagnosis of Male:

The male of this new species is most similar to that of *Drepanocentron vercaius* Malicky and Chantaramongkol, 1992. The new species can be distinguished because it has a more nearly parallel-sided ventromesal projection of segment IX with a rounded posterior margin having a mesal notch; *D. vercaius* has a more nearly triangular dorsum IX with a blunt posterior margin. This new species has spines on the dorsal margin of the inferior appendages, not the ventral margin is as in *D. vercaius*.

Etymology: The species is named *D. dentatum*, with "dentatum" meaning "toothed" in Latin, referring to the prominent toothy spines on the inferior appendages.

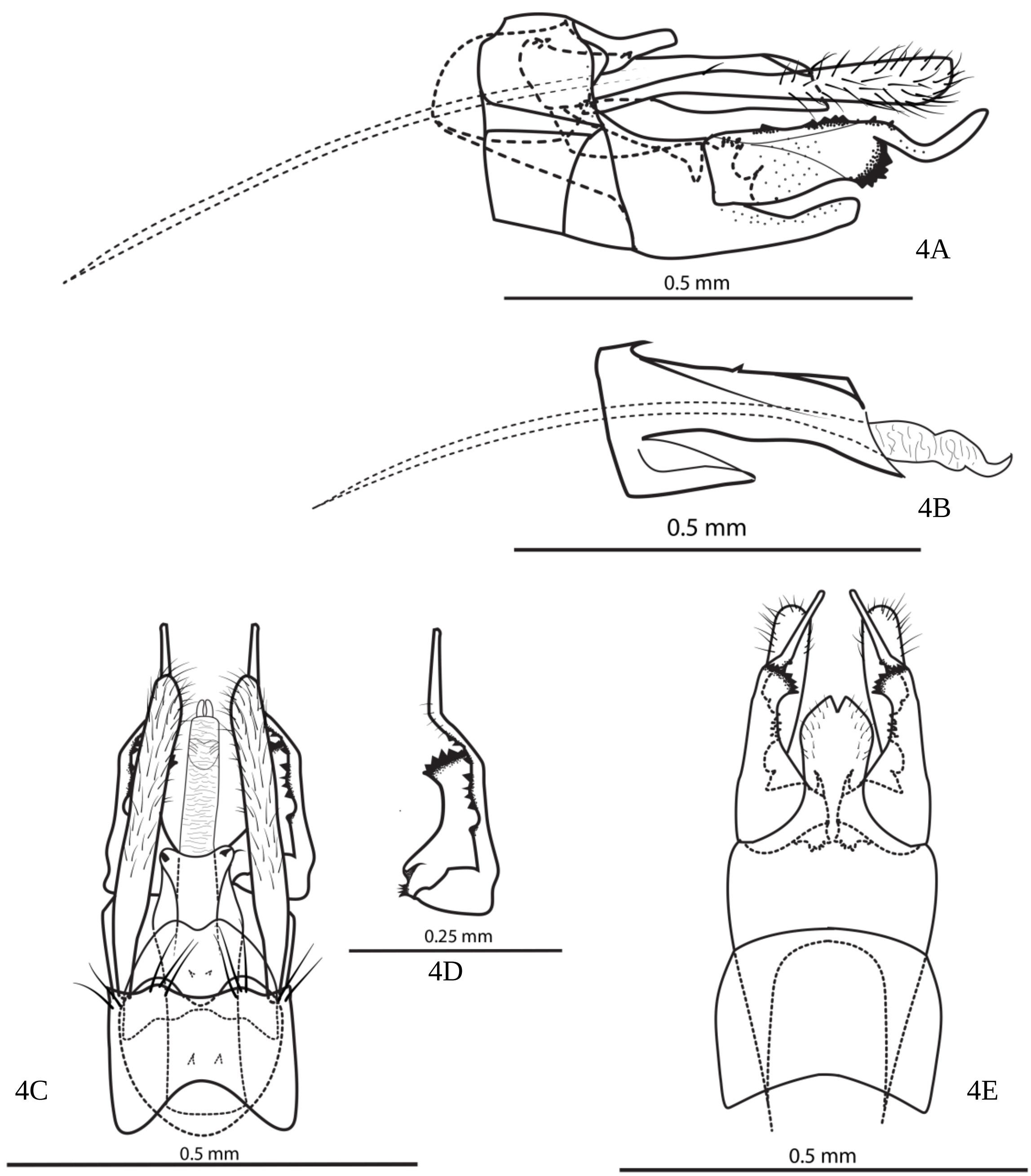


Figure 4. *Drepanocentron dentatum* n. sp., adult male genitalia, composite drawings of specimens VN59–VN62. 4A, genitalia, left lateral; 4B, segment X and phallus, left lateral; 4C, genitalia, dorsal; 4D, right inferior appendage, dorsal; 4E, genitalia, ventral.

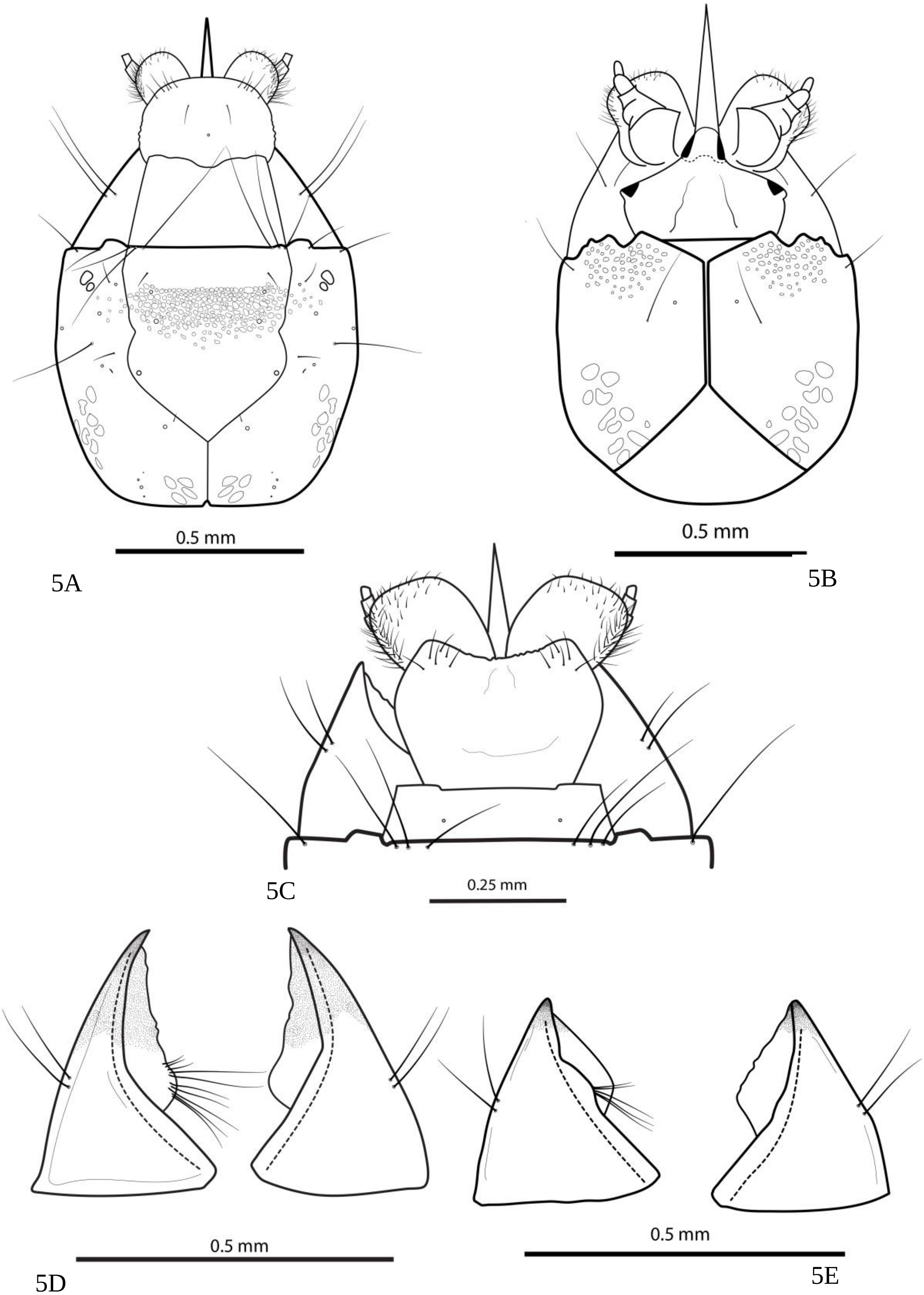
Description of Larva:

Mandibles triangular, with slight curvature to lateral margins or at tips. Tips of mandibles black. Thin mesal margin of each mandible with nearly smooth edge without teeth. Fan of setae mesally on left mandible. Dorsally, each mandible with pair of setae near lateral margin about 1/2 to 1/3 length of mandible from base. Maxillae large, inflated, and pillow-like, with fine hair along lateral and apical margins. Spinneret long, extending beyond mandibles and labrum, similar to but not as long as that of Dipseudopsidae. Labrum membranous and nearly circular or with distal margin concave. Labrum connected to frontoclypeus by expanded, membranous anteclypeus, extending labrum beyond apical tips of mandibles. Apical margin of frontoclypeus straight except for apical expansion just lateral of lyre-shaped suture on each side. Wide transverse band of circular markings dorsally on head; similar patch of circular markings on ventral side of head at apical margin. Ventrally, apical margin of head capsule conspicuously notched, similar to that of *Xiphocentron masapus* larva (fig. 11.1C, Wiggins 1996). Mentum and submentum membranous with no clear division, 1 pair of fine, long setae near posterior margin; tiny sclerotized corners of mentum possibly remnants of cardo. Ventral anterior apotome broad and triangular, posterior apotome absent. Very faint ovoid muscle scars on posterior half of head on both dorsal and ventral sides. Pronotum similar to that of larva of *Xiphocentron masapus* (Wiggins, 1996, fig. 11.1B) with dark flat areas on posterior margin. All legs with tibiae and tarsi fused. Mesopleural lobes fan-like, each with short, fine seta at each corner; each lobe associated with sclerotized,

invaginated pocket. Anal hooks of prolegs without teeth or spines, and smoothly curved at angle greater than 90° (Fig. 5).

Diagnosis of Larva:

The larva of *Drepanocentron dentatum* can be separated from those of the other two known xiphocentronid species by the smooth, thin mesal margin of each mandible, the fan-like shape of each mesopleural lobe, and the pattern of small circles on the head. The relevance of these differences for genus-level diagnosis remains unknown because there are no other larvae known from the genus that can be compared.


0.5 mm
5A
0.5 mm
5B
5C
0.25 mm
0.5 mm
5D
0.5 mm
5E

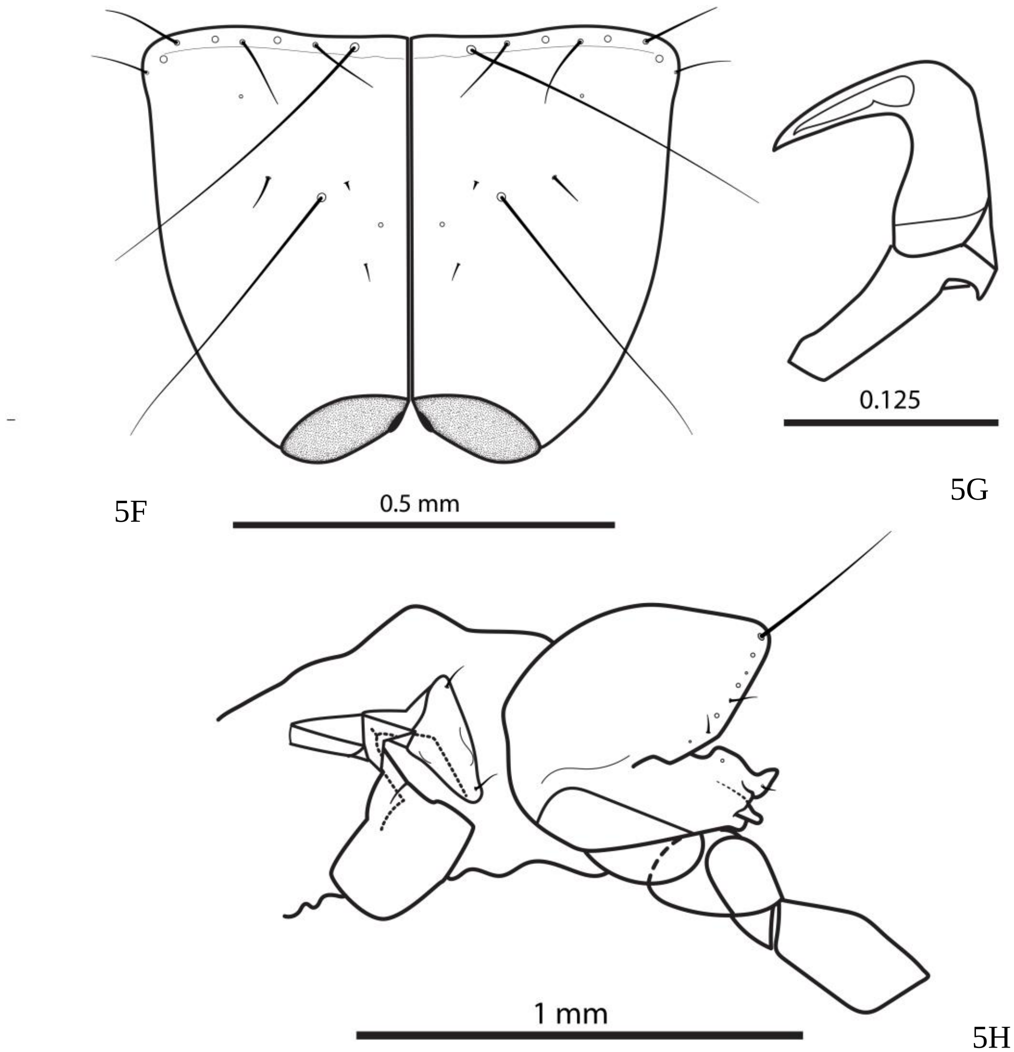


Figure 5. *Drepanocentron dentatum* n. sp., larva. 5A, head of specimen VN69, dorsal; 5B, head of VN69, ventral; 5C, labrum of VN70, dorsal; 5D, mandibles of VN69, dorsal; 5E, mandibles of VN70, dorsal; 5F, pronotum of VN69, dorsal; 5G, right anal proleg of VN 69, right lateral; 5F, pro- and mesopleura of VN69, right lateral.

Hydropsychidae Curtis, 1835

Hydropsychidae Curtis, 1835: plate 544 (text); type genus *Hydropsyche* Pictet, 1834.

Diagnosis of Adults:

Maxillary and labial palps, each with apical segment long, and narrowly annulate. The ocelli are absent. The spur formula is 2-4-4. The hind wings do not taper to a point, and are usually broader than forewings; the first apical fork on the forewings is stalked (Kachalova 1998).

Diagnosis of Larvae:

Stridulatory files are present on the ventral side of head (except in Macronematinae: Polymorphanisini). All 3 thoracic nota are sclerotized. The abdomen has multibranched lateroventral gills. Usually there is a fan of setae on each anal proleg. Larvae live in stationary retreats in flowing water (Dudgeon 1999; Morse 2004).

***Hydromanicus* Brauer, 1865**

Hydromanicus Brauer, 1865: 420; type species Hydromanicus irroratus Brauer (monobasic).

There are 71 *Hydromanicus* species globally, 70 from the Oriental Region, of which the larvae of only 5 species were previously known. Prommi *et al.* (2006) described the larva and pupa of *H. adonis* (Malicky & Chantaramongkol, 1996), and *H. klanklini* Malicky & Chantaramongkol,1993. Prommi & Permkam (2015) describe the larvae of *H. abiud* Malicky & Chantaramongkol, 1993, *H. inferior* Chantaramongkol &

Malicky, 1995, and *H. malayanus* Banks, 1931. Upon review of the larval descriptions and illustrations of these species, characters were found to separate them from one new species described here.

Diognosis of Adult:

Antennae are slightly longer than the wings, thread-like, serrate ventrally. The scape is short and not very thick. Ocelli are absent, the vertex and setal warts are bulging. The maxillary palps are long, the basal segment is short, the three following segments are almost equally long, the last segment is as long as all the preceding segments together. The thorax has two warts protruding behind the setal area. Middle legs of the female are not expanded, the spur formula is 2-4-4. The wings are similar to those of *Hydropsyche lepida* Pictet. The forewings are almost transversely truncate at the apical margins, the posterior wings are semi-elliptic, rounded at the apex, not much wider basally than the forewings, their anterior margins convex in the middle. In the hind wing the discoidal cell is also closed; the CU1 stem is close to the stem of M, as in the case of *Hydropsyche*, and Fork V is quite wide. Forewing hair is as in *Hydropsyche*, the hind wing is hyaline (Brauer, 1865, loosely translated from German).

Diagnosis of Larvae:

The frontoclypeus is more constricted posterior to the eyes than anteriorly. Posterior ventral apotome is inconspicuous or significantly smaller than the anterior ventral apotome. The foretrochantins have the dorsal tine of each fork longer than the

ventral tine. Abdominal gills are each with about 10 filaments arising on or near the apex of the central stalk (Morse 2004).

***Hydromanicus calyx*, new species**

Figs. 6 and 7.

Holotype, male (VN108). VIETNAM: Bạch Mã National Park, Vietnam, Pheasant Falls and its tributary (16.2287°N, 107.8486°E, elev: 159 m) on 30 June 2017 by J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., and Nguyễn V.H.; deposited in the Vietnam National Museum of Nature, Hanoi, Vietnam.

Paratypes: Two adult males (VN110 and VN111), three mature larvae (VN4, VN3, and VN121), and one younger instar (VN119), same data as for the holotype; VN4 deposited in the Vietnam Museum of Nature, all others deposited in the Clemson University Arthropod Collection, Clemson, South Carolina, USA.

Description of Adult Male:

Maxillary palps 5-segmented. Labial palps 3-segmented. All warts on head and prothorax white and hairy. Pair of irregularly shaped warts anterior to antennae. Ovoid medial wart at anterior margin of head. Posterior of antennae, 1 nearly circular wart with small notch in anterior margin, 1 pair of elongate (3 times longer than wide) transverse, parallel-sided warts, and 1 pair of ovoid warts. Posterior margin of dorsum of head with pair of large tear-drop-shaped warts (pointy ends positioned medially). Pronotum with pair of warts, touching or nearly so medially, and tapering laterally. Each anterolateral corner of mesothorax with bulbous tegulum. Mesoscutum without warts. Mesoscutellum

with large white medial wart, nearly circular, but constricted in posterior half. Spur formula 2-4-4. Wings greyish-brown in alcohol.

Description of Male Genitalia:

In lateral view segment IX with notch on each posterior margin, continuing anteriorly as internal sclerotized carina; dark setae present along posterior margin dorsal and ventral to notch. Dorsum of segment 10 divided, paired structures having rounded apices with tiny sensilla ventrally. Preanal appendages slender basally, enlarged and convex subapically, covered with fine setae with large alveoli. Inferior appendages two-segmented, long, extending beyond preanal appendages and segment X; long setae present about dorsally at apex of basal segment, giving cuticle bumpy appearance; harpagones distinctly cupped. In lateral view, basal half of phallus enlarged, constricted near center, with small vertical "dewlap" subapicoventrally, apical lobes darker in color than rest of phallus (Fig. 6).

Diagnosis of Male:

This new species is morphologically most similar to *Hydromanicus nieuwenhuisi* Ulmer, 1951, *Hydromanicus abiud* Malicky *&* Chantaramongkol, 1993, and *Hydromanicus serubabel* Malicky *&* Chantaramongkol, 1993. Unlike these three *Hydromanicus* species, the new species has inferior appendages with cupped harpagones. It also lacks the upturned point on dorsum of segment X, visible in lateral view present in *H. nieuwenhuisi* and *H. abiud*. Laterally, the connection between tergum and sternum IX is not as constricted as in *H. serubabel*.

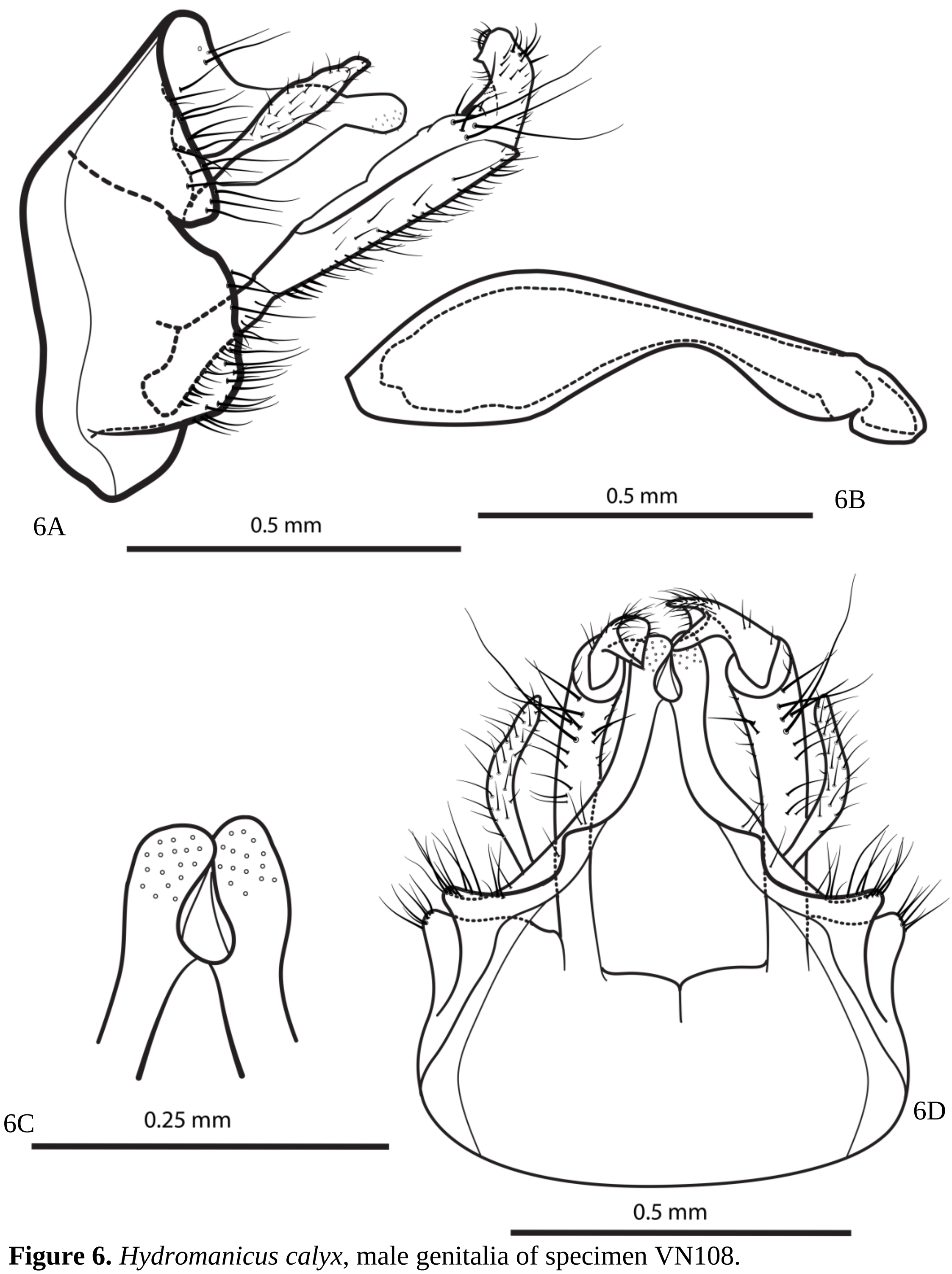


Figure 6. *Hydromanicus calyx*, male genitalia of specimen VN108.

6A, left lateral; 6B, phallus, left lateral; 6C, segment 10, dorsal; 6D, genitalia, dorsal.

Description of Larva:

Each mandibles approximately 3/4 as broad as long with large rounded teeth along mesal margin. Left mandible with brush of setae near mesal margin. In lateral view, each mandible with flattened triangular region bearing setae. Frontoclypeus with crenulated anterior margin. Corners of anterior margin of face near eyes with thick blunt setae. Hair more sparse on frontoclypeus than on lateral portions of head. Maxillae with long, thick setae on mesal margins. Labium with two pairs of setae. Ventrally, stridulatory regions spaning anterior 3/4 of head, not conspicuously tapered posteriorly. Lateral margins of stridulatory areas each interrupted by single faint muscle scar. Faint muscle scars present on head posterior to stridulatory areas. All three nota and abdomen densely covered with mix of fine setae and stubble-like scale hairs. Setae evenly distributed, except not covering faint pattern of muscle scars on thoracic nota (alveolae visible if setae broken). Anterior margin of each thoracic notum with fringe of thick hair, margin finely crenulate (visible under only very high magnification), and crenulations obscured by hair at margin. Posterior margin of pronotum with black band and with bead-like modeling. Mesonotum with black “M” pattern on posterior margin and black edges continuing laterally before tapering. Metanotum with black “T” pattern along posterior margin and black lateral margins tapering anteriorly and posteriorly. Curved divots in exoskeleton on meso- and metanota beginning at lateral margin and sloping posteromesally. Prosternal-mesosternal intersegmental sclerites angular and somewhat tapered at lateral ends. Large prosternal sclerite anterior to intersegmental sclerites with black anterior margin and black patch mesally along posterior margin. Abdomen with

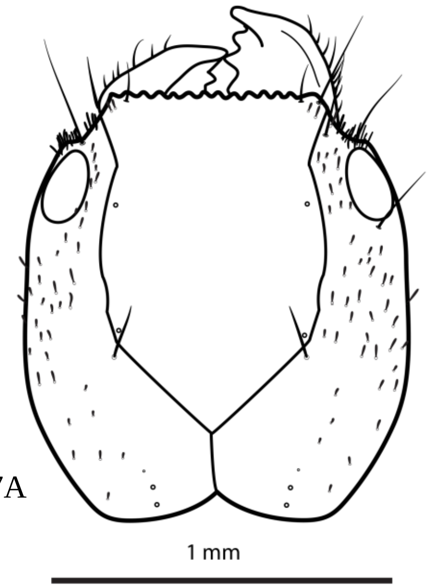
ventral gills as in other hydropsychids. Segments IV–VII each with 3 very small nub-like lateral gills. Segments VIII and IX with paired hook-plate-like sclerites (similar to those shown by Prommi and Permkam, 2015, figs 18 and 52). Gills present posteriorly, varying in length from specimen to specimen or possibly be retractable into pocket in abdomen. Anal prolegs each with large fan (if setae broken, black sclerite bearing alveolae present caudally on mesal margin of proleg); claw with single, thick, black seta near base extending towards tip; two lightly colored fine setae present between black seta and claw, seta nearest claw bent away from the claw (Fig. 7).

Diagnosis of Larva:

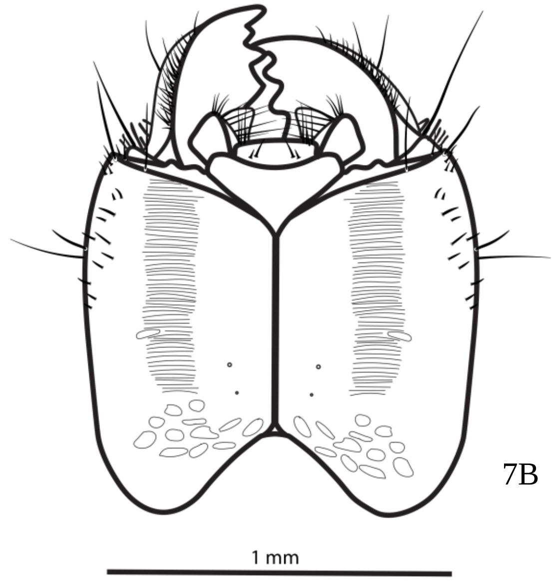
Hydromanicus calyx larvae lack color patterns on the dorsal side of the head, unlike *H. klanklini* Malicky & Chantaramongkol 1993 and *H. adonis* Malicky & P Chantaramongkol 1996. The new species has a straight anterior margin of the frontoclypeus, but the anterior margins of those of *H. malayanus* Banks 1931 are convex measly and *H. abiud* Malicky & Chantaramongkol 1993 are slightly asymmetrical with a convexity to the right. Of the 5 species with previously described larvae, the larva of *H. calyx* is morphologicaly most similar to that of *H. inferior*, but the new species can be distinguished by the slightly more slender intersegmental sclerites and by the presence of faint muscle scars interfering with the lateral margins of striduatory areas on the ventral side of the head. In my phylogram, larval specimen VN120 is sister *H. calyx*, but it likely represents a different species. It is nearly identical morphologically to *H. calyx*, but may possibly be separated as it seems to have a slightly shorter trunk to the T-shape on the

posterior margin of the metanotum. Additionally, this specimen (VN120) could possibly be *H. inferior* if Prommi et al. (2006) did not notice the faint muscle scar interfering with the lateral margin of each striduatory area on the ventral side of the head. My specimens were cleared during the DNA extraction process, this may make this character easier to see.

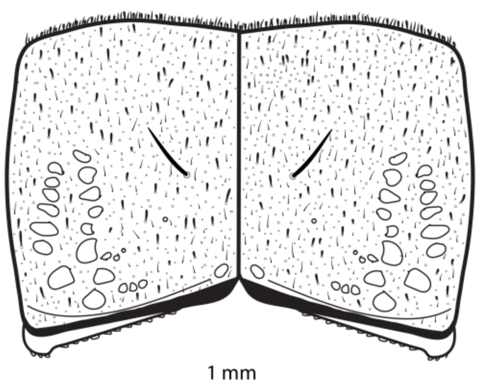
Etymology: The species is named *Hydromanicus calyx*, with calyx meaning “cup” in Latin, referring to the cup-shaped apices of the inferior appendages of the male.



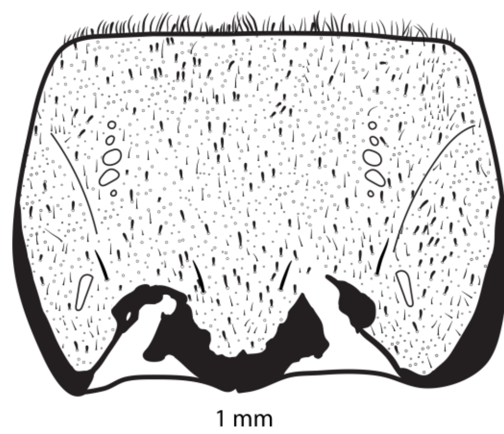
7A



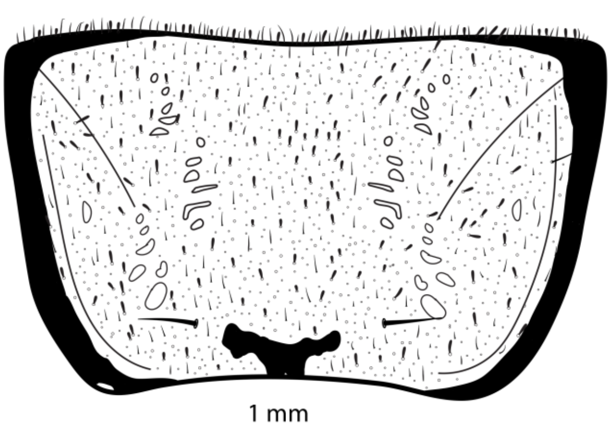
7B



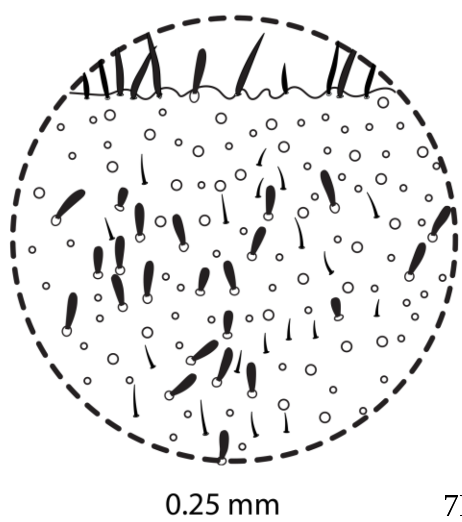
7C



7D



7E



7F

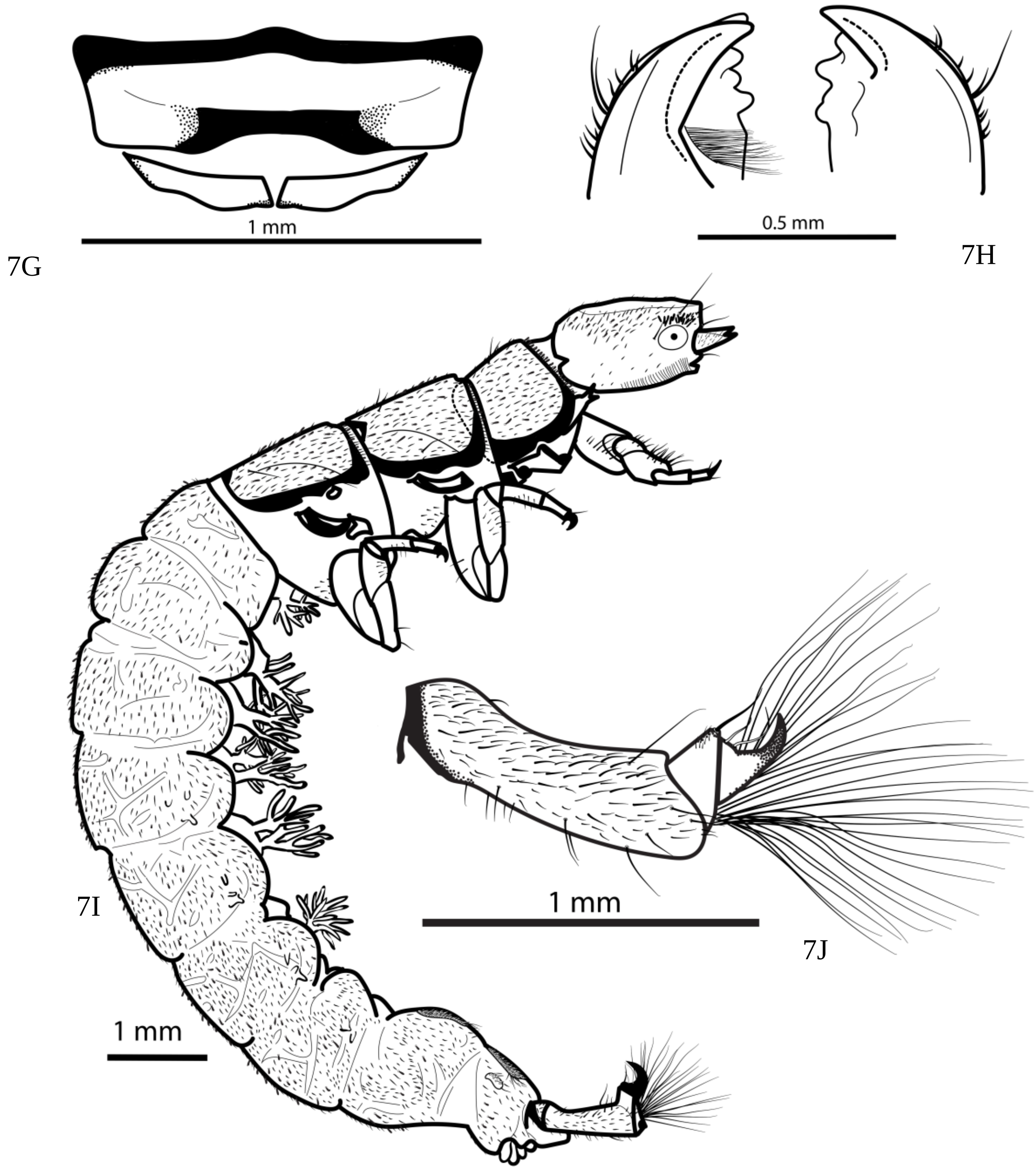


Figure 7. *Hydromanicus calyx*, larva of specimen VN4 except 7J of specimen VN3. 7A, head, dorsal; 7B, head, ventral; 7C, pronotum, dorsal; 7D, mesonotum, dorsal; 7E, metanotum, dorsal; 7F, inset of anterior margin of mesonotum, dorsal; 7G, prosternal sclerites, ventral; 7H, mandibles, dorsal; 7I, habitus, right lateral; 7J, right anal proleg, right lateral.

Cheumatopsyche Wallengren, 1891

Cheumatopsyche Wallengren, 1891: p 138, 142; type species *Hydropsyche lepida* FJ Pictet (monobasic).

Morse *et al.*'s (2017) list of southeastern U.S. Trichoptera includes 32 species of *Cheumatopsyche*—22 of these are found in North and/or South Carolina, but larvae of 11 (50%) of them have not been described. Many of those have been described only tentatively in morphotype groups, possibly containing multiple species.

Diagnosis of Larvae:

Anteromedian projection absent from anterior ventral apotome. Posterior ventral apotome very small, inconspicuous. Foretrochantins forked. Prosternum usually with pair of small intersegmental sclerites and frontoclypeus usually with mesal notch (if intersegmental sclerites large, notch is always present; if notch is absent, intersegmental sclerites always small). Abdominal gills each with approximately 10 filaments arising mostly near apex of central strunk. (Morse et al. 2017 and Morse & Holzenthal 2008).

Cheumatopsyche oxa Ross, 1938

Larva examined (MG20). USA: NC: Transylvania County: Davidson River; east of Wildlife Center, upstream of John Rock branch. 35.28384° N, 82.788852° W. Col. 4-Jan-2017 C. Wrege. Deposited in the Clemson University Arthropod Collection.

Description of Larva (Fig. 8).

Labrum rounded, with a conspicuous brush of golden setae at each lateral margin, extending anteriorly; labrum sometimes contracted beneath frontoclypeus. Anterior

margin of frontoclypeus with about 9 crenulations on either side of mesal notch; small hairs between each crenulation, hair between mesal most crenulations about level with base of notch, slightly anterior. Dorsum of head brown color except for pale yellowish areas around eyes, at posteriolateral corners of head, and an asymmetrical patch centrally on frontoclypeus, and pattern of faint , ovoid muscle scars on frontoclypeus. Prosternum with pair of small triangular intersegmental *sclerites* (typical of most *Cheumatopsyche*). Larger median intersegental sclerite with dark band at anterior margin, and darkend semi-rectangular patch posteriorly; posterior margin of sclerite slightly convex, nearly straight.

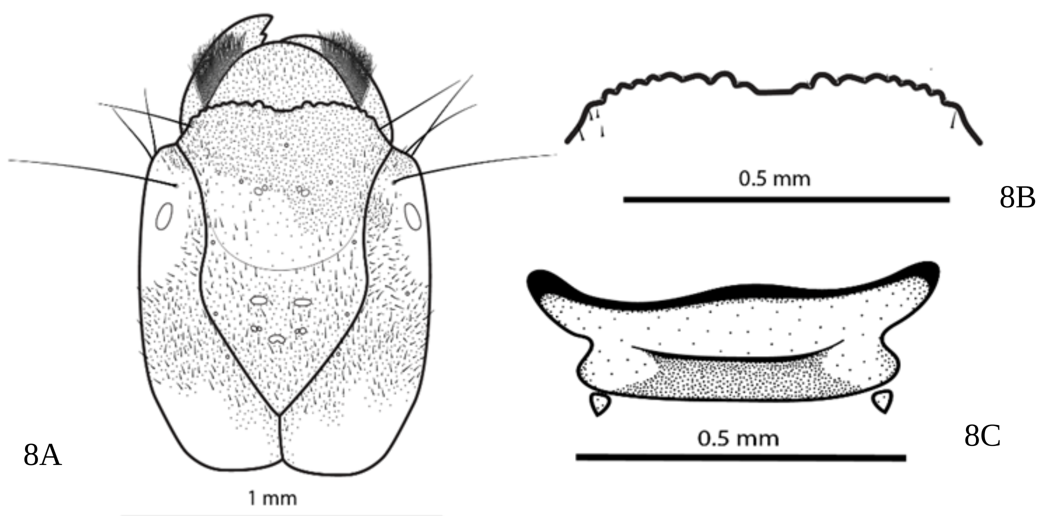


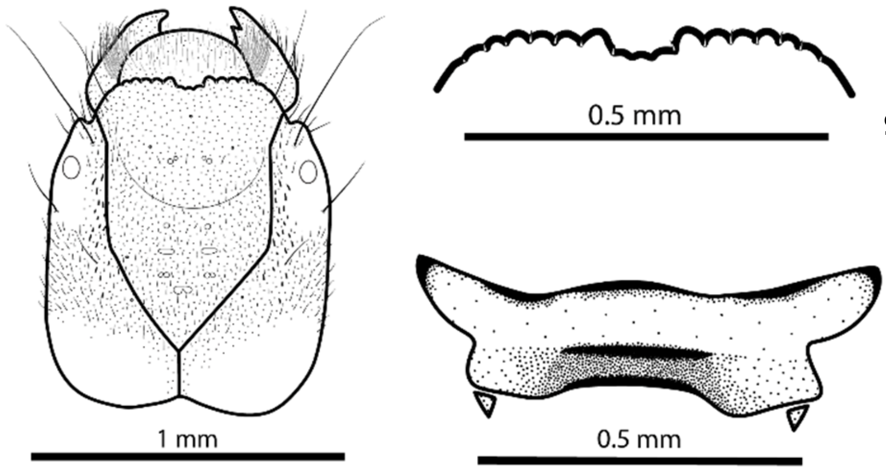
Figure 8. Larva of *Cheumatopsyche oxa*, specimen MG20. A. Head, dorsal; B. Anterior margin of frontoclypeus, dorsal; intersegmental sclerites, ventral.

***Cheumatopsyche pinaca* Ross, 1941**

Larva examined (MG65). USA: NC: Transylvania County: Davidson River; 1st fishing pull-off on 276. 35.274397° N, 82.707892 ° W. Col. 5-Jan-2017 C. Wrege. Deposited in the Clemson University Arthropod Collection.

Description of larva (Fig. 9)

Labrum rounded, with a conspicuous brush of golden setae at each lateral margin, extending anteriorly; labrum sometimes contracted beneath frontoclypeus. Anterior margin of frontoclypeus with about 7 crenulations on either side of mesal notch; small hairs between each crenulation, hair between mesal most crenulations about level with base of notch, slightly anterior. Dorsum of head brown color except for pale yellowish areas around eyes, at posteriolateral corners of head, and pattern of faint, ovoid muscle scars on frontoclypeus. Prosternum with pair of small triangular intersegmental *sclerites* (typical of most *Cheumatopsyche*). Larger median intersegental sclerite with dark band at anterior margin, and darkend semi rectangular patch posteriorly; posterior margin of sclerite concave.



9B

9A 9C

Figure 9. Larva of *Cheumatopsyche pinaca*, specimen MG65. A. Head, dorsal; B. Anterior margin of frontoclypeus, dorsal; intersegmental sclerites, ventral.

CHAPTER FIVE

DISCUSSION AND CONCLUSIONS

Ideally, when describing new species the following three criteria should be met: First, each character state must be distinct for its respective species, without intermediates. Secondly, each character state must not be correlated with observed environmental factors, such that the characters are consistent in specimens of a given species from different geographic locations and habitats types (as assigned by the habitat assessment). This can be evaluated by creating a scatter plot of barcoded larvae with the habitat score of the inhabited stream. For example, if caddis larvae of the same morphotype are found only in particular environmental conditions (as per the habitat assessment), I would support the hypothesis that the morphotype's character(s) is/are influenced by the environment and/or geography and is/are not reliably diagnostic for a species. Finally, the characters meeting the first two criteria must be coordinated with each other in multiple specimens of the same presumed species. For example, if presumed species A has characters 1, 2, and 3, all specimens of that presumed species must always have all three, and not some other combination. However, because each larvae-adult association made in this thesis were each collected from the same location, and due to the small number of larval specimens from each species, I could not test the final two criteria. However, I would assume that collecting larvae and adult specimens from the same location increases the likelihood that they are the same species.

Trichoptera of Vietnam

In this thesis I was able to associate and describe the adult males and larvae for two new species, *Drepanocentron dentatum* n. sp. (Xiphocentronidae) and *Hydromanicus calyx n. sp.* (Hydropsychidae). This is particularly exciting as there has never before been a larva of *Drepanocentron* known to science. Based on shared characters with the 2 other known larvae of xiphocentronid genera, I was able to hypothesize shared family-level characters as well. The *Hydromanicus* species described is only the sixth species for which the larva is now known in this mostly Oriental genus.

I am excited about the opportunity to continue describing some of the additional species collected from Vietnam. I am still uncertain about the identification of the *Pseudoleptonema quinquefasciatum* (Martynov, 1935), the adult and larval morphology varies slightly from the descriptions available in the literature. It would be worthwhile to describe the morphology of this species, whether to show morphological variation within *P. quinquefasciatum*, or as a new species.

Additionally, the *Pseudoneureclipsis* larvae in my samples can be described. They must be either *P. abia* Malicky & Chantaramongkol, 1993, or *P. ramosa* Ulmer, 1913, as adult specimens from BOLD of these two species matched on all trees with my larvae, with very short branch lengths on the phylogram (Fig. 3). I hope to contact the facilities at which these specimens are vouchered to confirm correct identification and possibly to borrow the vouchers for closer observation.

There are numerous adult specimens collected in Vietnam that still are awaiting identification, and several new species that I hope to continue to help describe. There

were also many larvae collected for which I did not have time or funding to continue barcoding; these along with more adults could continue to be associated by me or others in the Morse or Pham labs in the future.

Some initial research into surface water quality in the country has been explored, pertaining to the Nhue and Day sub-river systems, including chemical parameters such as dissolved oxygen, nutrients, and fecal coliform (Hanh *et al.* 2010). I hope that in the future, if the aquatic fauna in Vietnam continues to be studied by Dr. Pham and his students, or other local scientists, Vietnam can begin to use these animals to monitor water quality in their country. The benefits of using benthic macroinvretebrates for this purpose are well known, and allow for a more long-term reflection of the health of the system than chemical tests alone provide (Lenat & Penrose 1996, Resh & Unzicker 1975). I think that Vietnam is a good candidate for developing its own water quality monitoring program in the future, although the Vietnamese may have to adapt collection methods to accommodate regional physical, chemical, infrastructural, and social characteristics. Compared to streams with which I am most familiar in North and South Carolina, many of the streams in Vietnam had bedrock bottoms, or large boulders, or silty and/or grassy bottoms, few had the loose cobble mixed with gravel that is more typical here in the southeastern United States. I am not sure if this is the natural state of their streams, or if this is due to human impairment or disturbance to the stream bed.

All Vietnamese caddisfly collecting for this project was conducted within two National Parks, Bạch Mã and Cúc Phuöng. The streams in Bạch Mã were more pristine than those in Cúc Phuöng. Bạch Mã had an average stream score of 181.25 on the habitat

assessment with the lowest score being 166. Cúc Phuöng's average score was 156, with the lowest score being 107. The higher the score the more optimal the stream is, with a perfect score being 120. All of the streams we sampled fell into the optimal or suboptimal categories; this was because we were targeting streams the Vietnamese could use in the future as referece sites, and because we wanted to visit streams with high macroinvertebrate diversity due to the time constraints of travel. It should be noted that there were several streams in Cúc Phuöng for which we did not collect specimens or conduct habitat assessments because we could visually see the water quality was poor, due to algal blooms, trash, manure smell, and other issues; such that if all streams in the park were sampled the average score would likely be much lower. The most impacted streams were associated with high population density and rice agriculture in Cúc Phuöng, whereas Bạch Mã was high in the mountains and more protected from agriculture and human impact. Future outreach to the general public on agricultural best practices such as keeping animals away from the stream and filtering or allowing water exiting the rice paddies to settle before entering the streams or rivers may help clean the water, as well as provide local residents with a safer source of drinking water. The addition of a limit to the number of people allowed to take up new residence within the parks may also lend additional protection to the natural systems preserved in the parks.

This work is an exciting start to trichopterology in Vietnam. When Dr. Pham invited Dr. Morse and lab to visit, we were excited for the opportunity. Dr. Morse and students have always taken the perspective that it is better to share knowledge with local

scientists about how they can discover the fauna in their region, so that after the field experience ends, local scientists can continue to learn and research the local fauna.

Cheumatopsyche of North and South Carolina

Of the 22 species of *Cheumatopsyche* known from North and/or South Carolina, I have collected 8 species. For 7 of these species I was able to obtain DNA and include them in my analysis. Of these, larvae of four species (*C. harwoodi* Denning, 1948; *C. enigma* Ross *et al*. 1972; *C. pinaca* Ross, 1941; and *C. oxa* Ross, 1938) were matched with adults of the same species via DNA. According to a personal communication with Dr. John Morse (2017) species with both high and low pollution tolerance are thought to be found in pristine streams, whereas species with low pollution tolerance are found only in pristine streams; however, this has not been tested. All streams in which these *Cheumatopsyche* were collected scored as "Optimal" in the habitat assessment, the most pristine of the four categories. It is likely that the low-tolerant species are in much higher abundance and diversity in these streams than other taxa. I hypothesize that all the species I collected have low pollution tolerance, so that sampling of suboptimal, marginal, and poor streams may lead to collection of additional species. According to the intermediate disturbance hypothesis (Connell, 1978), slightly disturbed ecosystems have higher species diversity than pristine or highly disturbed sites. It would be an interesting follow-up study to test if suboptimal streams sometimes yield higher species diversity than pristine streams.

It was tremendously difficult to amplify DNA from these specimens. Many attempts were unsuccessful. I tried to extract and amplify DNA from 99 *Cheumatopsyche* specimens, but only 31 attempts were successful. I experienced a "steep learning curve." For 7 of the 8 species collected, I was able to obtain DNA, so I do not believe the primers were the issue. The larvae were particularly difficult. Initially I included the whole body of the animal in the extraction. However, when only the head and thorax were used and duration of the water bath increased, I saw increased success. This could be because the muscle was better exposed to the extraction fluid; or it could be that something in the abdomen was carried through the extraction process that somehow inhibited amplification during PCR; alternatively, the added water-bath time allowed for a more complete reaction. Improved success was likely a combination of some of these factors, but the individual modifications were not tested objectively.

It is unfortunate that I was not able to include the larval species diagnosis of the various *Cheumatopsyche* species I associated in this thesis. However, these results are still worth discussing. The larvae of *Cheumatopsyche* are somewhat well known for being morphologically similar, and also extremely challenging to separate using DNA. In Burington's MS thesis (2011), he discussed a personal communication with Zhou, and stated "the sequence divergence between species is slight or not apparent in most complexes of Nearctic *Cheumatopsyche* …so using this method for association is not possible for those groups". I was surprised by the confidence Burington expressed in this statement and reached out to him and Zhou for more information.

Zhou responded, “The issue with *Cheumatopsyche* is somewhat complicated… the major issue is that the species boundaries for many *Cheumatopsyche* spp. are not solid. One would need integrative evidence to determine species boundaries for this genus, including morphology, ecology, biology, and DNA (e.g., barcodes)”. This suggests that if the species boundaries are not clear, more work may be needed to separate and more strongly define the adult species before the larvae can be described. If the DNA sequences are very similar, making the species difficult to separate, perhaps the species in this genus have only recently evolutionarily diverged, or there are many more names than true species.

With the exception of *C. harwoodi* and *C. enigma*, most species of *Cheumatopsyche* in my analyses created monophyletic species groups, and thus were separable by DNA. All *C. harwoodi* added from BOLD came out monophyletic with each other, but not with my specimens of *C. harwoodi* and *C. enigma*. Gordon (1974) considered *C. enigma* to be a subspecies of *C. harwoodi*, but Flint et al. (2004) revalidated them as two distinct species. Specimens are challenging to separate, especially the females, as there are many intermediates. An alternative hypothesis is that the intermediates represent hybrids.

Zhou based much of his work on Neighbor Joining, rather than phylogenetic analysis. According to Huelsenbeck (1995) phylogenetic trees are better for reconstructing evolutionary relationships than neighbor-joining because it is a more robust analysis, it is more likely to “estimate the correct phylogeny even when the assumptions of the phylogenetic method are violated”, this is especially important

because “the idealized assumptions underlying phylogenetic methods are most likely violated with real data”. Therefore, the difference in the analysis used may account for why I was able to separate species of *Chumatopsyche*, while Zhou did not get as clear distinctions.

In a personal communication with Burington, he warned me of the difficulties he had attempting to find characters to separate *Cheumatopsyche* species, urging me to include other groups in my thesis in case *Cheumatopsyche* cannot be separated morphologically. He said most of the characters he used in his thesis were from the head and thoracic plates, but suggested that I may find more on the legs and anal prolegs.

I have spent many hours looking for characters to separate the larval species associated in my tree from each other and from larval species in the literature. I have not yet found characters that can separate them. However, I feel optimistic that since I have been able to separate species via DNA, that with additional time and close observation, characters can be found. When illustrating the larvae of *C. pinaca* and *C. oxa* I found differences in the color patterns on the dorsum of the head, and in the shape of the posterior margin of the large median intersegmental sclerite. I need to test these characters against other specimens of the same species (because I only had 1 larva each of *C. pinaca* and *C. oxa*) and different species, and would like to barrow additional voucher specimens from BOLD. Future evaluation of the setae viewed with cleared and slide mounted specimens as described by Schefter & Wiggins (1987) and Mackay (1978) may add momentum to the character search. Burington also suggested I try evaluating the anal prolegs, and other characters not as well discussed in the literature for this group. I

am hopeful that given more time that a closer inspection of morphology of these larvae may yield characters to separate them. Unfortunately, this will take much more time than afforded a typical Master's degree, thus I plan to continue to work on these species after graduation, and to describe these larvae in a subsequent publication.

APPENDICES

Appendix A
Voucher Information

CUAC #	extraction #	PCR #	Taxon	Life Stage/ sex	**Collection Info.**	**Sequence**
	JCM006	11VN9	*Neophylax*	larva	USA: NC: Jackson Co. Balsam Mtn. Preserve, Sugarloaf Cr. behind Morse Property. Col. Genco and Morse 18-Mar-2016	AACTTTATATTTTATTTTTGGAATCTGAGCCGGAATAGTAGGAACTTCATTAAGAATGATTATTCGCTCT GAATTGAGAATGACAGAATCTTTAATTAAAAATGATCAAATTTATAATGTTTTAGTTACTGCCCATGCTT TTATTATAATTTTTTTTATAGTAATACCTATTATAATTGGAGGGTTTGGGAATTGATTAGTACCTCTAATA ATTGGAGCCCCTGATATAGCATTCCCTCGAATAAATAATATAAGATTTTGACTCCTGCCCCCTTCTTTAA ATTTTCTCTTAATTAGATCTCTTGTAGAAAGAGGAACAGGAACTGGATGAACAGTTTATCCCCCTCTTTC TAGAAATTTAAGTCATGCTGGAGCTTCAGTAGATATCTCAATTTTTTCATTACATTTAGCAGGAATTTCTT CAATTTTAGGGGCTATTAACTTTATTTCTACAACTTTAAATATACGAAGTAACTTAATTACATTAGATCG TATTCCTTTATTTGTATGATCAGTAGCAATTACAGCTTTACTTTTATTACTATCTCTTCCTGTTTTAGCAG GAGCTATTACCATACTTCTTACTGACCGTAATTTAAATACATCATTTTTTGACCCATCTGGTGGTGGAGA CCCTATTTTATACCAACATTTATTT
	MG14	5MG2	*Cheumatopsyche gyra*	adult female	USA: SC: Pickens Co.: Rocky Bottom: Eastatoe Creek. Col. 11-Jul-2016 M Genco	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTAGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACCCCAGGATCCTTAATTGGGAATGACCAAATTTATAACGTAATTGTTACTTCCCACGCATT TATTATAATTTTTTTCATAGTTATGCCCATTATAATTGGAGGGTTTGGAAACTGATTAGTTCCTTTAATAT TAGGATCACCAGATATAGCTTTCCCTCGAATAAATAACTTAAGATTTTGATTTTTACCCCCCTCTCTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGAACAGGTTGAACTGTTTACCCTCCTTTATCGT CTAACCTTTCTCATTTAGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGGGCCATTAATTTTATCACTACATCCTTCAATATAAAAATTAATAAATTAAATTACGAAATCC TTCCCCTCTTTGTCTGATCAGTTGCTATTACTGCTGTTCTTCTTCTCTTATCCCTTCCTGTATTAGCCGGTG CAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTCTTT---- ??
000030971	MG17	6MG3	*Cheumatopsyche*	larva	USA: SC: Pickens Co.: Rocky Bottom: Eastatoe Creek. Col. 11-Jul-2016 M Genco	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTCATTCGAATTG AACTTAGAACACCAGGGTCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCA?GCGTT TATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATAT TAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCTCTATCAT CTAATCTATCCCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCA ATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATCC TTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTCCTATCTCTACCAGTTCTAGCTGGCG CAATTACTATATTATTAACAGATCGAAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCC TATTCTATACCAACATTTATTT
000030972	MG18	6MG4	*Cheumatopsyche pinaca*	adult female	USA: SC: Oconnee Co: Walhalla State Fish Hatchery. Col. Genco & Lewis 11-Aug-2016	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTTGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACTCCTGGATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACACGCATT TATTATAATTTTTTTTATAGTTATGCCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATAT TAGGCTCACCAGACATAGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTCTAATTTTAAGAAGAATAATAAACTCAGGAGCTGGTACAGGTTGAACTGTTTACCCCCCTCTATCAT CTAATTTATCCCACCTTGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTGTTCTCGCAGGCG CAATTACTATATTACTGACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCTGGAGGAGGAGATCC TATTTTATACCAACATTTATTT
000030973	MG19	6MG5	*Cheumatopsyche pinaca*	adult female	USA: SC: Oconnee Co: Walhalla State Fish Hatchery. Col. Genco & Lewis 11-Aug-2016	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTTGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACTCCTGGATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACACGCATT TATTATAATTTTTTTTATAGTTATGCCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATAT TAGGCTCACCAGACATAGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTCTAATTTTAAGAAGAATAATAAACTCAGGAGCTGGTACAGGTTGAACTGTTTACCCCCCTCTATCAT CTAATTTATCCCACCTTGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTGTTCTCGCAGGCG CAATTACTATATTACTGACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCTGGAGGAGGAGATCC TATTTTATACCAACATTTATTT
000031021	MG20	7MG1	*Cheumatopsyche*	larva	USA: NC: Transylvania co.: Davidson River; east of Wildlife Center, upstream of John Rock branch. 35.28384° N, 82.788852° W. Col. C. Wrege 4-Jan-2017	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTG AACTTAGAACCCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCGTT TATTATGATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATAT TAGGATCCCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCCTACCCCCCTCATTACTT CTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCAT CTAATCTATCTCATCTCGGAAGATCCGTAGATCTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCGTTTTATTACTCCTATCTCTCCCAGTTTTAGCTGGCG CAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCAGGAGGGGGGGATCC TATTTTATATCAACATTTATTT

	MG23	7MG24	*Cheumatopsyche*	larva	USA: NC: Transylvania co.: Davidson River; east of Wildlife Center, upstream of John Rock branch. 35.28384° N, 82.788852° W. Col. C. Wrege 4-Jan-2017	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTT TATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATAT TAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCAT CTAATCTATCTCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCA ATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTACCAGTTCTAGCTGGCG CAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCC TATTCTATACCAACATTTATTT
	MG24	7MG25	*Cheumatopsyche*	larva	USA: NC: Transylvania co.: Davidson River; east of Wildlife Center, upstream of John Rock branch. 35.28384° N, 82.788852° W. Col. C. Wrege 4-Jan-2017	TTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCA GGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTT TATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGAT ATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTTTAATTTTAAG AAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCATCTAATCTATCTCAT CTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCAATTTTAGGGGCAAT TAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTT GATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTACCAGTTCTAGCTGGCGCAATTACTATATTA TTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCCT---- ?????????????????
000031026	MG25	7MG6	*Cheumatopsyche*	larva	USA: NC: Transylvania co.: Davidson River; east of Wildlife Center, upstream of John Rock branch. 35.28384° N, 82.788852° W. Col. C. Wrege 4-Jan-2017	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTT TATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATAT TAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCAT CTAATCTATCTCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCA ATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTACCAGTTCTAGCTGGCG CAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCC T----?????????????????
000031027	MG26	7MG7	*Cheumatopsyche pasella*	adult female	USA: NC: Jackson Co.: Balsam Mtn. Preserve, Dark Ridge Creek. 35.40213° N, 83.09045°. Col. Genco & Morse 20-Jul-2016	AACTCTTTATTTTATTTTCGGAATTTGATCCGGATTAGTCGGATCTTCTTTAAGATTCCTTATTCGAATTG AACTCAGAACTCCAGGGTCTTTAATTGGAAATGACCAAATTTATAATGTAATTGTTACTTCTCATGCATT TATTATAATTTTCTTTATAGTTATACCCATTATAATCGGAGGATTTGGAAACTGATTAGTTCCTTTAATAT TAGGATCCCCAGATATAGCCTTCCCTCGAATAAATAATTTAAGATTTTGATTTTTACCTCCTTCATTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCATTATCAT CTAATCTATCCCACCTAGGAAGATCAGTAGATTTAACTATTTTCTCTCTTCATTTAGCTGGTATCTCATCA ATTTTAGGAGCAATTAATTTCATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTAGCTATTACTGCCGTTTTACTTCTATTATCCCTGCCTGTTTTAGCTGGCG CGATTACTATATTACTAACAGATCGTAATTTAAATACATCTTTTTTTGATCCAGCAGGAGGAGGAGACCC TATTTTATATCAACATTTATTT
000031028	MG27	7MG8	*Cheumatopsyche pinaca*	adult female	USA: SC: Pickens Co.: Clemson Experimental Forest: Wildcat Creek, 34.7561° N, 82.8562° W. Col. Genco 19Sep-2016	TCGGAATTTGATCAGGATTAGTTGGATCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACTCCTGG ATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACATGCATTTATTATAATTTTTTTA TAGTTATACCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATATTAGGTTCACCAGACAT AGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCTCCCTCATTACTTCTTCTAATTTTAAGAA GAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCTCTATCATCTAATTTATCCCACCT TGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTA ACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGA TCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTGTTCTCGCGGGCGCAATTACTATATTACT GACAGATCGTAATTTAAATACATCTTTTTTTGATCCAGCTGGAGGAGGAGATCCTAT--?????????????????
000031030	MG29	7MG10	*Cheumatopsyche pasella*	adult female	USA: SC: Pickens Co.: Table Rock St. Park, Carrick Creek. 35.031348° N, 82.700056° W. Col. Genco, Qiu, & Zhau 29-Jul-2016	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTG AACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATAT TAGGATCGCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCTTGCCCCCCTCATTACTT CTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCAT CTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAACTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCGTTTTATTACTCCTATCTCTCCCAGTTTTAGCTGGCG CAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCAGGAGGGGGGGATCC TATTTTATATCAACATTTATTT

000031031	MG30	7MG11	*Cheumatopsyche gyra*	adult female	USA: NC: Jackson Co.: Balsam Mtn. Preserve, Dark Ridge Creek. 35.40213° N, 83.09045°. Col. Genco & Morse 20-Jul-2016	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTAGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACCCCAGGATCCTTAATTGGGAATGACCAAATTTATAACGTAATTGTTACTTCCCACGCATT TATTATAATTTTTTTCATAGTTATGCCCATTATAATTGGAGGGTTTGGAAACTGATTAGTTCCTTTAATAT TAGGATCACCAGATATAGCTTTCCCTCGAATAAATAACTTAAGATTTTGATTTTTACCCCCCTCTCTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGAACAGGTTGAACTGTTTACCCTCCTTTATCGT CTAACCTTTCTCATTTAGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGGGCCATTAATTTTATCACTACATCCTTCAATATAAAAATTAATAAATTAAATTACGAAATCC TTCCCCTCTTTGTCTGATCAGTTGCTATTACTGCTGTTCTTCTTCTCTTATCCCTTCCTGTATTAGCCGGTG CAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTCTTTGACCCAGCTGGAGGGGGTGACCC CATCTTATACCAACATTTATTT
000031032	MG31	7MG12	*Cheumatopsyche pasella*	adult female	USA: NC: Jackson Co.: Balsam Mtn. Preserve, Dark Ridge Creek. 35.40213° N, 83.09045°. Col. Genco & Morse 20-Jul-2016	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTT TATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATAT TAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCAT CTAATCTATCTCACCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCA ATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTACCAGTTCTAGCTGGCG CAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCC TATTCTATACCAACATTTATTT
000031111	MG40	9MG1	*Cheumatopsyche gyra*	adult female	USA: SC: Pickens Co.: Table Rock St. Park, Carrick Creek. 35.031348° N, 82.700056° W. Col. Genco 29-Jul-2016	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTAGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACCCCAGGATCCTTAATTGGGAATGACCAAATTTATAACGTAATTGTTACTTCCCATGCATT TATTATAATTTTTTTCATAGTTATGCCCATTATAATTGGAGGGTTTGGAAACTGATTAGTTCCTTTAATAC TAGGATCACCAGATATAGCTTTCCCTCGAATAAATAACTTAAGATTTTGATTTTTACCCCCCTCACTTCTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGGACAGGTTGAACTGTTTACCCTCCTTTATCGT CTAATCTTTCTCATTTAGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCCATTAATTTCATCACTACATCCTTCAATATAAAAATTAATAAATTAAATTACGAAATCC TTCCCCTCTTTGTCTGATCAGTTGCTATTACCGCTGTTCTTCTTCTTTTATCCCTTCCTGTATTAGCCGGTG CAATTACTATATTATTAACAGATCGAAATTTAAATACATCTTTCTTTGACCCAGCTGGAGGGGGTGACCC CATCTTATACCAACATTTATTT
000031113	MG42	9MG3	*Cheumatopsyche pasella*	adult female	USA: SC: Pickens Co.: Table Rock St. Park, Carrick Creek. 35.031348° N, 82.700056° W. Col. Genco 29-Jul-2016	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTG AACTTAGAACTCCAGGGTCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCTCATGCATT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATAT TAGGATCGCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCTTACCCCCCTCATTACTT CTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCAT CTAACCTATCTCATCTTGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAACTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCGTTTTATTACTCCTATCTCTCCCAGTTTTAGCTGGCG CAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCAGGAGGGGGGGATCC TATTTTATATCAACATTTATTT
000031117	MG46	9MG7	*Cheumatopsyche pasella*	adult male	USA: SC: Pickens Co.: Table Rock St. Park, Carrick Creek. 35.031348° N, 82.700056° W. Col. Genco 29-Jul-2016	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTG AACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATAT TAGGATCGCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCTTGCCCCCCTCATTACTT CTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCAT CTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCGTTTTATTACTCCTATCTCTCCCAGTTTTAGCTGGCG CAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCAGGAGGGGGGGATCC TATTTTATATCAACATTTATTT
000031119	MG48	9MG9	*Cheumatopsyche gyra*	adult	USA: SC: Pickens Co.: Table Rock St. Park, Carrick Creek. 35.031348° N, 82.700056° W. Col. Genco 29-Jul-2016	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTAGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACCCCAGGATCCTTAATTGGGAATGACCAAATTTATAACGTAATTGTTACTTCCCATGCATT TATTATAATTTTTTTCATAGTTATGCCCATTATAATTGGAGGGTTTGGAAACTGATTAGTTCCTTTAATAC TAGGATCACCAGATATAGCTTTCCCTCGAATAAATAACTTAAGATTTTGATTTTTACCCCCCTCACTTCTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGGACAGGTTGAACTGTTTACCCTCCTTTATCGT CTAATCTTTCTCATTTAGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCCATTAATTTCATCACTACATCCTTCAATATAAAAATTAATAAATTAAATTACGAAATCC TTCCCCTCTTTGTCTGATCAGTTGCTATTACCGCTGTTCTTCTTCTTTTATCCCTTCCTGTATTAGCCGGTG CAATTACTATATTATTAACAGATCGAAATTTAAATACATCTTTCTTTGACCCAGCTGGAGGGGGTGACCC CATCTTATACCAACATTTATTT

000031121	MG50	9MG11	*Cheumatopsyche pasella*	adult female	USA: SC: Pickens Co.: Table Rock St. Park, Carrick Creek. 35.031348° N, 82.700056° W. Col. Genco 29-Jul-2016	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATATTAGGATCGCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCTTGCCCCCCTCATTACTTCTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCATCTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAACTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCGTTTTATTACTCCTATCTCTCCCAGTTTTAGCTGGCGCAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGGGGGGATCCTATTTTATATCAACATTTATTT
000031122	MG51	9MG12	*Cheumatopsyche pasella*	adult female	USA: SC: Pickens Co.: Table Rock St. Park, Carrick Creek. 35.031348° N, 82.700056° W. Col. Genco 29-Jul-2016	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATATTAGGATCGCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCTTGCCCCCCTCATTACTTCTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCATCTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAACTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCGTTTTATTACTCCTATCTCTCCCAGTTTTAGCTGGCGCAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCAGGAGGGGGGGATCCTATTTTATATCAACATTTATTT
	MG65	10MG21	*Cheumatopsyche*	larva	USA: NC: Transylvania co.: Davidson River; 1st fishing pull-off on 276. 35.274397° N, 82.707892 ° W. Col. C. Wrege 5-Jan-2017	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTTGGATCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACTCCTGGATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACACGCATTTATTATAATTTTTTTTATAGTTATGCCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATATTAGGCTCACCAGACATAGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTCTAATTTTAAGAAGAATAATAAACTCAGGAGCTGGTACAGGTTGAACTGTTTACCCCCCTCTATCATCTAATTTATCCCACCTTGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTGTTCTCGCAGGCGCAATTACTATATTACTGACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCTGGAGGAGG-----??????????????????????
	MG87A	12MG7	*Cheumatopsyche pinaca*	adult female	USA: SC: Pickens Co.: Clemson Experimental Forest: Wildcat Creek, 34.7561° N, 82.8562° W. Col. Genco 29-Mar-2017	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGATCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACTCCTGGATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACATGCATTTATTATAATTTTTTTTATAGTTATGCCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATATTAGGCTCACCAGACATAGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTCTAATTTTAAGAAGAATAATAAACTCAGGAGCTGGTACAGGTTGAACTGTTTACCCCCCTCTATCATCTAATTTATCCCACCTTGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTATTCTCGCAGGCGCAATTACTATATTACTGACAGATCGTAATTTAAATACATCTTTTTTTGATCCAGCTGGAGGAGGAGATCCTATTTTATACCAACATTTATTT
000031037	MG88	13MG1	*Cheumatopsyche*	larva	?	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGGTCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCTCTATCATCTAATCTATCCCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCCTTTAATATAAAGATTAATAAATTAAATTATGAAATCCTTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTCCTATCCCTACCAGTTCTAGCTGGCGCAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCCTATTCTATACCAACATTTATTT
000031038	MG89	13MG2	*Cheumatopsyche*	larva	?	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGGTCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCTCTATCATCTAATCTATCCCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTCCTATCCCTACCAGTTCTAGCTGGCGCAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCCTATTC?????????????????

000031040	MG91	13MG4	*Cheumatopsyche pinaca*	adult female	USA: SC: Jackson Co.: Whitewater River. 35.018826, -82.996999. Col. C. Wrege 18-Mar-2017	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTTGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACTCCTGGATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACACGCATT TATTATAATTTTTTTTATAGTTATGCCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATAT TAGGCTCACCAGACATAGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTCTAATTTTAAGAAGAATAATAAACTCAGGAGCTGGTACAGGTTGAACTGTTTACCCCCCTCTATCAT CTAATTTATCCCACCTTGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTGTTCTCGCAGGCG CAATTACTATATTACTGACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCTGGAGGAGGAGATCC TATTTTATACCAACATTTATTT
000031042	MG93	13MG6	*Cheumatopsyche harwoodi*	adult female	USA: SC: Pickens Co.: Clemson Experimental Forest: Wildcat Creek, 34.7561° N, 82.8562° W. Col. Genco 29-Mar-2017	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTTGGGTCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACACCAGGGTCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTT TATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATAT TAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCTCTATCAT CTAATCTATCCCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCA ATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATCC TTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTCCTATCCCTACCAGTTCTAGCTGGCG CAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGC-- ???????????????????????????????????
000031043	MG94	14MG1	*Cheumatopsyche analis?*	adult female	USA: NC: Jackson co.: Balsam Mtn. Preserve. Dark Ridge Creek. 35.40213° N, 83.09045° W. Col. Genco & Morse 20-Jul-2016	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTAGGATCCTCTTTAAGATTCCTTATTCGAATTG AACTTAGAACTCCTGGGTCTTTAATTGGAAATGACCAAATTTATAATGTAATTGTCACTTCTCATGCATT TATTATAATTTTCTTTATAGTTATACCCATTATAATTGGAGGATTTGGAAATTGATTAGTTCCTTTAATAT TAGGATCCCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTTTTACCTCCTTCATTACTC CTTCTAATTTTAAGAAGAATAATAAATTCAGGGGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCAT CAAATCTATCTCACCTTGGAAGATCAGTAGATTTAACTATTTTCTCTCTTCATTTAGCTGGTATCTCATCA ATTCTAGGAGCAATTAACTTTATTACTACATCTTTTAACATAAAAATTAATAAATTAAATTATGAAATTC TTCCTCTCTTTGTTTGATCAGTAGCCATTACTGCCGTTCTACTTCTATTATCCCTGCCTGTTTTAGCCGGC GCAATTACTATATTACTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGGGGAGACC CTATTTTATATCAACATTTATTT
000031044	MG95	14MG2	*Cheumatopsyche harwoodi*	adult female	USA: NC: Jackson Co.: Balsam Mtn. Preserve, Dark Ridge Creek. 35.40213° N, 83.09045°. Col. Genco & Morse 20-Jul-2016	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACGCCAGGGTCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTT TATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATAT TAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTT CTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTCTACCCTCCTCTATCAT CTAATCTATCCCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCA ATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATCC TTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTCCTATCCCTACCAGTTCTAGCTGGCG CAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGGGGGGATCC TATTCTATACCAACATTTATTT
000031045	MG96	14MG3	*Cheumatopsyche pinaca*	adult female	USA: SC: Pickens Co.: Clemson Experimental Forest: Wildcat Creek, 34.7561° N, 82.8562° W. Col. Genco 29-Mar-2017	AACTCTTTATTTTATTTTCSGAATTTGATCAGGATTAGTTGGATCTTCTTTAAGATTTCTTATTCGAATTG AACTTAGAACTCCTGGATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACATGCATT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATAT TAGGTTCACCAGACATAGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCTCCCTCATTACTT CTTCTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCTCTATCAT CTAATTTATCCCACCTTGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCA ATTTTAGGAGCAATTAACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTC TTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTGTTCTCGCAGGCG CAATTACTATATTACTGACAGATCGTAATTTAAATACATCTTTTTTTGATCCAGCTGGAGGAGGAGATCC TATTTTATACCAACATTTATTT
	VN104	10VN7	*Cheumatopsyche zao*	adult male	VIETNAM: Cúc Phuöng National Park: Small 1st order cobble-bottom stream in woods near rice paddies of small village near Nghéo River. Elv. 107 m 20.3287°N, 105.5333°E Col. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	AACTCTATATTTTCTCTTTGGAATTTGATCTGGTTTAGTCGGTTCTTCTCTCAGATTCTTAATCCGAATTG AATTAAGAACCCCCGGTTCTTTAATTGGAAATGATCAAATCTATAATGTTATTGTTACTTCCCACGCTTTT ATTATAATTTTCTTTATAGTTATACCTATTATAATTGGTGGGTTTGGAAATTGATTAGTTCCCTTAATATT AGGATCTCCCGATATAGCCTTTCCTCGAATGAATAATTTAAGATTCTGATTTTTACCCCCTTCTATTATTT TATTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGAACAGGATGAACTGTTTACCCTCCCCTATCATC TAATTTATCTCATTTAGGAAGATCTGTCGACTTAACTATTTTTTCTCTTCATTTAGCAGGAATCTCCTCAA TCTTAGGAGCTATTAATTTTATCTCTACCTCCTTTAACATAAAAATTAATAAATTAAATTACGAAATTCTT CCCCTATTTGTATGATCCGTGGCAATCACAGCTGTTCTCTTACTTTTATCTCTCCCTGTTCTCGCCGGAGC AATCACTATGCTACTAACCGACCGAAATTTAAATACTTCCTTTTTTGACCCTGCAGGCGGGG???????????? ????????????????

	VN105	10VN8	*Cheumatopsyche zao*	adult male	VIETNAM: Cúc Phuöng National Park: Small 1st order cobble-bottom stream in woods near rice paddies of small village near Nghéo River. Elv. 107 m 20.3287°N, 105.5333°E Col. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	AACTCTATATTTTCTCTTTGGAATTTGATCTGGTTTAGTCGGTTCTTCTCTCAGATTCTTAATCCGAATTG AATTAAGAACCCCCGGTTCTTTAATTGGAAATGATCAAATCTATAATGTTATTGTTACTTCCCACGCTTTT ATTATAATTTTCTTTATAGTTATACCTATTATAATTGGTGGGTTTGGAAATTGATTAGTTCCCTTAATATT AGGATCTCCCGATATAGCCTTTCCTCGAATGAATAATTTAAGATTCTGATTTTTACCCCCTTCTATTATTT TATTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGAACAGGATGAACTGTTTACCCTCCCCTATCATC TAATTTATCTCATTTAGGAAGATCTGTCGACTTAACTATTTTTTCTCTTCATTTAGCAGGAATCTCCTCAA TCTTAGGAGCTATTAATTTTATCTCTACCTCCTTTAACATAAAAATTAATAAATTAAATTACGAAATTCTT CCCCTATTTGTATGATCCGTGGCAATCACAGCTGTTCTCTTACTTTTATCTCTCCCTGTTCTCGCCGGAGC AATCACTATGCTACTAACCGACCGAAATTTAAATACTTCCTTTTTTGACCCTGCAGGCGGGG???????????? ?????????????????
	VN106	10VN9	*Cheumatopsyche nr. doan*	adult male	VIETNAM: Bạch Mã National Park: Tributary to Pheasant Falls (tributary to Truoi River) Elv. 159 m 16.2287°N, 107.8486°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30Jun–3Jul 2017	AACACTATATTTCATATTTGGAATTTGATCAGGCCTTGTTGGCTCCTCTCTCAGATTTCTAATTCGAATTG AATTAAGAACACCTGGATCATTAATTGGAAATGATCAAATTTATAATGTAATTGTTACTTCTCATGCTTT TATTATAATTTTTTTTATGGTTATACCCATTATAATTGGAGGATTTGGAAACTGATTAGTACCATTAATAT TAGGATCCCCTGATATGGCCTTCCCTCGCATAAATAATTTAAGATTTTGATTTTTACCCCCATCCTTAATT CTCTTAATCTTAAGAAGAATAATAAATTCAGGAGCAGGTACAGGATGAACAGTCTATCCTCCCTTATCAT CAAACCTTTCTCATTTGGGAAGATCAGTAGACTTAACTATTTTTTCTCTTCATTTAGCTGGAATTTCTTCC ATTTTAGGAGCAATTAATTTTATTTCTACTTCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTCT TCCTTTATTTGTCTGATCTGTTGTAATTACTGCTATTCTTCTCCTTTTATCATTACCAGTCCTAGCTGGCGC AATTACAATACTATTAACTGATCGAAATTTAAACACATCATTTTTTGATCCTGCAGGAGGAGGAGATCC--- --?????????????????
	VN107	10VN10	*Hydromanicus nr. punctosalis*	adult male	VIETNAM: Cúc Phuöng National Park, small 1st order cobble-bottom stream in woods near rice paddies of small village near Nghéo River. Elv. 107 m. 20.3287°N, 105.5333°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	AACCTTATATTTTATTCTAGGAATTTGATCTGGTTTAATTGGATCCTCTTTAAGATTTATTATTCGAATAG AATTAAGAATTCCAGGAACTTTAATTGGTAATGATCAAATTTATAATGTTGTTGTTACTTCTCATGCATTT ATTATAATTTTCTTTATAGTAATACCTATCATAATTGGGGGATTTGGAAACTGATTAGTACCATTAATAC TAGGATCTCCAGATATAGCTTTCCCCCGAATAAATAATATAAGATTTTGATTTTTACCCCCTTCTTTAACA TTTTTAATTTTTAGAGGATTAATTAATTCAGGATCTGGGACAGGATGAACTGTTTATCCTCCTTTATCATC TAATCTTTCTCATATAGGTAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCCTCAA TTTTAGGGGCTATTAATTTTATTTCTACAATTATAAATATAAAATTTAATAACGTAAACTACGAAATAAT TCCCTTATTTGTTTGATCAGTTTTAATTACTGCCGTATTACTTCTTCTTTCACTACCAGTATTGGCTGGAG CCATTACAATATTATTAACTGACCGTAATTTAAATACCTCATTTTTTGACCCAGCTGGAGGAGGAGACCC AATTTTATATCAACATTTATTT
	VN108	10VN11	*Hydromanicus n. sp.*	adult male	VIETNAM: Bạch Mã National Park: Light trap at tributary to Pheasant Falls tributary to Truoi River)Elv. 159 m 16.2287°N, 107.8486°E .Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACTTTATATTTCCTTTTAGGTATTTGATCAGGACTTATCGGATCCTCACTCAGATTTATTATCCGAATGG AACTAAGAATCCCCGGAACTCTTATCGGCAATGATCAAATTTACAATGTTATTGTAACATCTCATGCTTT TATTATAATTTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAACTGACTAGTTCCTCTAATAT TAGGATCTCCAGACATAGCTTTCCCTCGTATAAATAATATAAGATTTTGATTTTTACCCCCTTCTCTCATA TTCTTAATTTTTAGTAGACTAATTAATTCAGGATCTGGAACAGGATGAACTGTTTACCCTCCACTATCCT CAAATCTTTCTCATATAGGAAGTTCAGTAGACATAACAATTTTCTCCCTTCACTTAGCTGGTATCTCATCT ATTCTAGGAGCAATCAATTTTATCTCAACAATTATAAATATAAAATTTAATAATGTAAATTTTGAAATAA TTCCCCTTTTTGTTTGATCTGTTCTAATTACAGCAATTCTTCTTCTTCTTTCTTTACCCGTTTTAGCAGGAG CCATCACTATACTACTAACAGATCGAAACTTAAATACATCTTTCTTTGATCCTGCAGGAGGGGGGGATCC TATTCTTTATCAACATTTATTT
	VN110	10VN13	*Hydromanicus n. sp.*	adult male	VIETNAM: Bạch Mã National Park: Light trap at tributary to Pheasant Falls tributary to Truoi River)Elv. 159 m 16.2287°N, 107.8486°E .Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACTTTATATTTCCTTTTAGGTATTTGATCAGGACTTATCGGATCCTCACTCAGATTTATTATCCGAATGG AACTAAGAATCCCCGGAACTCTTATCGGCAATGATCAAATTTACAATGTTATTGTAACATCTCATGCTTT TATTATAATTTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAACTGACTAGTTCCTCTAATAT TAGGATCTCCAGACATAGCTTTCCCTCGTATAAATAATATAAGATTTTGATTTTTACCCCCTTCTCTCATA TTCTTAATTTTTAGTAGACTAATTAATTCAGGATCTGGAACAGGATGAACTGTTTACCCTCCACTATCCT CAAATCTTTCTCATATAGGAAGTTCAGTAGACATAACAATTTTCTCCCTTCACTTAGCTGGTATCTCATCT ATTCTAGGAGCAATCAATTTTATCTCAACAATTATAAATATAAAATTTAATAATGTAAATTTTGAAATAA TTCCCCTTTTTGTTTGATCTGTTCTAATTACAGCAATTCTTCTTCTTCTTTCTTTACCCGTTTTAGCAGGAG CCATCACTATACTACTAACAGATCGAAACTTAAATACATCTTTCTTTGATCCTGCAGGAGGGGGGGATCC TATTCTTTATCAACATTTATTT
	VN111	10VN14	*Hydromanicus n. sp.*	adult male	VIETNAM: Bạch Mã National Park: Light trap at tributary to Pheasant Falls tributary to Truoi River)Elv. 159 m 16.2287°N, 107.8486°E .Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACTTTATATTTCCTTTTAGGTATTTGATCAGGACTTATCGGATCCTCACTCAGATTTATTATCCGAATGG AACTAAGAATCCCCGGAACTCTTATCGGCAATGATCAAATTTACAATGTTATTGTAACATCTCATGCTTT TATTATAATTTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAACTGACTAGTTCCTCTAATAT TAGGATCTCCAGACATAGCTTTCCCTCGTATAAATAATATAAGATTTTGATTTTTACCCCCTTCTCTCATA TTCTTAATTTTTAGTAGACTAATTAATTCAGGATCTGGAACAGGATGAACTGTTTACCCTCCACTATCCT CAAATCTTTCTCATATAGGAAGTTCAGTAGACATAACAATTTTCTCCCTTCACTTAGCTGGTATCTCATCT ATTCTAGGAGCAATCAATTTTATCTCAACAATTATAAATATAAAATTTAATAATGTAAATTTTGAAATAA TTCCCCTTTTTGTTTGATCTGTTCTAATTACAGCAATTCTTCTTCTTCTTTCTTTACCCGTTTTAGCAGGAG CCATCACTATACTACTAACAGATCGAAACTTAAATACATCTTTCTTTGATCCTGCAGGAGGGGGGGATCC TATTCTTTATCAACATTTATTT
	VN116	10VN19	*Cheumatopsyche pinaca*	larva	VIETNAM: Cúc Phuöng National Park: Small 1st order cobble-bottom stream in woods near rice paddies of small village near Nghéo River. Elv. 107 m 20.3287°N, 105.5333°E Col. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	

	VN119	10VN22	*Hydromanicus*	larva	VIETNAM: Bạch Mã National Park: Tributary along trail to Pheasant Falls (tributary to Truoi River) Elv. 159 m 16.2287°N, 107.8486°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACTTTATATTTCCTTTTAGGTATTTGATCAGGACTTATCGGATCCTCACTCAGATTTATTATCCGAATGG AACTAAGAATCCCCGGAACTCTTATCGGCAATGATCAAATTTACAATGTTATTGTAACATCTCATGCTTT CATTATAATTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAACTGACTAGTTCCTCTAATAT TAGGATCTCCAGACATAGCTTTCCCTCGTATAAATAATATAAGATTTTGATTTTTACCCCCTTCTCTCATA TTCTTAATTTTTAGTAGACTAATTAATTCAGGATCTGGAACAGGATGAACTGTTTACCCTCCACTATCCT CAAATCTTTCTCATATAGGAAGTTCAGTAGACATAACAATTTTCTCCCTTCACTTAGCTGGTATCTCATCT ATTCTAGGAGCAATCAATTTTATCTCAACAATTATAAATATAAAATTTAATAATGTAAATTTTGAAATAA TTCCCCTTTTTGTTTGATCTGTTCTAATTACAGCAATTCTTCTTCTTCTTTCTTTACCCGTTTTAGCAGGAG CCATCACTATACTACTAACAGATCGAAACTTAAATACATCTTTCTTTGATCCTGCAGGAGGGGGGGATCC TATTCTTTATCAACATTTATTT
	VN120	10VN23	*Hydromanicus*	larva	VIETNAM: Bạch Mã National Park: Tributary along trail to Pheasant Falls (tributary to Truoi River) Elv. 159 m 16.2287°N, 107.8486°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACCTTATATTTTATATTAGGTATTTGATCCGGCCTAATTGGCTCCTCATTAAGATTTATTATTCGTATAG AATTAAGAATCCCAGGAACATTAATTGGAAATGACCAAATCTATAATGTTATTGTAACCTCTCATGCCTT TATTATAATTTTCTTTATAGTTATACCAATTATAATTGGAGGATTTGGTAATTGATTAGTCCCATTAATGT TAGGATCTCCTGATATAGCTTTCCCACGTATAAATAACATAAGATTTTGATTTTTACCCCCCTCATTAAC ATTTTTAATTTTTAGAAGATTAATCAATTCAGGATCAGGTACAGGATGAACAGTATACCCCCCACTTTCC TCTAATTTATCTCATATAGGAAGATCCGTTGACATGACTATTTTTTCTCTACATTTAGCTGGAATCTCATC TATTTTAGGGGCCATTAATTTCATTTCTACAATTATAAATATAAAATTTAATAATATTAATTATGAAATA ATTCCTCTTTTTGTATGATCAGTACTTATTACTGCTGTTCTTCTATTACTTTCATTACCAGTTCTTGCTGGA GCCATTACAATATTACTTACTGATCGCAATTTAAATACCTCTTTCTTTGACCCAGCAGGGGGAGGAGATC CTATTCTATATCAACATTTATTT
	VN121	10VN24	*Hydropsyche*	larva	VIETNAM: Bạch Mã National Park: Tributary along trail to Pheasant Falls (tributary to Truoi River) Elv. 159 m 16.2287°N, 107.8486°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACTTTATATTTCCTTTTAGGTATTTGATCAGGACTTATCGGATCCTCACTCAGATTTATTATCCGAATGG AACTAAGAATCCCCGGAACTCTTATCGGCAATGATCAAATTTACAATGTTATTGTAACATCTCATGCTTT TATTATAATTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAACTGACTAGTTCCTCTAATAT TAGGATCTCCAGACATAGCTTTCCCTCGTATAAATAATATAAGATTTTGATTTTTACCCCCTTCTCTCATA TTCTTAATTTTTAGTAGACTAATTAATTCAGGATCTGGAACAGGATGAACTGTTTACCCTCCACTATCCT CAAATCTTTCTCATATAGGAAGTTCAGTAGACATAACAATTTTCTCCCTTCACTTAGCTGGTATCTCATCT ATTCTAGGAGCAATCAATTTTATCTCAACAATTATAAATATAAAATTTAATAATGTAAATTTTGAAATAA TTCCCCTTTTTGTTTGATCTGTTCTAATTACAGCAATTCTTCTTCTTCTTTCTTTACCCGTTTTAGCAGGAG CCATCACTATACTACTAACAGATCGAAACTTAAATACATCTTTCTTTGATCCTGCAGGAGGGGGGGATC? ??????????????????????
	VN123	11VN5	*Diplectrona*	larva	VIETNAM: Cúc Phuöng National Park: Lang La Stream: small grassy-bottomed 1st order stream, 20.2941°N, 105.7059°E Elv. 49 m. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Tô T.H.Y., Nguyễn V.H. 24-Jun-2017	TACCCTTTATTTCATCCTAGGAATCTGATCTGGCCTTATTGGTTCATCGTTAAGACTCATTATCCGAACTG AACTCAGAAGACCAGGATTTTTCATCGGAAATGATCAAATCTATAACGTAATCGTTACAGCACACGCTT TCATCATAATTTTCTTTATAGTAATACCAATTATGATCGGTGGATTTGGAAATTGGTTAGTCCCCCTAAT ACTTGGATCACCCGACATAGCTTTCCCACGAATAAATAATATAAGGTTTTGATTCCTCCCCCCCTCACTC TCTCTTTTAATCTCAAGAAGACTTATTAACTCAGGAGCCGGGACTGGTTGAACAGTGTACCCACCCCTTT CATCCAATCTGTCACATCTCGGATCCTCAGTGGATTTAACAATTTTCTCTCTTCACCTGGCTGGAATTTCA TCCATTTTGGGAGCTGTAAACTTTATCACTACCATCTTAAATATAAAATTCTTCAACTTAAATTATGACA TAATTCCTCTATTCGTTTGATCAGTTCTAATTACAGCAGTTCTTTTACTTCTATCTCTCCCAGTTCTGGCTG GAGCTATTACTATACTACTTACAGATCGCAATTTAAATAC-- ??
	VN13	4VN5	*Macrostemum nr. Fastasum*	adult male	VIETNAM: Bạch Mã National Park: Hoãng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	AACCTTATACTTTATTTTTGGAATTTGATCAGGTATATTAGGTTCAACTCTAAGTTTAATTATTCGCATTG AATTAAGAACCCCTAATACTCTTATTGGTAATGATCAACTTTATAATGTAATTGTTACAGCTCATGCATT CATTATAATTTTCTTTATAGTTATACCAATCATAATCGGAGGATTTGGAAATTGATTAATTCCTCTTATAT TAGGAGCTCCTGATATAGCATTCCCTCGAATAAATAACATAAGATTTTGACTTTTACCCCCATCTTTAAC ATTTCTAATTTTTAGAAGTATTATTAATAATGGAGCAGGCACAGGATGAACAGTTTACCCTCCTCTCTCC TCTAACTTATCCCATATAGGTAGATCTGTAGACTTAACTATTTTTTCCCTTCATCTTGCAGGTATTTCCTC AATTCTAGGAGCTATCAATTTTATTACAACTATTTTAAATATAAAAATTAATAACTTAAACATTGACAAA CTACCTCTATTTATTTGATCTATTTTTATCACCACAATTTTACTTCTTCTTTCTTTACCTGTTCTAGCAGGA GCTATTACTATATTATTAACAGACCGTAACCTTAATACATCATTTTTTGATCCTGCTGGAGGGGGGGACC CT----?????????????????
	VN14	2VN6	*Macrostemum nr. Fastasum*	adult male	VIETNAM: Bạch Mã National Park: Hoãng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	AACCTTATACTTTATTTTTGGAATTTGATCAGGTATATTAGGTTCAACTCTAAGTTTAATTATTCGCATTG AATTAAGAACCCCTAATACTCTTATTGGTAATGATCAACTTTATAATGTAATTGTTACAGCTCATGCATT CATTATAATTTTCTTTATAGTTATACCAATCATAATCGGAGGATTTGGAAATTGATTAATTCCTCTTATAT TAGGAGCTCCTGATATAGCATTCCCTCGAATAAATAACATAAGATTTTGACTTTTACCCCCATCTTTAAC ATTTCTAATTTTTAGAAGTATTATTAATAATGGAGCAGGCACAGGATGAACAGTTTACCCTCCTCTCTCC TCTAACTTATCCCATATAGGTAGATCTGTAGACTTAACTATTTTTTCCCTTCATCTTGCAGGTATTTCCTC AATTCTAGGAGCTATCAATTTTATTACAACTATTTTAAATATAAAAATTAATAACTTAAACATTGACAAA CTACCTCTATTTATTTGATCTATTTTTATCACCACAATTTTACTTCTTCTTTCTTTACCTGTTCTAGCAGGA GCTATTACTATATTATTAACAGACCGTAACCTTAATACATCATTTTTTGATCCTGCTGGAGGGGGGGACC CTATTT?????????????????
	VN14	4VN6	*Macrostemum nr. Fastasum*	adult male	VIETNAM: Bạch Mã National Park: Hoãng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	

	VN15	4VN7	*Chimarra*	larva	VIETNAM: Bạch Mã National Park: Hoãng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	AACCTTATACTTCATTTTTGGGCTATGATCAAGAATACTAGGCCTATCATTAAGAATACTAATTCGATTA GAATTAAGAACACCAGGAGCTTTAATTGGAAATGATCAAATTTTTAACTCTATTGTTACCGCTCACGCTT TTATTATAATTTTCTTCATAGTTATACCTATCATAATTGGAGGATTTGGGAACTGATTAGTTCCCTTAATA TTAGGGGCCCCTGATATAGCCTTCCCTCGAATAAACAATATAAGATTTTGATTCCTACCTCCCTCTCTTTT TTTCCTTTTATTTGGTATACTTATAGATAACGGGGCAGGAACAGGGTGAACAGTTTACCCTCCTCTATCA GCAAATATCTCTCATATAGGAAAAGCTGTAGATTTAACAATTTTTAGTTTACATTTAGCAGGAATCTCTT CAATTTTAGGAGCTGTAAACTTTATTTCAACTATTATTAATATACGATTAAATTTTATAATATTAGACCA ACTTCCTCTTTTCACTTGATCAGTAATTATTACAGCAATTCTATTACTCCTTTCTCTCCCTGTTTTAGCTGG GGCCATCACTATACTATTAACTGATCGAAATATAAACACCTCATTTTTTGACCCTGCAGGAGGGGGAGA CCCAAT--?????????????????
	VN16	4VN8	*Chimarra*	larva	VIETNAM: Bạch Mã National Park: Hoãng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	AACTTTATATTTTATTTTTGGTCTTTGATCTAGAATACTAGGTCTATCCTTAAGAATATTAATTCGTCTAG AATTAAGAACCCCTGGAGCTTTAATTGGAAATGATCAAATTTTCAATTCAATTGTGACTGCTCACGCTTT CATTATAATTTTTTTCATAGTAATACCAATTATAATCGGAGGATTTGGAAATTGACTAGTACCCTTAATA CTAGGAGCCCCCGATATGGCCTTCCCTCGAATAAATAACATAAGATTCTGATTCCTCCCCCCCTCACTAT TTTTTCTCTTATTTGGTATATTAATAGATAACGGGGCTGGAACTGGGTGAACAGTATACCCTCCTTTATC AGCTAATATTTCTCATATAGGAAAGGCAGTAGATCTAACTATTTTCTCTCTCCATCTAGCTGGAATCTCC TCAATTTTAGGGGCTGTAAATTTTATTTCTACTATTCTCAATATACGACTTAATTTCATAATATTAGATCA ACTACCTCTATTTACATGATCAGTAATCATCACCGCTATCCTACTATTACTTTCTTTACCTGTTCTTGCAG GTGCTATCACTATACTTTTAACAGATCGAAATATTAACACCTCATTCTTTGACCCCGCTGGAGGGGGGGA CCCCATCCTATACCAACACTTATTC
	VN17	4VN9	*Chimarra*	larva	VIETNAM: Bạch Mã National Park: Hoãng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	AACTTTATATTTTATTTTTGGTCTTTGATCTAGAATACTAGGTCTATCCTTAAGAATATTAATTCGTCTAG AATTAAGAACCCCTGGAGCTTTAATTGGAAATGATCAAATTTTCAATTCAATTGTGACTGCTCACGCTTT CATTATAATTTTTTTCATAGTAATACCAATTATAATCGGAGGATTTGGAAACTGACTAGTACCCTTAATA CTAGGAGCCCCCGATATGGCCTTCCCTCGAATAAATAACATAAGATTCTGATTCCTCCCCCCCTCACTAT TTTTTCTCTTATTTGGTATATTAATAGATAACGGGGCTGGAACTGGGTGAACAGTATACCCTCCTTTATC AGCTAATATTTCTCATATAGGAAAGGCAGTAGATCTAACTATTTTCTCTCTCCATCTAGCTGGAATCTCC TCAATTTTAGGGGCTGTAAATTTTATTTCTACTATTCTCAATATACGACTTAATTTCATAATATTAGATCA ACTACCTCTATTTACATGATCAGTAATCATCACCGCTATCCTACTATTACTTTCTCTACCTGTTCTTGCAG GTGCTATCACTATACTTTTAACAGATCGAAATATTAACACCTCATTCTTTGACCCCGCTGGAGGGGGAGA CCCCATCCTATACCAACACTTATTC
	VN21	5VN1	*Pseudoleptonema*	larva	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AACTTTATATTTCATTTTTGGTATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAATT GAACTATCCTCTCCCTTTAGAATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCAT TTATTATAATTTTTTTTATAGTAATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAATA TTAGGCGCTCCTGACATGGCATTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTAA TTTTTCTTACTATCAGAAGATTAACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTATC TTCTAATTTATCTCATAGAGGTAGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCTT CTATTTTAGGAGCAATTAATTTTATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAA ACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGG AGCAATTACTATATTACTAACCGATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGAT CCTATTTTATATCAACATTTATTT
	VN22	5VN2	*Pseudoleptonema*	larva	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AACTTTATATTTCATTTTTGGTATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAATT GAACTATCCTCTCCCTTTAGAATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCAT TTATTATAATTTTTTTTATAGTAATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAATA TTAGGCGCTCCTGACATGGCATTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTAA TTTTTCTTTCTATCAGAAGATTAACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTATC TTCTAATTTATCTCATAGAGGTAGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCTT CTATTTTAGGAGCAATTAATTTTATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAA ACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGG AGCAATTACTATATTACTAACCGATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGAT CCTATTTTATATCAACATTTATTT
	VN23	5VN3	*Pseudoleptonema*	larva	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AACTTTATATTTCATTTTTGGTATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAATT GAACTATCCTCTCCCTTTAGAATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCAT TTATTATAATTTTTTTTATAGTAATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAATA TTAGGTGCTCCTGACATGGCATTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTAA TTTTTCTTACTATCAGAAGATTAACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTATC TTCTAATTTATCTCATAGAGGTAGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCTT CTATTTTAGGAGCAATTAATTTTATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAA ACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGG AGCAATTACTATATTACTAACCGATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGAT CCTATTTTATATCAACATTTA?TT

	VN24	5VN4	*Pseudoleptonema*	larva	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AACTTTATATTTCATTTTTGGTATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAATT GAACTATCCTCTCCCTTTAGAATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCAT TTATTATAATTTTTTTTATAGTAATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAATA TTAGGCGCTCCTGACATGGCATTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTAA TTTTTCTTTCTATCAGAAGATTAACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTATC TTCTAATTTATCTCATAGAGGTAGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCTT CTATTTTAGGAGCAATTAATTTTATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAA ACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGG AGCAATTACTATATTACTAACCGATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGAT CCTATTTTATATCAACATTTATTT
	VN25	5VN5	*Pseudoleptonema quinquefuscitatum*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	TATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAATTGAACTATCCTCTCCCTTTAGA ATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCATTTATTATAATTTTTTTTATAGT AATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAATATTAGGCGCTCCTGACATGGCA TTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTAATTTTTCTTTCTATCAGAAGATT AACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTATCTTCTAATTTATCTCATAGAGGT AGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCTTCTATTTTAGGAGCAATTAATTT TATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAAACTTCCTTTATTTGTTTGATCTG TTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGGAGCAATTACTATATTACTAACC GATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGATCCTATTTTATATCAACATTTAT TT
	VN26	5VN6	*Pseudoleptonema quinquefuscitatum*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	GAACTTTATATTTCATTTTTGGTATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAAT TGAACTATCCTCTCCCTTTAGAATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCA TTTATTATAATTTTTTTTATAGTAATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAAT ATTAGGCGCTCCTGACATGGCATTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTA ATTTTTCTTTCTATCAGAAGATTAACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTAT CTTCTAATTTATCTCATAGAGGTAGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCT TCTATTTTAGGAGCAATTAATTTTATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAA ACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGG AGCAATTACTATATTACTAACCGATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGAT CCT----?????????????????
	VN27	5VN7	*Pseudoleptonema quinquefuscitatum*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AACTTTATATTTCATTTTTGGTATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAATT GAACTATCCTCTCCCTTTAGAATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCAT TTATTATAATTTTTTTTATAGTAATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAATA TTAGGTGCTCCTGACATGGCATTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTAA TTTTTCTTACTATCAGAAGATTAACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTATC TTCTAATTTATCTCATAGAGGTAGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCTT CTATTTTAGGAGCAATTAATTTTATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAA ACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGG AGCAATTACTATATTACTAACCGATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGAT CCTATTTTATATCAACATTTATTT
	VN28	5VN8	*Pseudoleptonema quinquefuscitatum*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AACTTTATATTTCATTTTTGGTATCTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGAATT GAACTATCCTCTCCCTTTAGAATAATTGGTAATGATCAAATTTATAATGTAACAGTTACAGCCCATGCAT TTATTATAATTTTTTTTATAGTAATACCAATCATAATTGGAGGATTTGGAAATTGACTTGTTCCTTTAATA TTAGGCGCTCCTGACATGGCATTCCCACGAATAAATAATATAAGATTTTGATTACTACCTCCTTCATTAA TTTTTCTTTCTATCAGAAGATTAACTAATATAGGAGCAGGAACAGGATGAACAGTTTACCCTCCTTTATC TTCTAATTTATCTCATAGAGGTAGAGCTGTAGATTTAACAATCTTTTCTTTACATCTTGCAGGTATCTCTT CTATTTTAGGAGCAATTAATTTTATTTCAACAATTTTAAATATAAAAATCTTTAATTTAACTTCAGACAA ACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTACTTTCTCTTCCAGTTCTTGCAGG AGCAATTACTATATTACTAACCGATCGAAATTTAAATACTTCTTTTTTTGACCCAGCAGGAGGAGGAGAT CCTATTTTATATCAACATTTATTT
	VN29	5VN9	*Hydromanicus chattrakan*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	TACACTTTATTTTATTTTTGGAATTTGATCAGGATTAATTGGGTCTTCACTAAGATTCTTAATTCGCATAG AACTAAGAATTCCAGGGACATTAATTGGAAATGATCAAATTTATAACGTAATCGTAACTTCCCATGCTTT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTTGGTAATTGACTAGTCCCTCTCATAT TAGGATCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTCCTGCCTCCTTCATTAAT TTTCTTAATCTTTAGAAGACTTCTAAATTCAGGAGCTGGAACAGGATGAACAGTCTATCCACCCTTATCC TCAAATCTCTCACATCTAGGAAGATCTGTTGACATAACAATTTTTTCTCTCCATCTTGCGGGTATTTCCTC CATTCTAGGAGCTATTAATTTTATTTCTACTATTATAAATATAAAATTTAAAAATTTAAATTACGAAATA ATACCCTTATTTGTTTGATCTGTTTTAATTACTGCAGTTCTTTTACTCTTATCTTTACCAGTCTTAGCTGGG GCAATTACTATGCTTTTAACAGACCGAAATCTTAATACATCCTTCTTTGACCCAGCAGGAGGGGGAGAC CCAATTCTTTATCAACATTTATTC

	VN3	1VN3	*Hydromanicus*	larva	VIETNAM: Bạch Mã National Park: Tributary along trail to Pheasant Falls (tributary to Truoi River) Elv. 159 m 16.2287°N, 107.8486°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACTTTATATTTCCTTTTAGGTATTTGATCAGGACTTATCGGATCCTCACTCAGATTTATTATCCGAATGG AACTAAGAATCCCCGGAACTCTTATCGGCAATGATCAAATTTACAATGTTATTGTAACATCTCATGCTTT TATTATAATTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAACTGACTAGTTCCTCTAATAT TAGGATCTCCAGACATAGCTTTCCCTCGTATAAATAATATAAGATTTTGATTTTTACCCCCTTCTCTCATA TTCTTAATTTTTAGTAGACTAATTAATTCAGGATCTGGAACAGGATGAACTGTTTACCCTCCACTATCCT CAAATCTTTCTCATATAGGAAGTTCAGTAGACATAACAATTTTCTCCCTTCACTTAGCTGGTATCTCATCT ATTCTAGGAGCAATCAATTTTATCTCAACAATTATAAATATAAAATTTAATAATGTAAATTTTGAAATAA TTCCCCTTTTTGTTTGATCTGTTCTAATTACAGCAATTCTTCTTCTTCTTTCTTTACCCGTTTTAGCAGGAG CCATCACTATACTACTAACAGATCGAAACTTAAATACATCTTTCTTTGATCCTGCAGGAGGGGGGGATCC TATTCTTTATCAACATTTATTT
	VN30	5VN10	*Hydromanicus chattrakan*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	TACACTTTATTTTATTTTTGGAATTTGATCAGGATTAATTGGGTCTTCACTAAGATTCTTAATTCGCATAG AACTAAGAATTCCAGGGACATTAATTGGAAATGATCAAATTTATAACGTAATCGTAACTTCCCATGCTTT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTTGGTAATTGACTAGTTCCTCTCATAT TAGGATCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTCCTGCCTCCTTCATTAAT TTTCTTAATCTTTAGAAGACTTCTAAATTCAGGAGCTGGAACAGGATGAACAGTCTATCCACCCTTATCC TCAAATCTCTCACATCTAGGAAGATCTGTTGACATAACAATTTTTTCTCTCCATCTTGCGGGTATTTCCTC CATTCTAGGAGCTATTAATTTTATTTCTACTATTATAAATATAAAATTTAAAAATTTAAATTACGAAATA ATACCCTTATTTGTTTGATCTGTTTTAATTACTGCAGTTCTTTTACTCTTATCTTTACCAGTCTTAGCTGGG GCAATTACTATGCTTTTAACAGACCGAAATCTTAATACATCCTTCTTTGACCCAGCAGGAGGGGGGGAC CCAAT--?????????????????
	VN31	5VN11	*Hydromanicus chattrakan*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	TACACTTTATTTTATTTTTGGAATTTGATCAGGATTAATTGGGTCTTCACTAAGATTCTTAATTCGCATAG AACTAAGAATTCCAGGGACATTAATTGGAAATGATCAAATTTATAACGTAATCGTAACTTCCCATGCTTT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTTGGTAATTGACTAGTCCCTCTCATAT TAGGATCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTCCTGCCTCCTTCATTAAT TTTCTTAATCTTTAGAAGACTTCTAAATTCAGGAGCTGGAACAGGATGAACAGTCTATCCACCCTTATCC TCAAATCTCTCACATCTAGGAAGATCTGTTGACATAACAATTTTTTCTCTCCATCTTGCGGGTATTTCCTC CATTCTAGGAGCTATTAATTTTATTTCTACTATTATAAATATAAAATTTAAAAATTTAAATTACGAAATA ATACCCTTATTTGTTTGATCTGTTTTAATTACTGCAGTTCTTTTACTCTTATCTTTACCAGTCTTAGCTGGG GCAATTACTATGCTTTTAACAGACCGAAATCTTAATACATCCTTCTTTGACCCAGCAGGAGGGGGAGAC CCAATTCTTTATCAACATTTATTC
	VN32	5VN12	*Hydromanicus chattrakan*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	TACACTTTATTTTATTTTTGGAATTTGATCAGGATTAATTGGGTCTTCACTAAGATTCTTAATTCGCATAG AACTAAGAATTCCAGGGACATTAATTGGAAATGATCAAATTTATAACGTAATCGTAACTTCCCATGCTTT TATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTTGGTAATTGACTAGTCCCTCTCATAT TAGGATCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTCCTGCCTCCTTCATTAAT TTTCTTAATCTTTAGAAGACTTCTAAATTCAGGAGCTGGAACAGGATGAACAGTCTATCCACCCTTATCC TCAAATCTCTCACATCTAGGAAGATCTGTTGACATAACAATTTTTTCTCTCCATCTTGCGGGTATTTCCTC CATTCTAGGAGCTATTAATTTTATTTCTACTATTATAAATATAAAATTTAAAAATTTAAATTACGAAATA ATACCCTTATTTGTTTGATCTGTTTTAATTACTGCAGTTCTTTTACTCTTATCTTTACCAGTCTTAGCTGGG GCAATTACTATGCTTTTAACAGACCGAAATCTTAATACATCCTTCTTTGACCCAGCAGGAGGGGGAGAC CCAATTCTTTATCAACATTTATTC
	VN33	6VN1	*Ecnomus n. nr. totiio*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AATTCTTTATTTTATCTTTGGAATTTGATCCAGATTAGTAGGATCTTCCTTAAGAATAATTATTCGAATAG AACTTAGATCCCCAAATTTAATAATTATAAATGATCAAATTTATAATTCAATTATTACAATTCATGCATT TATTATAATTTTTTTTATAATTATACCAATTATAATTGGAGGTTTTGGAAATTGATTAGTACCATTAATAT TAGGAGCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTATTACCTCCATCATTAAC ATTTTTAATCTCAAGAATATTTATAGATAATGGATTAGGTACAGGATGAACAGTATACCCCCCACTATCT AATTATAATTATCATTTAGGTAAAGCTGTTGATATCTCAATTTTTTCATTACACTTAGCTGGAATTTCATC AATTTTAGGAGCAATTAATTTTATTTCAACTATTATAAATATAAAAATTAAATTTATTTCATTAAATTTAA TTCCATTATTTGTTTGATCTATTAAAATTACAGCAATTTTATTACTTTTATCCCTACCAGTATTAGCAGGT GCAATTACTATACTTCTTACTGATCGAAATTTAAATACTTCATTTTTTGAACCAGCAGGMGGAGGTGACC CAATTCTTTATCAACATTTATTT
	VN34	6VN2	*Ecnomus n. nr. totiio*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AATTCTTTATTTTATCTTTGGAATTTGATCCAGATTAGTAGGATCTTCCTTAAGAATAATTATTCGAATAG AACTTAGATCCCCAAATTTAATAATTATAAATGATCAAATTTATAATTCAATTATTACAATTCATGCATT TATTATAATTTTTTTTATAATTATACCAATTATAATTGGAGGTTTTGGAAATTGATTAGTACCATTAATAT TAGGAGCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTATTACCTCCATCATTAAC ATTTTTAATCTCAAGAATATTTATAGATAATGGATTAGGTACAGGATGAACAGTATACCCCCCACTATCT AATTATAATTATCATTTAGGTAAAGCTGTTGATATCTCAATTTTTTCATTACACTTAGCTGGAATTTCATC AATTTTAGGAGCAATTAATTTTATTTCAACTATTATAAATATAAAAATTAAATTTATTTCATTAAATTTAA TTCCATTATTTGTTTGATCTATTAAAATTACAGCAATTTTATTACTTTTATCCCTACCAGTATTAGCAGGT GCAATTACTATACTTCTTACTGATCGAAATTTAAATACTTCATTTTTT---- ??

	VN36	6VN4	*Ecnomus n. nr. pseudotenellus*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AATTCTATATTTTATCTTTGGAATTTGAGCAAGAATAGTAGGCTCATCACTAAGAATAATTATCCGAATA GAATTAAGATCCCCAAATTCAATAATTGGAAATGATCAAATTTATAATTCAATTATTACAATTCATGCAT TCATTATAATTTTTTTTATAATTATACCAATTATAATTGGAGGATTTGGAAACTGATTAGTTCCTCTAATA CTAGGAGCACCAGATATAGCATTTCCACGAATAAATAACATAAGATTTTGACTTTTACCTCCATCATTAA CATTTCTATTATCAAGCATATTTATAGATAATAGAATAGGAACAGGATGAACAGTTTACCCACCCTTATC AAATTATGATTTTCACCTAGGAAAAGCAGTAGATATTTCAATTTTTTCATTACATTTAGCTGGAATTTCTT CAATCCTAGGAGCAATCAACTTTATCTCAACTATTATAAATATAAAATTTAAATTTATTTCAATAAACTT CATTCCACTATTTGTTTGATCAATTAAAATTACAGCAATTCTACTATTATTATCACTTCCAGTTCTAGCTG GAGCAATTACTATATTATTAACAGATCGAAATTTAAATACTTCATTTTTCGAACCAGCTGGAGGAGGAG ACCCAATTTTATAT-AACATCTATTT
	VN37	6VN5	*Ecnomus n. nr. pseudotenellus*	adult male	VIETNAM: Bạch Mã National Park: Thuy diên Waterfall. Elv. 31 m, 16.2653°N, 107.8703°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 2-Jul-2017	AATTCTATATTTTATCTTTGGAATTTGAGCAAGAATAGTAGGCTCATCACTAAGAATAATTATCCGAATA GAATTAAGATCCCCAAATTCAATAATTGGAAATGATCAAATTTATAATTCAATTATTACAATTCATGCAT TCATTATAATTTTTTTTATAATTATACCAATTATAATTGGAGGATTTGGAAACTGATTAGTTCCTCTAATA CTAGGAGCACCAGATATAGCATTTCCACGAATAAATAACATAAGATTTTGACTTTTACCTCCATCATTAA CATTTCTATTATCAAGCATATTTATAGATAATAGAATAGGAACAGGATGAACAGTTTATCCACCCTTATC AAATTATGATTTTCACCTAGGAAAAGCAGTAGATATTTCAATTTTTTCATTACATTTAGCTGGAATTTCTT CAATCCTAGGAGCAATCAACTTTATCTCAACTATTATAAATATAAAATTTAAATTTATTTCAATAAACTT CATTCCACTATTTGTTTGATCAATTAAAATTACAGCAATTCTACTATTATTATCACTTCCAGTTCTAGCTG GAGCAATTACTATATTATTAACAGATCGAAATTTAAATACTTCATTTTTCGAACCAGCTGGAGGAGGAG ACCCAATTTT-----???????????
	VN39	6VN7	*Ecnomus*	larva	VIETNAM: Cúc Phuöng National : Bub'i River, just upstream of bridge Elv. 14 m. 20.3902°N, 105.5168°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	AACACTATACTTCATACTAGGAATCTGATCTAGATTAATTGGAACTTCACTAAGAATAATAATTCGACTC GAACTAAGAATCCCAGGATCGTTTTATAATAATGAACAACTTTATAACTCCATAGTTACAATCCACGCAT TCATTATAATTTTTTTCATAATTATACCAATTATAATTGGAGGATTTGGAAACTGAATAGTACCATTAAT AATAGGATCACCAGACATAGCTTTCCCACGAATAAATAATCTTAGATTCTGACTCCTACCCCCATCCCTA TTTTTCTTAATTTCAAGTATATTCATAAATAATAGATTAGGTACAGGATGAACAATATACCCCCCACTAT CAAATAATTTATTCCATAGAGGAAAATCAGTAGACATAGCCATCTTCTCCTTACACCTAGCAGGAATTTC ATCAATCCTAGGAGCCATTAACTTTATCTCAACAATCCTGAATATAAAACTCAAATCCTTACCCCTCAAC AACCTAACTCTATTTTCCTGATCAATTATAATTACAGCAATCCTATTACTATTATCCCTTCCCGTTCTTGC CGGAGCAATTACTATAGTACTAACAGACCGAAACATAAATACATCATTCTTCAATCCCATAGGAGGAGG AGATCCTTTACTATTCCAACACCTATTC
	VN4	1VN4	*Hydromanicus*	larva	VIETNAM: Bạch Mã National Park: Tributary along trail to Pheasant Falls (tributary to Truoi River) Elv. 159 m 16.2287°N, 107.8486°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh D.H., Nguyễn V.H. 30-Jun-2017	AACTTTATATTTCCTTTTAGGTATTTGATCAGGACTTATCGGATCCTCACTCAGATTTATTATCCGAATGG AACTAAGAATCCCCGGAACTCTTATCGGCAATGATCAAATTTACAATGTTATTGTAACATCTCATGCTTT TATTATAATTTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAACTGACTAGTTCCTCTAATAT TAGGATCTCCAGACATAGCTTTCCCTCGTATAAATAATATAAGATTTTGATTTTTACCCCCTTCTCTCATA TTCTTAATTTTTAGTAGACTAATTAATTCAGGATCTGGAACAGGATGAACTGTTTACCCTCCACTATCCT CAAATCTTTCTCATATAGGAAGTTCAGTAGACATAACAATTTTCTCCCTTCACTTAGCTGGTATCTCATCT ATTCTAGGAGCAATCAATTTTATCTCAACAATTATAAATATAAAATTTAATAATGTAAATTTTGAAATAA TTCCCCTTTTTGTTTGATCTGTTCTAATTACAGCAATTCTTCTTCTTCTTTCTTTACCCGTTTTAGCAGGAG CCATCACTATACTACTAACAGATCGAAACTTAAATACATCTTTCTTTGATCCTGCAGGAGGGGGGGATCC TATTCTTTATCAACATTTATTT
	VN40	6VN8	*Ecnomus*	larva	VIETNAM: Cúc Phuöng National : Bub'i River, just upstream of bridge Elv. 14 m. 20.3902°N, 105.5168°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	AACACTATACTTCATACTAGGAATCTGATCTAGATTAATTGGAACTTCACTAAGAATAATAATTCGACTC GAACTAAGAATCCCAGGATCGTTTTATAATAATGAACAACTTTATAACTCCATAGTTACAATCCACGCAT TCATTATAATTTTTTTCATAATTATACCAATTATAATTGGAGGATTTGGAAACTGAATAGTACCATTAAT AATAGGATCACCAGACATAGCTTTCCCACGAATAAATAATCTTAGATTCTGACTCCTACCCCCATCCCTA TTTTTCTTAATTTCAAGTATATTCATAAATAATAGATTAGGTACAGGATGAACAATATACCCCCCACTAT CAAATAATTTATTCCATAGAGGAAAATCAGTAGACATAGCCATCTTCTCCTTACACCTAGCAGGAATTTC ATCAATCCTAGGAGCCATTAACTTTATCTCAACAATCCTGAATATAAAACTCAAATCCTTACCCCTCAAC AACCTAACTCTATTTTCCTGATCAATTATAATTACAGCAATCCTATTACTATTATCCCTTCCCGTTCTTGC CGGAGCAATTACTATAGTACTAACAGACCGAAACATAAATACATCATTCTTCAATCCCATAGGAGGAGG AG---???????????????????????
	VN41	6VN9	*Ecnomus*	larva	VIETNAM: Cúc Phuöng National : Bub'i River, just upstream of bridge Elv. 14 m. 20.3902°N, 105.5168°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	AACACTATACTTCATACTAGGAATCTGATCTAGATTAATTGGAACTTCACTAAGAATAATAATTCGACTC GAACTAAGAATCCCAGGATCGTTTTATAATAATGAACAACTTTATAACTCCATAGTTACAATCCACGCAT TCATTATAATTTTTTTCATAATTATACCAATTATAATTGGAGGATTTGGAAACTGAATAGTACCATTAAT AATAGGATCACCAGACATAGCTTTCCCACGAATAAATAATCTTAGATTCTGACTCCTACCCCCATCCCTA TTTTTCTTAATTTCAAGTATATTCATAAATAATAGATTAGGTACAGGATGAACAATATACCCCCCACTAT CAAATAATTTATTCCATAGAGGAAAATCAGTAGACATAGCCATCTTCTCCTTACACCTAGCAGGAATTTC ATCAATCCTAGGAGCCATTAACTTTATCTCAACAATCCTGAATATAAAACTCAAATCCTTACCCCTCAAC AACCTAACTCTATTTTCCTGATCAATTATAATTACAGCAATCCTATTACTATTATCCCTTCCCGTTCTTGC CGGAGCAATTACTATAGTACTAACAGACCGAAACATAAATACATCATTCTTCAATCCCATAGGAGGAGG AGATCCTT---?????????????????

	VN42	6VN10	*Ecnomus*	larva	VIETNAM: Cúc Phuōng National Park: May Waterfall. Tributary to tributary of Sông River. 20.3654°N, 105.4479°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 25Jun-2017	AATTTTATATTTTATTTTTGGGATTTGAGCAAGAATAGTAGGATCCTCATTAAGAATAATTATTCGAATAGAATTAAGATCACCAAATTCAATAATTGGAAATGATCAAATTTACAATTCAATTATTACAATTCATGCATTTATTATAATTTTTTTTATAATTATACCAATTATAATTGGAGGTTTCGGAAACTGACTAGTTCCATTAATATTAGGAGCCCCCGATATAGCCTTCCCACGAATAAATAACATAAGATTTTGATTATTACCTCCATCCTTAACATTCCTAATCTCCAGAATATTTATAGATAATAGATTAGGAACAGGATGAACAATTTACCCCCCCTTATCAAATTATGAATATCACTTAGGAAAAGCAGTAGATATCTCAATTTTTTCTTTACATATAGCAGGAATTTCTTCAATTCTTGGAGCAATTAACTTTATTTCAACTATTCTAAATATAAAAATTAAATTTATTTCATTAAATTTAATTCCATTATTTGTATGATCAATTAAAATTACAGCAATTTTATTATTATTATCACTTCCTGTACTCGCTGGAGCAATTACAATACTATTAACAGATCGAAACTTAAATACTTCATTCTTTGAACCTGCTGGAGGAGGGGATCCAATTCTTTATCAACATTTATTT
	VN5	1VN5	*Ecnomus*	larva	VIETNAM: Cúc Phuōng National Park: Lang La Stream: small grassy-bottomed 1st order stream, 20.2941°N, 105.7059°E Elv. 49 m. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Tô T.H.Y., Nguyễn V.H. 24-Jun-2017	AATTTTATATTTTATTTTTGGAATTTGAGCAAGAATAGTAGGATCCTCATTAAGAATAATTATTCGAATAGAATTAAGATCACCAAATTCAATAATTGGAAATGATCAAATTTACAATTCAATTATTACAATTCATGCATTTATTATAATTTTTTTTATAATTATACCAATTATAATTGGAGGTTTCGGAAACTGACTAGTTCCCTTAATATTAGGAGCCCCCGATATAGCCTTCCCACGAATAAATAACATAAGATTTTGATTATTACCTCCATCCTTAACATTCCTAATCTCCAGAATATTTATAGATAATAGATTAGGAACAGGATGAACAATTTACCCCCCCTTATCAAATTATGAATATCACTTAGGAAAAGCAGTAGATATCTCAATTTTTTCTTTACATATAGCAGGAATTTCTTCAATTCTTGGAGCAATTAACTTTATTTCAACTATTCTAAATATAAAAATTAAATTTATTTCATTAAATTTAATTCCATTATTTGTATGATCAATTAAAATTACAGCAATTTTATTATTATTATCACTTCCTGTACTCGCTGGAGCAATTACAATACTATTAACAGATCGAAACTTAAATACTTCATTCTTTGAACCTGCTGGAGGAGGGGATCCAA---?????????????????
	VN52	7VN8	*Rhyacophila*	larva	VIETNAM: Bạch Mã National Park: Hoāng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	AACTTTATATTTTATTTTTGGGATTTGAGCAGGTATAGTAGGATCTTCATTAAGAATAATTATTCGTACAGAATTAGGAATACCAGGATCACTAATTGGAAATGATCAAATTTATAATGTAGTAGTAACCGCTCATGCTTTTATCATAATTTTCTTTATAGTAATACCTATTATAATTGGAGGATTCGGGAATTGATTAGTTCCATTAATACTTGGTGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGACTTTTACCACCTTCATTAACTCTTTTAACTATAAGAAGAATTGTAGAAAATGGAGCAGGTACTGGATGAACAGTTTATCCCCCTCTTTCTAGAAATATTGGACATATAGGAAGTTCAGTAGATCTAACAATTTTTTCTCTTCATTTAGCAGGAATTTCATCTATTTTAGGAGCTATTAATTTTATTACAACAGTAATAAATATACGCTCTAAAGGTATATCTTTAGATCAAATACCTTTATTTGTTTGATCTGTAGCTATTACAGCTCTTCTTCTCTTATTATCATTACCTGTTTTAGCAGGAGCTATTACTATACTTTTAACTGATCGAAATCTTAATACTTCCTTTTTTGACCCTGCAGGAGGAGGAGATCCAATTTTATATCAACATTTATTT
	VN54	7VN10	*Rhyacophila*	larva	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACTTTATATTTTATTTTTGGGATTTGAGCAGGTATAGTAGGATCTTCATTAAGAATAATTATTCGTACAGAATTAGGAATACCAGGATCACTAATTGGAAATGATCAAATTTATAATGTAGTAGTAACCGCTCATGCTTTTATCATAATTTTCTTTATAGTAATACCTATTATAATTGGAGGATTCGGGAATTGATTAGTTCCATTAATACTTGGTGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGACTTTTACCACCTTCATTAACTCTTTTAACTATAAGAAGAATTGTAGAAAATGGAGCAGGTACTGGATGAACAGTTTATCCCCCTCTTTCTAGAAATATTGGACATATAGGAAGTTCAGTAGATCTAACAATTTTTTCTCTTCATTTAGCAGGAATTTCATCTATTTTAGGAGCTATTAATTTTATTACAACAGTAATAAATATACGCTCTAAAGGTATATCTTTAGATCAAATACCTTTATTTGTTTGATCTGTAGCTATTACAGCTCTTCTTCTCTTATTATCATTACCTGTTTTAGCAGGAGCTATTACTATACTTTTAACTGATCGAAATCTTAATACTTCCTTTTTTGACCCTGCAGGAGGAGGAGATCCAATTTTATATCAACATTTATTT
	VN55	7VN11	*Rhyacophila*	larva	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	TGGGATTTGAGCAGGTATAGTAGGATCTTCATTAAGAATAATTATTCGTACAGAATTAGGAATACCAGGATCACTAATTGGAAATGATCAAATTTATAATGTAGTAGTAACCGCTCATGCTTTTATCATAATTTTCTTTATAGTAATACCTATTATAATTGGAGGATTCGGGAATTGATTAGTTCCATTAATACTTGGTGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGACTTTTACCACCTTCATTAACTCTTTTAACTATAAGAAGAATTGTAGAAAATGGAGCAGGTACTGGATGAACAGTTTATCCCCCTCTTTCTAGAAATATTGGACATATAGGAAGTTCAGTAGATCTAACAATTTTTTCTCTTCATTTAGCAGGAATTTCATCTATTTTAGGAGCTATTAATTTTATTACAACAGTAATAAATATACGCTCTAAAGGTATATCTTTAGATCAAATACCTTTATTTGTTTGATCTGTAGCTATTACAGCTCTTCTTCTCTTATTATCATTACCTGTTTTAGCAGGAGCTATTACTATACTTTTAACTGATCGAAATCTTAATACTTCCTTTTTTGACCCTGCAGGAGGAGGAG---??????????????????????
	VN56	7VN12	*Rhyacophila*	larva	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACTTTATATTTTATTTTTGGGATTTGAGCAGGTATAGTAGGATCTTCATTAAGAATAATTATTCGTACAGAATTAGGAATACCAGGATCACTAATTGGAAATGATCAAATTTATAATGTAGTAGTAACCGCTCATGCTTTTATCATAATTTTCTTTATAGTAATACCTATTATAATTGGAGGATTCGGGAATTGATTAGTTCCATTAATACTTGGTGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGACTTTTACCACCTTCATTAACTCTTTTAACTATAAGAAGAATTGTAGAAAATGGAGCAGGTACTGGATGAACAGTTTATCCCCCTCTTTCTAGAAATATTGGACATATAGGAAGTTCAGTAGATCTAACAATTTTTTCTCTTCATTTAGCAGGAATTTCATCTATTTTAGGAGCTATTAATTTTATTACAACAGTAATAAATATACGCTCTAAAGGTATATCTTTAGATCAAATACCTTTATTTGTTTGATCTGTAGCTATTACAGCTCTTCTTCTCTTATTATCATTACCTGTTTTAGCAGGAGCTATTACTATACTTTTAACTGATCGAAATCTTAATACTTCCTTTTTTGACCCTGCAGGAGGAGGAGATCCA----?????????????????

	VN57	7VN13	*Rhyacophila*	larva	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACTTTATATTTTATTTTTGGGATTTGAGCAGGTATAGTAGGATCTTCATTAAGAATAATTATTCGTACA GAATTAGGAATACCAGGATCACTAATTGGAAATGATCAAATTTATAATGTAGTAGTAACCGCTCATGCT TTTATCATAATTTTCTTTATAGTAATACCTATTATAATTGGAGGATTCGGGAATTGATTAGTTCCATTAAT ACTTGGTGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGACTTTTACCACCTTCATTAA CTCTTTTAACTATAAGAAGAATTGTAGAAAATGGAGCAGGTACTGGATGAACAGTTTATCCCCCTCTTTC TAGAAATATTGGACATATAGGAAGTTCAGTAGATCTAACAATTTTTTCTCTTCATTTAGCAGGAATTTCA TCTATTTTAGGAGCTATTAATTTTATTACAACAGTAATAAATATACGCTCTAAAGGTATATCTTTAGATC AAATACCTTTATTTGTTTGATCTGTAGCTATTACAGCTCTTCTTCTCTTATTATCATTACCTGTTTTAGCAG GAGCTATTACTATACTTTTAACTGATCGAAATCTTAATACTTCCTTTTTTGACCCTGCAGGAGGAGGAGA TCCAATTTTATATCAACATTTATTT
	VN59	8VN1	*Drepantocentron sp nr.vercaius*	adult male	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACATTATACTTTATATTTGGAATCTGATCAAGATTAATTGGAACTTCTTTAAGAATAATTATTCGAATT GAATTATCAACTCCTAATTCTTTCTTAGGTAATGATCAAATCTATAATTCAATTGTAACAATTCATGCTTT TATTATAATTTTTTTTATAGTTATACCAATTATAATTGGTGGATTTGGAAATTGACTTGTACCATTGATAC TTTCAGCTCCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGATTTTTACCCCCCTCACTACTT TTCTTAATTTCAAGAATATTCATAGATTCAAGTATAGGAACAGGATGAACTGTTTACCCTCCCCTATCAA ACAATTTATTTCATTCAGGAAAGGCTGTAGATATTTCAATTTTCTCATTACATTTAGCCGGAATCTCTTCC ATTTTAGGTGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAACAATATCATTTGACTCTTT ACCTCTTTTCGTATGATCTGTAGGAATTACAGCCTTACTACTACTTCTTTCTTTACCCGTCTTAGCAGGAG CCATCACAATACTTCTAACTGATCGAAATTTAAATACTTCCTTTTTCGACCCTAATGGAGGAGGAGACCC AATTCTTTATCAACATTTATTC
	VN6	1VN6	*Ecnomus*	larva	VIETNAM: Bạch Mã National Park: Hoãng Yên Stream, near potable water station. Elv. 1301 m 16.1949°N, 107.8577°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1 July 2017	AACATTATATTTCATTCTAGGAATTTGATCTAGACTAATCGGAACATCCCTAAGAATAATAATCCGACTA GAACTCAGAATCCCTGGATCATTATATAACAATGAACAACTTTACAACTCAATCGTTACAATCCATGCAT TCATTATAATTTTCTTCATGATTATACCAATCATAATTGGAGGATTCGGAAATTGAATAGTACCTCTAAT ACTAGGATCCCCAGATATAGCATTCCCACGAATAAATAATCTCAGATTCTGATTACTACCTCCATCACTC TTTTTCCTAATTTCAAGAATATTCATAAATAATAGACTAGGTACAGGATGAACTATATACCCCCCATTAT CAAACAATCTATTCCATAGAGGAAAATCCGTAGATATAGCAATTTTCTCCCTACATCTAGCAGGAATCTC ATCAATCCTAGGAGCAATCAACTTCATTTCAACAACCCTAAATATAAAACTGAAATCACTACCCCTTAAC AATTTAACCCTATTCGCATGATCAATTATAATTACCGCAATTCTTCTCCTACTATCTCTTCCAGTACTTGC AGGAGCAATCACCATAGTATTAACAGACCGGAACATAAATACCTCATTTTTCAATCCTATAGGGGGAGG AGACCCATTACTATTCCAACACCTATTC
	VN60	11VN1	*Drepantocentron n. sp.*	adult male	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACATTATACTTTATATTTGGAATCTGATCAAGATTAATTGGAACTTCTTTAAGAATAATTATTCGAATT GAATTATCAACTCCTAATTCTTTCTTAGGTAATGATCAAATCTATAATTCAATTGTAACAATTCATGCTTT TATTATAATTTTTTTTATAGTTATACCAATTATAATTGGTGGATTTGGAAATTGACTTGTACCATTGATAC TTTCAGCTCCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGATTTTTACCCCCCTCACTACTT TTCTTAATTTCAAGAATATTCATAGATTCAAGTATAGGAACAGGATGAACTGTTTACCCTCCCCTATCAA ACAATTTATTTCATTCAGGAAAGGCTGTAGATATTTCAATTTTCTCATTACATTTAGCCGGAATCTCTTCC ATTTTAGGAGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAACAATATCATTTGACTCTTT ACCTCTTTTCGTATGATCTGTAGGAATTACAGCCTTACTACTACTTCTTTCTTTACCCGTCTTAGCAGGAG CCATCACAATACTTCTAACTGATCGAAATTTAAATACTTCCTTTTTCGACCCTAATGGAGGAGGAGACCC AA---?????????????????
	VN61	11VN2	*Drepantocentron n. sp.*	adult male	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACATTATACTTTATATTTGGAATCTGATCAAGATTAATTGGAACTTCTTTAAGAATAATTATTCGAATT GAATTATCAACTCCTAATTCTTTCTTAGGTAATGATCAAATCTATAATTCAATTGTAACAATTCATGCTTT TATTATAATTTTTTTTATAGTTATACCAATTATAATTGGTGGATTTGGAAATTGACTTGTACCATTGATAC TTTCAGCTCCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGATTTTTACCCCCCTCACTACTT TTCTTAATTTCAAGAATATTCATAGATTCAAGTATAGGAACAGGATGAACTGTTTACCCTCCCCTATCAA ACAATTTATTTCATTCAGGAAAGGCTGTAGATATTTCAATTTTCTCATTACATTTAGCCGGAATCTCTTCC ATTTTAGGTGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAACAATATCATTTGACTCTTT ACCTCTTTTCGTATGATCTGTAGGAATTACAGCCTTACTACTACTTCTTTCTTTACCCGTCTTAGCAGGAG CCATCACAATACTTCTAACTGATCGAAATTTAAATACTTCCTTTTTCGACCCTAATGGAGGAGGAGACCC AATTCTTTATCAACATTTATTC
	VN62	11VN3	*Drepantocentron n. sp.*	adult male	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACATTATACTTTATATTTGGAATCTGATCAAGATTAATTGGAACTTCTTTAAGAATAATTATTCGAATT GAATTATCAACTCCTAATTCTTTCTTAGGTAATGATCAAATCTATAATTCAATTGTAACAATTCATGCTTT TATTATAATTTTTTTTATAGTTATACCAATTATAATTGGTGGATTTGGAAATTGACTTGTACCATTGATAC TTTCAGCTCCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGATTTTTACCCCCCTCACTACTT TTCTTAATTTCAAGAATATTCATAGATTCAAGTATAGGAACAGGATGAACTGTTTACCCTCCCCTATCAA ACAATTTATTTCATTCAGGAAAGGCTGTAGATATTTCAATTTTCTCATTACATTTAGCCGGAATCTCTTCC ATTTTAGGAGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAACAATATCATTTGACTCTTT ACCTCTTTTCGTATGATCTGTAGGAATTACAGCCTTACTACTACTTCTTTCTTTACCCGTCTTAGCAGGAG CCATCACAATACTTCTAACTGATCGAAATTTAAATACTTCCTTTTTCGACCCTAATGGAGGAGGAGACCC AATTCTTTATCAACATTTATTC

	VN67	8VN9	*Drepanocentron*	larva	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACATTATACTTTATATTTGGAATCTGATCAAGATTAATTGGAACTTCTTTAAGAATAATTATTCGAATT GAATTATCAACTCCTAATTCTTTCTTAGGTAATGATCAAATCTATAATTCAATTGTAACAATTCATGCTTT TATTATAATTTTTTTATAGTTATACCAATTATAATTGGTGGATTTGGAAATTGACTTGTACCATTGATAC TTTCAGCTCCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGATTTTTACCCCCCTCACTACTT TTCTTAATTTCAAGAATATTCATAGATTCAAGTATAGGAACAGGATGAACTGTTTACCCTCCCCTATCAA ACAATTTATTTCATTCAGGAAAGGCTGTAGATATTTCAATTTTCTCATTACATTTAGCCGGAATCTCTTCC ATTTTAGGTGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAACAATATCATTTGACTCTTT ACCTCTTTTCGTATGATCTGTAGGAATTACAGCCTTACTACTACTTCTTTCTTTACCCGTCTTAGCAGGAG CCATCACAATACTTCTAACTGATCGAAATTTAAATACTTCCTTTTTCGACCCTAATGGAGGAGGAGACCC AATTCTTTATCAACATTTATTC
	VN69	8VN11	*Drepanocentron*	larva	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACATTATACTTTATATTTGGAATCTGATCAAGATTAATTGGAACTTCTTTAAGAATAATTATTCGAATT GAATTATCAACTCCTAATTCTTTCTTAGGTAATGATCAAATCTATAATTCAATTGTAACAATTCATGCTTT TATTATAATTTTTTTATAGTTATACCAATTATAATTGGTGGATTTGGAAATTGACTTGTACCATTGATAC TTTCAGCTCCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGATTTTTACCCCCCTCACTACTT TTCTTAATTTCAAGAATATTCATAGATTCAAGTATAGGAACAGGATGAACTGTTTACCCTCCCCTATCAA ACAATTTATTTCATTCAGGAAAGGCTGTAGATATTTCAATTTTCTCATTACATTTAGCCGGAATCTCTTCC ATTTTAGGAGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAACAATATCATTTGACTCTTT ACCTCTTTTCGTATGATCTGTAGGAATTACAGCCTTACTACTACTTCTTTCTTTACCCGTCTTAGCAGGAG CCATCACAATACTTCTAACTGATCGAAATTTAAATACTTCCTTTTTCGACCCTAATGGAGGAGGAGACCC AAT--?????????????????
	VN7	1VN7	*Diplectrona*	larva	VIETNAM: Cúc Phuōng National ParkOld Tree Stream. Elv. 406 m 20.3501°N, 105.6026°E Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Tô T.H.Y., Nguyễn V.H. 24-Jun-2017	??????????????TTTTAGGGATCTGATCAGGATTAATTGGTTCATCTTTAAGATTAATTATTCGAACTGAATT AAGAAGACCTGGATTTTTTATTGGTAATGACCAAATTTATAACGTAATTGTTACAGCACATGCTTTTATT ATAATTTTCTTCATAGTTATACCTATTATAATCGGAGGATTTGGAAATTGATTAGTTCCATTAATATTAG GATCTCCTGACATAGCCTTTCCTCGAATAAATAATATGAGATTCTGATTTTTACCCCCTTCTCTTTCTTTA TTAATTTCAAGAAGATTGATTAATTCAGGAGCAGGAACTGGATGAACTGTTTACCCTCCCCTATCCTCAA ATTTATCCCATTTAGGTTCATCAGTAGATTTAACTATTTTCTCTCTTCATTTAGCTGGAATTTCCTCTATTC TTGGAGCTGTTAATTTTATCACTACAATTTTAAATATAAAATTCTTTAATTTAAACTACGATATAATTCCT CTATTTGTATGATCAGTTCTAATTACAGCTGTACTTCTTTTATTATCCCTACCAGTACTAGCAGGGGCTAT TACTATATTATTAACAGATCGAAATCTAAACACATCTTTTTTCGACCCCGC-- ??????????????????????????????????????
	VN70	8VN12	*Drepanocentron*	larva	VIETNAM: Bạch Mã National Park Krem Stream, upstream of culvert at road Elv. 1159 m, 16.1958°N, 107.8490°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Hugnh, D.H., Nguyễn V.H. 1-Jul-2017	AACATTATACTTTATATTTGGAATCTGATCAAGATTAATTGGAACTTCTTTAAGAATAATTATTCGAATT GAATTATCAACTCCTAATTCTTTCTTAGGTAATGATCAAATCTATAATTCAATTGTAACAATTCATGCTTT TATTATAATTTTTTTATAGTTATACCAATTATAATTGGTGGATTTGGAAATTGACTTGTACCATTGATAC TTTCAGCTCCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGATTTTTACCCCCCTCACTACTT TTCTTAATTTCAAGAATATTCATAGATTCAAGTATAGGAACAGGATGAACTGTTTACCCTCCCCTATCAA ACAATTTATTTCATTCAGGAAAGGCTGTAGATATTTCAATTTTCTCATTACATTTAGCCGGAATCTCTTCC ATTTTAGGAGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAACAATATCATTTGACTCTTT ACCTCTTTTCGTATGATCTGTAGGAATTACAGCCTTACTACTACTTCTTTCTTTACCCGTCTTAGCAGGAG CCATCACAATACTTCTAACTGATCGAAATTTAAATACTTCCTTTTTCGACCCTAATGGAGGAGGAGACCC AATTCTTTATCAACATTTATTC
	VN98	10VN1	*Cheumatopsyche lucida*	adult male	VIETNAM: Cúc Phuōng National Park, small 1st order cobble-bottom stream in woods near rice paddies of small village near Nghéo River. Elv. 107 m. 20.3287°N, 105.5333°E. Coll. J.C. Morse, K. Murray, M.S. Genco, Nguyễn T.M., Mai V.S., Nguyễn V.H. 27-Jun-2017	AACTCTTTATTTCATATTTGGAATTTGATCAGGTATTGTAGGATCATCTCTTAGATTCCTTATTCGAATAG AATTAAGAATACCTGGTTCACTAATTGGAAATGATCAAATTTATAATGTAATTGTTACATCTCATGCTTT TATTATAATTTTCTTCATAGTTATACCTATTATAATTGGGGGATTTGGAAACTGATTAGTTCCATTAATAT TAGGATCTCCTGATATAGCCTTTCCTCGAATAAATAATCTAAGATTCTGGTTCCTCCCCCCTTCTTTAATT TTACTTTTATTAAGAAGATTAACTAATTCAGGAGCAGGAACAGGTTGAACAGTTTACCCCCCCCTATCAT CAAATTTATCTCATTTGGGGAGATCGGTAGATCTTACTATTTTTTCTCTTCATTTAGCTGGAATTTCATCA ATTTTAGGAGCAATCAATTTTATTTCTACTTCATTCAATATGAAATTAAATAAATTAAACTATGAAATTT TACCTCTTTTTGTTTGATCAGTAGCAATTACAGCTTTACTTCTTTTATTATCTTTACCTGTATTAGCTGGG GCCATTACTATATTACTAACCGATCGAAATTTAAATACATCGTTTTTTGACCCAGC-- ??????????????????????????????????????

Appendix B
BOLD Outgroup Information

processid	species_name	Lifestage/ sex	lat	long	country	province_state	identified by	collectors	institution_storing	sequence	seq_primers
ABCAD049-08	*Brachycentrus americanus*	adult	49.078	-113.882	Canada	Alberta	Xin Zhou	BIObus 2008	Centre for Biodiversity Genomics	TACAATTTATTTTTTATTTGGAATTTGATCAGGAATAGTGGGAACTTCATTAAGAATAATTATTCGAATTGAATTATCCTCAGTTAATTCATTAATTTTAAATGATCAAATTTATAATGTATTAGTTACAGCTCATGCATTCATTATAATTTTTTTATAGTAATACCTATTATAATTGGAGGATTTGGAAATTGATTAGTCCCATTAATAATTGGGGCCCCTGATATAGCTTTTCCTCGTATAAATAATATAAGTTTTTGACTTCTTCCCCCTTCTTTAAATTTTCTTTTAATTAGATCTGTTGTTGAAAGTGGAACTGGAACAGGATGAACTGTTTACCCTCCTCTTTCTAGAAATTTAGCTCATTCAGGGAGATCAGTTGATTTTTCAATTTTTTCCTTACATTTAGCTGGAATTTCTTCTATTCTTGGAGCTATTAATTTTATTTCTACAACTATTAATATACGATCAAATTTAATTTCTTTAGACCGAATACCCCTATTTGTTTGATCAGTAGCTATTACTGCTCTATTATTATTATTATCTCTCCCTGTTTTAGCCGGAGCTATTACCATACTTTTAACTGATCGAAATTTAAATACATCATTTTTTGATCCTGCAGGAGGGGGCGACCCAATTTTATACCAACATTTATTT	M13R|M13F
BGICH418-11	*Hydropsyche simulata*	imature	23.6774	113.771	China	Guangdong	Weifang Shi	Xin Zhou,Shanlin Liu,Yiyuan Li,Qiong Wu,Weifang Shi,Tao Song,Huimin Zhong	Beijing Genomics Institute	AACCTTATATTTTATATTTGGTATTTGATCAGGTTTAGTCGGATCATCACTAAGATTTATTATCCGAATAGAATTAAGAACCCCCGGAAGATTCATTGGAAATGACCAAATTTACAATGTAATTGTCACTTCTCATGCTTTTATTATAATTTTTTTCATAGTTATACCCATTATAATTGGAGGATTTGGTAATTGGCTAGTGCCCCTAATATTAGGTTCTCCCGATATAGCTTTCCCTCGAATAAACAATCTCAGATTTTGATTTTTACCACCCTCTTTAATTTTCCTTCTATTAAGAAGAATGACTAATTCAGGGGCTGGAACTGGTTGAACAGTATACCCTCCCCTATCTTCAAACCTATCTCATGCAGGCAGATCAGTCGATTTAACTATTTTTTCTTTGCACATAGCTGGAATTTCATCCATTTTAGGGGCTATTAACTTTATTTCTACTATTATAAATATAAAATTTAAAAATTTAAATTTTGAAATAATTCCCCTATTTGTATGATCAATTTTAATCACTGCTATCCTTCTTCTTCTTTCATTACCTGTACTAGCAGGGGCTATTACCATACTTCTTACTGACCGTAATCTCAACACCTCTTTCTTTGACCCAGCAGGAGGGGGGGATCCAATTTTATACCAACATTTATTT	
KKUMN113-10	*Pseudoleptonema sinuatum*	adult female	4.95	117.75	Malaysia	Sabah	Ralph W. Holzenthal	Huisman & de Jong	University of Minnesota Insect Collection	AACCTTATATTTCATCTTCGGAATTTGATCAGGATGCCTTGGTTCTTCAATAAGAATTCTTATTCGAATTGAATTATCATCTCCATTAAGTTTAATCGGAAATGATCAAATTTATAATGTTATTGTTACTGCTCATGCTTTCATTATAATTTTCTTTATAGTTATACCTATTATAATTGGAGGATTTGGAAACTGACTTATTCCTCTTATACTTGGAGCCCCAGATATAGCCTTCCCTCGAATAAATAATATAAGATTTTGATTATTACCACCATCTCTTACTTTCTTATTAATCAGAAGATTAACTAATACAGGAGCAGGGACTGGTTGAACAGTTTACCCTCCTTTAGCATCTAATCTTTCTCACGCTGGAAGAGCAGTTGATCTAACAATTTTTTCATTACATTTAGCAGGTATCTCTTCAATTTTAGGAGCCATCAATTTTATTACTACTATTTTAAATATAAAATCTAATAATCTTAAAATAGATAAAATTCCTCTTTTTGTATGATCAGTATTAATTACAGCCGTACTATTACTTCTATCTTTACCAGTTCTAGCTGGTGCTATTACTATGCTTTTAACAGATCGTAACTTAAACACTTCCTTTTTCGACCCAGCTGGAGGGGGGGATCCAATTTTATATCAACATTTATTT	MLepF1|M13R|M13R|LCO1490
BHMKK055-12	*Stenopsyche benaventi*	adult male	19.383	98.383	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AACTTTATATTTCATCTTTGGTATTTGATCCGGAATAGTAGGAACCTCCTTAAGAATAATTATTCGATTAGAATTAAGAACTACAGGAACTTTTATTGGCAACGATCAAATCTATAATTCAATCGTAACTGCCCACGCATTTGTTATAATTTTTTTCATAGTAATACCAATTATAATCGGAGGATTCGGAAATTGATTAGTCCCTCTGATATTAGGGGCTCCAGATATAGCCTTCCCCCGAATAAATAACATAAGATTTTGACTACTCCCCCCTTCATTAATCTTCCTAACTTCCTCAATATTCATAGATAACGGAGCAGGAACAGGCTGAACAGTATACCCACCCTTATCCGCCAATATCTCCCATAGAGGGAAAGCTGTAGACATTACAATTTTTTCACTTCACCTAGCTGGTATCTCATCAATTTTAGGAGCCATTAATTTTATTACTACAATTATAAATATACGACCCTCATCAATAACATTAGAACAAATCCCTCTATTTGTCTGATCTGTAAAAATTACAGCCATTCTTTTACTTCTCTCACTACCAGTACTAGCCGGAGCAATTACTATACTATTAACAGACCGAAATCTAAATACCTCATTTTTCGACCCTGCTGGAGGGGGAGACCCCATTTTATACCAACATTTATTTNNNNNNNNN	LCO1490|HCO2198
ABCAD092-08	*Glossosoma velonum*	adult female	49.11	-113.842	Canada	Alberta	Xin Zhou	BIObus 2008	Centre for Biodiversity Genomics	------------------------------------ACTAGGAACATCTTTAAGAATATTAATTCGTTTAGAATTAAGAACTTCTGGATACTTAATTGGAAACGACCAAATTTATAATGTTATTGTAACAGCTCATGCTTTTGTAATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTTGGGAATTGATTAGTTCCCTTAATACTAGGAGCACCAGATATAGCTTTCCCACGTCTTAATAATATAAG	M13F|M13R
UMNEA053-08	*Cheumatopsyche pasella*	adult male			United States	Florida	Roger J. Blahnik	Nations & Howe	University of Minnesota Insect Collection	AACTCTTTATTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATTGGAAATGACCAAATTTATAATGTAATTGTCACTTCTCATGCATTTATTATAATTTTCTTTATAGTTATACCCATTATAATCGGAGGATTTGGAAACTGACTAGTTCCTTTAATATTAGGGTCCCCAGATATAGCCTTCCCTCGAATAAATAATTTAAGATTTTGATTTTTACCTCCTTCATTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTATCCTCCTCTATCATCTAATCTATCTCACCTAGGAAGATCAGTAGATTTAACTATTTTCTCTCTTCATTTAGCTGGTATCTCATCAATTTTAGGAGCAATTAATTTCATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTCTGATCAGTAGCTATTACTGCCGTTTTACTTCTATTATCCCTACCTGTTTTAGCTGGCGCGATTACTATACTACTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGGGGAGACCCCATTCTATATCAACATTTATTT	M13R|M13F
HMKKT889-11	*Pseudoneureclipsis ramosa*	adult male	-8.2575	115.07	Indonesia	Bali	Hans Malicky	V. Ivanov	University of Minnesota	AACTCTATATTTTATTCTAGGAATCTGATCAAGACTAATCGGAACCTCACTAAGAATAATGATTCGACTAGAACTGAGAATCCCTGGATCACTTTACAATAATGAACAATTATACAACTCCATTGTTACAATCCATGCATTCATTATAATTTTCTTCATAATTATACCAATTATAATTGGAGGATTCGGAAATTGAATAGTACCACTAATACTAGGATCACCAGATATAGCATTCCCACGAATAAATAATCTCAGATTCTGATTACTGCCCCCATCACTCTTTTTCCTAATCTCAAGAATATTTATAAATAATAGATTAGGTACAGGATGAACTATATACCCACCATTATCAAATAACTTATTTCACAGAGGAAAATCAGTAGATATAGCAATCTTCTCATTACACCTAGCTGGAATCTCATCAATCCTAGGAGCCATTAATTTCATCTCAACAACCTTAAATATAAAACTTAAATCCCTACCTCTCAATAACCTAACTCTATTCTCTTGATCAATTATAATTACAGCAGTACTCCTATTACTATCCCTTCCAGTTCTAGCAGGAGCAATTACTATAATATTAACAGATCGAAACATAAACACATCATTTTTCAACCCAATAGGAGGAGGAGATCCCCTTCTATTTCAACACCTATTC	C_LepFolF|C_LepFolR
ABCAD189-08	*Psychomyia flavida*	adult	49.078	-113.882	Canada	Alberta	Xin Zhou	BIObus 2008	Centre for Biodiversity Genomics	AACTTTATATTTTATTTTTGGCATTTGATCAAGCTTAATTGGAACATCATTAAGTATAATTATTCGAATTGAACTAAGAACCCCAGGATCATTTATGGGAAACGATCAAATTTATAATTCAATTGTTACTGTTCATGCATTTATTATAATTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGAAATTGATTAGTACCACTAATATTAGGAGCACCAGATATAGCATTCCCTCGAATAAATAACCTGAGATTTTGATTTTTACCTCCCTCAATTTTTTTTTTAATTTCTGCCATATTCATAGATAATAGAGCAGGAACTGGGTGAACAGTATACCCACCTCTTTCAAATAATATATTTCATTCAGGAAAAGCTGTTGATATTTCAATTTTTTCTCTTCACTTAGCAGGAATCTCATCAATTTTAGGAGCTATTAACTTTATTACAACTATCATTAATATAAAACTCAAACAAATTACATTTGACATTTTACCCCTTTTTGTTTGATCAATTGGAATTACAGCATTATTATTACTTTTATCTTTACCAGTACTAGCAGGAGCTATTACTATATTACTTACAGACCGTAATTTAAATACCTCATTCTTTGACCCAGCAGGAGGAGGAGATCCTATTCTATACCAACATTTATTT	M13F|M13R

BBLOB1401-11	*Smicridea signata*	adult	34.75	-112.022	United States	Arizona		BioBus 2011	Centre for Biodiversity Genomics	CACATTATATTTTATTTTTGGAATCTGATCAGGAATTTTAGGTATAACATTAAGTTTAATTATTCGAATTGAATTAAGAACACTAAATAATTTTCTTAACAATGACCAAATTTATAACGTAATAGTTACTTCTCACGCTTTTATCATAATTTTTTTATAGTTATACCAATTATAATTGGAGGATTCGGTAATTGATTAGTTCCTTTAATAATAACAACCCCAGATATAGCTTTTCCTCGAATAAATAATCTTAGTTTTTGATTTTTACCTCCTTCTATAATATTAATAATCACTAGCATATTAGTGAATTCAGGCTCAGGAACAGGTTGAACAGTCTATCCTCCTCTTTCTTCTAATCTATCCCATATAGGCTCTTCAGTAGATTTAACTATTTTTCTTTACATCTTGCAGGAATTTCATCAATTCTAGGAGCTATTAACTTCATAACTACAATTATAAATATAAAAATTAATAATTTAAATTTTGAACTTATTCCTTTATTTAGTTGATCTGTATTTATTACAGCAGTCTTACTCCTTCTTTCTCTTCCTGTTCTAGCTGGGGCTATCACTATACTCTTATTTGACCGTAATCTAAATTCTTCATTTTTTGACCCTGCAGGAGGAGGAGATCCAATTCTTTATCAACATCTTTTT	LepF1|LepR1
CRCAD030-07	*Diplectrona modesta*	adult female			United States	South Carolina	Ian Stocks	T. Ames	Clemson University	AACCCTATATTTTATTTTAGGAATCTGATCAGGAATAATTGGATCATCTCTAAGTTTAATTATTCGAACTGAATTAAGAAGACCCGGATTTTTCATTGGAAACGACCAGATTTATAATGTAATTGTCACTGCTCATGCTTTTGTTATAATTTTCTTTATAGTTATACCTATTATAATTGGAGGTTTTGGAAATTGATTAGTTCCATTAATATTAGGGTCCCCTGATATAGCTTTTCCACGTATAAATAACATAAGATTTTGATTTCTCCCCCCTTCTTTAACTCTCTTAGTTTCAAGAAGCCTTATTAACTCAGGAGCTGGGACTGGATGAACAGTTTACCCCCCCTTATCTTCTAATTTATCTCATCTAGGATCATCAGTCGATTTAACAATTTTCTCACTTCATTTAGCAGGTATTTCCTCTATTTTAGGAGCCGTAAATTTTATCACTACAATTCTAAATATAAAATTATTTAATTTAAACTACGATATAATTCCCCTATTTGTATGATCAGTACTTATTACAGCTGTCTTACTTCTTTTATCCTTACCAGTTTTAGCAGGAGCTATCACTATACTATTAACTGATCGAAATTTAAACACATCTTTCTTTGACCCTGCAGGAGGGGGAGATCCTATTCTGTACCAACATCTATTT	LepF1|LepR1
LEPTO1068-13	*Cheumatopsyche oxa*	imature	39.918	-75.723	United States	Pennsylvania	Trevor Bringloe	T. Bringloe, V. Harvey, S. Ripley, K. Rondollo	Centre for Biodiversity Genomics	-ACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGAATAAATAATTTAAG	C_LepFolR
CJCAD012-07	*Hydromanicus melli*	adult male	23.702	114.609	China	Guangdong	Christy J. Geraci	J.C. Morse,Sun C.,X. Zhou	Smithsonian Institution	AACTTTATATTTTATTTTTGGAATTTGATCCGGTTTAATCGGTTCATCCTTAAGATTCCTAATTCGTATAGAATTAAGAATCCCCGGAACTTTAATTGGTAATGATCAAATTTACAATGTAATTGTAACCTCACATGCTTTTATTATAATTTTTTTATAGTTATACCAATTATAATTGGTGGTTTCGGAAACTGACTAATCCCACTAATACTCGGGTCCCCCGATATAGCTTTCCCTCGAATAAACAATATAAGATTTTGATTCCTTCCCCCCTCCTTAATTTTTTTACTTTTTAGAAGTCTTTTAAATTCAGGAGCAGGAACTGGTTGAACAGTTTACCCTCCCCTATCCTCTAATCTATCTCACTTAGGTAGATCTGTCGATATAACAATTTTTTCTCTACATTTAGCAGGAATTTCTTCTATTCTTGGAGCAATCAATTTTATCTCTACTATTATAAATATAAAATTTAAAAATTTAAATTATGAAATAATACCACTCTTTGTTTGATCAGTATTAATCACAGCAGTATTATTATTACTGTCTTTACCAGTTCTCGCAGGAGCTATTACTATATTATTAACTGATCGAAATCTAAATACATCTTTTTTTGACCCAGCTGGAGGGGGAGATCCTATTCTTTATCAACATCTTTTT	M13F|M13R
AVMTT043-09	*Hydroptila waubesiana*	adult	45.4684	-73.6311	Canada	Quebec	Xin Zhou	Andrey Vedenin	Centre for Biodiversity Genomics	----------------TTAGGAATCTGATCAGGAATAATCGGAACTTCCTTAAGAATATTAATTCGATTAGAATTAAGATCCCCAGGATTTCTAATTGGAAACGATCAAATTTATAATGTAATTGTAACAGCGCATGCTTTTATTATAATTTTTTTCATAGTAATACCTATTATGGTTGGAGGATTCGGAAATTGATTAGTCCCACTAATATTGGGAATTCCGGATATAGCATTTCCCCGAATAAATAATATAAG	LepF1|LepR1
SMCAD352-07	*Cheumatopsyche enigma*	adult female	35.6275	-83.0989	United States	North Carolina	David Etnier	I.Stocks,CJGeraci, L.Harvey,J.Robinson,X.Zhou,K.Hind ,J.Wilson,A.Timm	University of Tennessee, Knoxville	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTTTAATTTTAAGAAGAATAATAAACTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCATCTAATCTATCTCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTACCAGTTCTAGCTGGCGCAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCCTATTCTATACCAACATTTATTT	M13F|M13R
HMKKT906-11	*Pseudoneureclipsis ramosa*	adult male			Indonesia	Nusa Tenggara Barat	Hans Malicky	S.I. Meinitsky	University of Minnesota	AACTCTATATTTTATTCTCGGAATCTGATCAAGACTAATCGGAACCTCACTGAGAATAATAATTCGACTAGAACTAAGAATCCCTGGATCACTTTACAATAATGAACAATTATACAACTCCATTGTTACAATTCATGCATTTATTATAATTTTCTTCATAATTATACCAATTATAATTGGAGGATTCGGAAATTGAATAGTACCACTAATACTAGGATCACCAGATATAGCATTCCCACGAATAAATAATCTCAGATTCTGACTACTACCCCCATCACTTTTTTTCTTAATCTCAAGAATATTCATAAATAATAGATTGGGTACGGGATGAACTATATACCCACCATTATCAAATAACTTATTCCACAGAGGTAAATCAGTAGATATAGCAATCTTCTCATTACACCTAGCTGGAATCTCATCAATTCTAGGAGCTATTAATTTCATTTCAACAACCTTAAATATAAAACTTAAATCCCTACCTCTCAATAACCTAACCCTATTCTCTTGATCAATTATAATTACAGCAGTACTACTATTACTATCTCTTCCAGTTCTAGCAGGAGCAATTACTATAGTACTAACAGATCGAAATATAAACACATCATTTTTCAACCCAATAGGAGGAGGAGATCCCCTTCTATTCCAACACCTATTC	C_LepFolF|C_LepFolR
BHMKK129-12	*Pseudoneureclipsis philemon*	adult male	19.35	98.45	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AACTTTATATTTTATACTAGGTATCTGATCAAGACTAATTGGAACATCACTAAGAATAATAATTCGATTAGAATTAAGAATCCCAGGATCATTCATCAATAATGAACAACTATACAATTCAATAGTAACCATTCATGCATTTATTATAATTTTCTTCATAATTATACCAATCATAATTGGAGGATTCGGAAATTGAATAGTCCCTCTAATACTCGGATCACCTGATATAGCTTTCCCACGAATAAATAATTTAAGATTCTGACTCTTACCCCCATCACTTTTCTTCCTAATTTCAAGAATATTCATAAATAATAGACTAGGAACAGGATGAACGATATATCCACCATTATCAAACAATATATTTCATAGAGGAAAATCAGTAGATATATCAATTTTCTCTTTACATCTAGCAGGCATTTCATCAATTCTTGGAGCCATTAATTTCATCTCAACATCACTAAATATAAAACTCAATTTCCTTCCTCTAAATAACTTAACATTATTCACATGATCAATTATAATTACAGCAATTCTCCTATTATTATCTCTACCAGTACTAGCAGGAGCAATTACTATAGTACTTACAGACCGAAACCTAAACACATCATTTTTCAATCCAATAGGAGGAGGAGATCCACTACTATTTCAACACCTATGTNNNNNNNNN	LCO1490|HCO2198
BHMKK070-12	*Diplectrona eurydike*	adult male	19.433	98.333	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AACTCTGTATTTTATCCTAGGRATTTGATCTGGTTTAATCGGATCCTCGCTTAGATTAATCATTCGAACTGAACTAAGAAGCCCAGGTATATTTATTGGTAACGATCAAATCTACAACGTAGTTGTTACAGCCCATGCCTTCATTATAATCTTTTTTATAGTAATACCCATTATAATCGGAGGATTCGGAAATTGATTAGTCCCATTAATATTAGGTTCTCCTGATATAGCTTTCCCCCGAATAAATAATATAAGATTTTGATTTTTACCCCCCTCGTTAACTCTTCTAATTTCAAGTAGATTAATCAACTCAGGTGCTGGAACAGGATGAACTGTCTACCCTCCCCTTTCGTCTAATCTTTCTCACTTAGGATCATCAGTAGACTTAACCATTTTTTCTCTTCACTTAGCTGGAATCTCTTCAATTCTTGGGGCCGTCAATTTTATTACTACCATCATTAATATAAAATTCTTCAATCTAAACTACGATATAATCCCCCTCTTCGTCTGATCAGTACTTATTACAGCTGTACTACTCCTATTATCACTCCCAGTTTTAGCCGGAGCTATTACTATATTATTAACTGACCGCAATCTAAACACATCCTTCTTTGATCCAGCAGGAGGGGGGGACCCAATCTTGTATCAACATTTATTTNNNNNNNNN	LCO1490|HCO2198

NBCAD466-08	*Cheumatopsyche enigma*	adult male	46.8227	-66.1105	Canada	New Brunswick	David Ruiter	X. Zhou, K.H.	Centre for Biodiversity Genomics	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCATCTAATCTATCTCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTACCAGTTCTAGCTGGCGCAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGGGATCCTATTCTATACCAACATTTATTT	M13R|M13F|LepR1|LepF1
ECTRI058-10	*Nyctiophylax affinis*	adult	48.492	-54.022	Canada	Newfoundland and Labrador	Xin Zhou	BIObus 2009	Centre for Biodiversity Genomics	AACAATATATTTTATTTTCGGAATTTGATCAAGATTAATTGGAACAACACTTAGATTAATAATTCGAATTGAACTTAGAACATCAGGATCATTTATAATAAATGACCAAATTTATAATTCAATTGTTACTATACATGCATTTATTATAATTTTCTTTATAATTATACCATTAATAATTGGTGGATTTGGAAATTGACTAGTACCATTAATAATTACAGCACCTGACATAGCTTTTCCACGAATAAATAATATAAGATTTTGACTACTTCCTCCATCAATTTTCTTTTTAATTTCAGGAATATTTATAGATAATAGAGTAGGAACTGGATGAACAGTGTATCCTCCACTTTCTAACAATATATTTCACTCTGGAAAAGCAGTAGATATCTCCATTTTTTCACTTCATTTAGCAGGAATTTCATCAATCCTAGGAGCAATTAATTTTATTTCAACAATTATAAATATAAAAATGAAAAATATTCCAATAAATATAATTCCACTATTTGTTTGATCAATTAAAATTACAGCAATTTTACTATTATTATCACTTCCAGTATTAGCTGGAGCTATTACTATACTACTAACAGATCGAAATTTAAATACATCATTTTTTGATCCAGCAGGAGGAGGAGATCCAATTTTATATCAACACCTATTC	LepF1|LepR1
BHMKK046-12	*Chimarra spinifera*	adult male	19.383	98.383	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AACTCTATACTTCATTTTTGGTCTGTGATCAAGAATACTAGGACTTTCCCTAAGTATATTAATTCGATTAGAATTAAGAACCCCGGGGGCCTTAATTGGAAATGATCAAATTTTTAATTCAATTGTAACTGCCCATGCATTCATTATAATTTTCTTCATAGTAATACCAATTATAATTGGAGGATTCGGTAATTGATTAGTCCCCTTAATATTAGGAGCCCCCGATATGGCCTTCCCGCGAATAAATAATATAAGATTTTGATTCCTCCCTCCTTCATTATTTTTCCTTTTATTCGGTATATTAATAGATAACGGAGCAGGAACTGGGTGAACAGTTTACCCCCCTCTATCTGCAAATATTTCTCATATAGGAAAGGCAGTAGACTTAACTATTTTCTCCCTCCATTTAGCAGGAATTTCTTCAATTTTAGGGGCAGTTAATTTCATTTCTACTATTATCAACATGCGTCTTAATTTTATAATACTAGATCAACTACCTCTATTCACATGATCTGTTATTATTACTGCCATCCTTCTACTCCTATCCCTCCCTGTCCTTGCAGGAGCAATTACTATACTTTTAACAGACCGAAATATTAATACTTCATTTTTTGACCCTGCCGGGGGAGGTGACCCCATTTTATACCAGCATTTATTTNNNNNNNNN	LCO1490|HCO2198
BHMKK066-12	*Cheumatopsyche lucida*	adult male	19.383	98.383	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	CTCTCTTTATTTTATATTAGGAATTTGATCAGGCTTGATAGGATCCTCTTTAAGATTTTTAATTCGAATTGAATTAAGTACCCCTGGATCTTTAATTGGAAATGATCAAATTTATAATGTAATTGTTACTTCCCATGCCTTTATTATAATTTTTTTATAGTAATACCTATTATAATTGGAGGATTTGGTAATTGATTAGTTCCACTAATATTAGGATCTCCAGATATAGCTTTTCCTCGAATAAATAATTTAAGATTTTGATTTCTTCCTCCTTCTTTAACTTTATTATTATTAAGAAGATTAACCAATTCAGGAGCAGGAACTGGTTGAACTGTTTACCCTCCTTTATCATCTAATTTATCTCATTTAGGAAGATCTGTAGATCTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCTTCAATCTTAGGGGCCATTAACTTTATTACTACCTCCTTTAATATAAAACTAAATAAATTAAATTATGAAATATTACCTCTTTTTGTTTGATCCGTTATTATTACAGCTCTTTTACTTCTACTTTCCCTACCTGTTTTAGCAGGAGCAATTACCATATTATTAACTGATCGAAATTTAAATACATCATTTTTTGACCCTGCTGGAGGGGGGGACCCAATTTTATATCAACATTTATTTNNNNNNNNN	LCO1490|HCO2198
CNCAD482-07	*Melanotrichia*	adult male	24.938	113.003	China	Guangdong	Xin Zhou	Lianfang Yang,Xin Zhou,Christy Jo Geraci	Nanjing Agricultural University	AACACTATACTTTCTATTTGGTATTTGATCAAGACTTATTGGAACATCACTAAGAATAATTATTCGAATTGAATTAAGAACCCCCAACTCATTTTTAGGAAATGATCAAATTTATAATTCTATTGTCACAATTCACGCTTTTATCATAATTTTTTTCATGGTTATACCTATCATAATTGGAGGATTTGGTAATTGACTTGTACCATTAATATTATCAGCCCCAGATATAGCTTTCCCACGAATAAATAACCTCAGATTTTGATTTCTTCCTCCATCAATTCTTTTTTTAATTTCTAGAATATTTATAGACTCAAGAATAGGAACAGGATGAACAGTTTACCCTCCTTTATCAAATAATCTTTTTCACTCAGGAAAAGCTGTAGATATCTCAATTTTCTCCCTTCACCTTGCCGGTATTTCATCAATCTTAGGAGCAATTAATTTTATTACAACAATTATTAATATAAAATTAAAAAATATATCCTTCGACTCAATTCCTCTATTTGTATGATCAGTCGGAATTACTGCCTTACTTCTACTCCTATCTTTGCCCGTATTAGCAGGAGCCATTACCATACTACTTACTGATCGAAATCTTAATACATCTTTTTTCGACCCCAACGGGGGGGGAGATCCAATTTTATATCAACATTTATTC	LepR1|LepF1
BKCAD075-08	*Hydropsyche sparna*	adult male	42.257	-74.04	United States	New York	David Ruiter	L. Myers	Centre for Biodiversity Genomics	CACTTTATATTTTATATTTGGAATTTGATCAGGATTAGTAGGATCTTCTCTTAGTTTTATTATTCGAATAGAATTAAGAACTCCAGGAAGATTTATTGGAAATGACCAAATTTATAATGTGATTGTAACTTCTCATGCTTTTATTATAATTTTCTTTATAGTTATACCAATTATAATTGGGGGATTCGGAAATTGACTAGTACCCTTAATATTAGGATCACCTGATATAGCTTTTCCTCGAATAAATAATCTTAGATTTTGATTCCTTCCCCCATCTCTTATTTTTTTATTATTAAGAAGTATAACTAATTCTGGAGCTGGGACAGGATGAACTGTCTATCCTCCTTTATCTTCTAATTTATCTCATGCAGGCAGATCAGTTGATTTAACTATTTTTTCTCTTCATATAGCTGGAATTTCTTCAATTTTAGGGGCTATTAATTTTATTTCTACAATTATAAACATAAAATTTAAAAATTTAAATTTTGAAATAATTCCTTTATTTGTCTGATCAATTTTAATTACCGCAATTTTACTACTTCTATCTTTACCTGTTCTTGCTGGAGCAATTACAATACTTTTAACTGATCGAAATTTAAATACTTCTTTTTTTGATCCTGCAGGAGGGGGTGATCCTATTCTATATCAACATTTATTT	LepF1|LepR1
BKCAD014-08	*Lype diversa*	adult	44.25	-74.238	United States	New York	David Ruiter	L. Myers, B. Kondratieff	Centre for Biodiversity Genomics	TACTTTATATTTTATTTTCGGTATTTGATCTTCTTTACTTGGAACTTCTTTAAGAATAATTATTCGAATTGAATTGAGAACTCCCGGCTCATTTATTAATAATGATCAAATTTATAATTCAATTATTACAATTCACGCATTTATTATAATTTTCTTTATAGTAATACCTATTATAATTGGAGGATTCGGAAATTGATTAGTCCCCCTAATACTCGGAGCTCCAGACATAGCTTTCCCTCGAATGAATAATCTTAGATTTTGATTCTTGCCTCCCTCACTTTTCTTCTTAATTTCTAGAATATTTATAGATAACAGAGCCGGAACAGGATGAACTGTTTACCCCCCTCTATCAAATTCAATGTTCCATATAGGAAAAGCCATTGACATTTCAATTTTCTCTTTACACTTAGCAGGAATCTCATCAATTCTAGGGGCTATTAATTTCATTACTACTATTATTAATATAAAATTAAATACTGTTTCTTTTGAGATCATTCCTCTTTTTGTTTGATCAATCGGAATTACAGCTCTTCTTCTTCTTCTCTCCCTCCCTGTTCTTGCAGGAGCAATTACTATACTTCTAACAGATCGCAACCTAAACACTTCCTTTTTTGATCCTGCAGGAGGGGGGGATCCAATTTTATACCAACATCTTTTT	LepF1|LepR1
KJTRI261-13	*Hydromanicus chattrakan*	adult male	15.1633	106.158	Laos	Champasak	Hans Malicky	Jiri Hajek	University of Minnesota	TACTCTTTATTTTCTTTTTGGAATTTGATCAGGATTAATTGGATCCTCCCTCAGATTCTTAATTCGAATAGAACTTAGAATTCCAGGAACTCTTATTGGAAATGATCAAATTTATAATGTAATTGTAACATCTCATGCCTTTATTATAATTTTCTTTATAGTTATACCTATTATAATTGGAGGATTTGGAAATTGACTTGTGCCTCTTATACTAGGATCACCAGACATAGCTTTTCCGCGAATAAATAATATAAGATTTTGATTTCTCCCTCCTTCTTTAATTTTCTTAATTTTTAGAAGATTATTAAACTCAGGAGCTGGAACTGGATGAACTGTTTATCCTCCCCTTTCTTCCAATTTATCTCACCTAGGAAGATCAGTTGATATAACTATTTTTTCTTTACATTTAGCAGGAATTTCTTCTATTTTAGGAGCTATTAACTTTATTTCTACCATCATAAATATAAAATTTAAAAATTTAAATTATGAAATAATACCCCTATTTGTATGATCAGTATTAATTACTGCTATTTTACTATTACTATCCCTTCCTGTCCTAGCAGGAGCAATTACTATACTTTTAACAGACCGAAATTTAAATACTTCTTTTTTTGACCCTGCTGGAGGTGGAGACCCAATCTTATACCAACACTTATTT	

CNCAD525-07	*Polyplectropus nanjingensis*	adult male	32.0667	118.833	China	Jiangsu	Xin Zhou		Nanjing Agricultural University	AACTTTATATTTTATATTTGGAATCTGAGCAAGAATCTTAGGATCTACCTTAAGATTTATTATTCGAATTGAATTAAGAACATCAGGATCCTTAATAGGAAATGACCAAATTTATAATTCAATTGTTACTATTCATGCTTTTATTATAATTTTTTTATAATTATACCTTTAATAATCGGAGGATTTGGAAATTGATTAATCCCTTTAATAATAATATCCCCAGACATAGCATTTCCTCGAATAAATAATATAAGATTTTGAATATTACCCCCTTCAATTTTATTTCTTATTTCAAGAATATTTATAGATAATAGAGTAGGAACTGGTTGAACAGTATATCCTCCATTATCAAACAATTTATTTCATTCAGGAAAGGCTGTTGATATCTCAATTTTCTCTTTACATCTAGCCGGAATTTCATCAATTTTAGGAGCTATTAATTTTATTACAACAATTCTAAATATAAAATTAAAAAATATTTCAATTACAATAATTCCCTTATTTGTATGATCAATTAAAATTACAGCAGTATTATTATTATTATCATTACCTGTACTAGCAGGAGCTATTACAATACTTCTTACAGATCGAAATTTAAATACTTCATTTTTTGATCCATCAGGAGGTGGGGACCCAATTTTATATCAACATCTATTT	LepR1|LepF1
AMIA009-07	*Neophylax concinnus*	imature	39.441	-76.864	United States	Maryland	Jayme E. Sones	Maryland - Dept Natural Resources	United States Environmental Protection Agency	TAGTTGGAACTTCATTAAGAATAATTATTCGATCTGAATTAAGTATAACAGAATCTTTAATTAAAAATGATCAAATTTATAATGTTTTAGTTACTGCCCATGCTTTTATTATAATTTTTTTTATAGTAATACCTATTATAATTGGAGGATTTGGAAATTGATTAGTGCCTCTAATAATTGGAGCCCCAGACATAGCTTTCCCTCGAATAAATAATATAAGATTTTGACTTCTGCCCCCCTCTTTAAATTTTCTTTTAATTAGATCTCTTGTAGAAAGAGGGACAGGGACAGGATGAACAGTTTATCCCCCCCTATCGAGAAATTTAAGTCATGCTGGAGCTTCAGTAGATATTTCTATTTTTTCCTTACATTTAGCAGGAATTTCTTCAATTTTAGGAGCTATTAATTTTATTTCTACAACTTTAAATATGCGAAGTAATTTAATTACATTAGATCGTATTCCTTTATTTGTATGATCTGTAGCAATTACAGCTTTATTACTACTGTTATCTCTTCCTGTTTTAGCTGGAGCTATTACAATACTTCTTACTGACCGAAATTTAAATACATCATTTT-	LCO1490|HCO2198
BHMKK041-12	*Hydropsyche pallipennis*	adult male	19.383	98.383	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	TACTTTATATTTTATATTTGGAATTTGGTCAGGCCTAGTTGGATCCTCTTTAAGCTTCATTATTCGAATAGAATTAAGAACTCCAGGAAGATTTATTGGCAATGACCAAATTTATAATGTAGTTGTCACATCACATGCTTTTATTATAATTTTTTTATAGTTATACCCATTATAATTGGGGGATTTGGAAATTGATTAGTTCCTCTAATATTAGGTTCCCCAGACATAGCTTTTCCCCGAATAAATAATTTAAGATTCTGATTCTTACCCCCCTCTCTAATTTTTCTTTTATTAAGAAGAATAACTAACTCAGGAGCTGGAACAGGATGAACTGTCTACCCTCCCCTATCTTCCAATTTATCCCACGCAGGAAGATCCGTAGATTTAACTATTTTCTCTTTACATATAGCAGGAATCTCTTCAATCCTAGGAGCTATTAATTTTATTTCTACTATTATAAATATAAAATTTAAAAACTTAAATTTTGAAATAATCCCACTATTCGTTTGATCAATTCTAATTACTGCTGTATTATTACTTCTTTCTTTACCAGTACTAGCTGGAGCTATTACTATACTTTTAACAGATCGAAATTTAAATACTTCTTTTTTTGATCCCGCAGGAGGAGGAGACCCCATCCTATATCAACATCTATTTNNNNNNNNN	LCO1490|HCO2198
ELPYO237-08	*Cheumatopsyche harwoodi*	adult female	43.627	-80.448	Canada	Ontario	Xin Zhou	Xin Zhou	Centre for Biodiversity Genomics	AACTCTTTATTTTATTTTCGGAATTTGATCCGGATTAGTCGGATCCTCTTTAAGATTTCTTATTCGAATTGAACTCAGAACCCCAGGATCTTTGATCGGTAATGACCAAATTTATAATGTAATTGTTACTTCTCACGCATTTATTATAATTTTTTTATAGTTATACCTATTATGATTGGAGGATTTGGAAACTGACTAGTCCCTTTAATGTTAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCTTCATTACTTCTTCTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACGGGTTGAACTGTTTACCCTCCTTTATCATCTAATCTATCACATCTAGGCAGATCAGTAGACTTAACTATTTTTTCCCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAATTTCATTACTACATCTTTTAACATAAAAATTAATAAATTAAATTATGAAATTCTTCCCCTCTTTGTTTGATCAGTTGCTATTACTGCCATTTTATTACTTCTGTCCCTCCCTGTTTTAGCTGGCGCAATTACTATACTATTAACAGATCGCAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGGGGAGACCCTATTTTATACCAACATTTATTT	LepF1|LepR1
OFCAD039-08	*Austrotinodes texensis*	adult male	29.3683	-100.885	United States	Texas	Oliver S. Flint, Jr.	C. & O. Flint	Smithsonian Institution	AGTTTTATATTTCATTTTTGGAATCTGAGCCAGATTAATTGGACTTTCACTTAGAATAATTATTCGTCTTGAACTAAGAACACCAAATTCAATTATTATAAATGATCAATTTTATAATTCAATTATTACAATTCACGCTTTCATTATAATTTTCTTTATAATTATACCAATTATAATTGGAGGTTTTGGAAATTGATTAATTCCATTAATATTAGGAGCCCCAGATATAGCTTTCCCACGAATAAATAACATAAGATTTTGATTACTTCCCCCATCATTAATTTTTTTAATCTCTAGAATATTTATAGACAACAGAGCAGGAACTGGTTGAACAGTATACCCACCATTATCAAATTTTAATTTTCATATAGGAAAAGCAATTGATATTACTATTTTCTCACTACATTTAGCAGGAATTTCCTCAATCCTAGGAGCAATTAATTTTATTACAACAATTATTAACATAAAATCTAGTACTTTATCATTTAATATAATCCCATTATTTGTTTGATCAATTAAAATTACAGCAATTTTACTCCTTCTTTCTTTACCAGTTTTAGCAGGAGCTATTACCATACTTCTTACAGATCGAAACATAAATACTTCATTTTTTGAACCAGCAGGAGGAGGAGATCCTATTTTATATCAACATTTATTT--	LepR1
PKCAD748-08	*Sisko sisko*	adult male	36.07	-84.9028	United States	Tennessee	Jason L. Robinson	Jason L Robinson	University of Tennessee, Knoxville	NNNNNNNNNNNNNNNNNNNNNNNNNNNNNTCTAGAATACTAGGACTATCCCTTAGGCTTTTAATTCGAACTGAATTAAGAACTCCTGGATCCCTAATTGGAAATGACCAAATTTTTAATTCAATTGTCACAGCTCACGCTTTTGTAATAATTTTCTTTATAGTAATACCCATTATAATTGGGGGGTTTGGAAACTGATTAGTGCCCCTTATACTGGGGGCCCCTGACATAGCCTTTCCTCGAATAAACAACATAAGATTTTGATTTTTGCCCCCCTCTCTTTTTTTTTTAATTTTTGGGATATTAATAGACAGAGGAGCTGGGACAGGTTGAACAGTTTACCCCCCCTTATCAGCCAATATTTCCCATATAGGAAAAGCCGTAGATATCACCATTTTTTCTCTTCATCTAGCCGGAATTTCCTCAATTCTAGGAGCTATTAACTTCATTACCACCATTATTAATATACGTTCTAACTATATAACATTTGATCGAATGCCCCTATTCGCGTGATCTGTTGGAATCACAGCTATTCTCTTATTATTATCTCTGCCAGTTTTAGCCGGAGCAATCACTATACTTCTCACAGACCGAAATCTTAATACCTCTTTTTTTGACCCAGCGGGGGGGGGAACCCAATTTNNNNNNNNNNNNNNNNN	LepF1
OFTRI457-10	*Machairocentron echinatum*	adult	10.7382	-62.6492	Venezuela	Sucre	Oliver S. Flint, Jr.	Holzenthal, Flint, Cressa	Smithsonian Institution National Museum of Natural History	AACATTATACTTTATATTCGGAATTTGGTCAAGTTTAATTGGAACATCTTTAAGTTTAATTATTCGAATTGAATTAAGAACCCCTAACTCATTTTTAGGGAATGATCAAATTTATAACTCAATTGTAACTATTCACGCCTTTATCATAATTTTCTTTATAGTTATACCAATTATAATTGGGGGATTTGGAAACTGATTAGTTCCTTTAATATTATCCGCCCCAGATATGGCTTTTCCGCGAATAAATAATTTAAGATTTTGATTTTTACCCCCATCCATTTTATTCCTTATTTCAAGAATATTCATAGATTACAGAATAGGAACTGGATGAACAGTTTATCCACCTTTATCTAATAATTTATTCCACTCAGGGAAAGCTGTTGATATCTCTATTTTCTCATTACATTTAGCTGGGATTTCATCAATCTTAGGAGCTATTAATTTTATTACTACAATTATTAATATAAAATTAAAAATAATATCCTTTGACATAATCCCCCTACTTGTTTGGTCAGTAGGAATTACAGCATTATTATTACTTCTATCACTGCCAGTATTAGCCGGAGCTATTACCATATTATTAACTGN--	C_LepFolF|C_LepFolR
BHMKK064-12	*Ecnomus puro*	adult male	19.383	98.383	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AATTTTATACTTCATTTTTGGAATTTGAGCAAGAATAGTAGGTTCATCTTTTAGCTTAATTATTCGAATAGAATTAAGATCCCCATCATCAATAATTGGAAACGATCRAATTTATAATTCAATTATTACAATTCATGCATTTATTATAATTTTTTTATAATTATACCAATTATAATTGGAGGATTCGGAAATTGATTAGTACCATTAATATTAGGTACACCTGATATAGCATTCCCACGAATAAATAATATAAGATTCTGACTTCTTCCACCATCTTTAACTTTTTTAATTTCTTCAATATTTATRGATAACAGATTAGGAACAGGATGAACTGTAKATCCTCCATTATCAAATTACGAATACCATTTAGGAAAAGCMGTAGACATCTCTATTTTTTCATTACATCTAGCTGGAATTTCTTCAATTCTTGGAGCAATCAATTTTATTTCAACTATTATAAACATAAAAATTAAATTTATTTCAATTAACTTAATTCCACTATTTGTATGATCAATTAAAATTACAGCAATTTTACTATTATTATCACTTCCAGTATTAGCAGGAGCCATTACCATACTACTAACAGATCGAAATTTARATACTTCATTTTTTGAACCAGCTGGAGGAGGAGATCCAATTCTATATCAACATTTATTTNNNNNNNNN	

CRCAD039-07	*Goera calcarata*	adult male	34.9193	-83.1688	United States	South Carolina	Ian Stocks	J. C. Morse	Clemson University	AACAATTTATTTTATTTTTGGTATTTGATCAGGAATAGTAGGAACATCCTTAAGAATAATTATTCGAACTGAATTAGGAACAGCCGAATCTTTAATTAAAAATGATCAAATTTATAATGTTCTAGTAACAGCTCATGCTTTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGAAATTGATTAGTTCCCTTAATAATTGGGGCCCCTGATATAGCATTCCCTCGAATAAATAATATAAGATTTTGATTCTTACCTCCTTCTTTAAATTTTCTATTAATTAGTTCTTTTATTGAAAGAGGAACTGGAACTGGGTGAACAGTTTATCCCCCTCTTTCAAGAAATTTAGCTCATGCAGGTAGATCAGTTGATATTTCTATTTTTAGTCTTCATTTAGCAGGAATTTCATCAATTTTAGGGGCTATTAACTTTATTTCTACTACTTTAAATATACGAAATAATTTAATTTCACTTGATCGAATTCCTTTATTTGTTTGATCAGTTGCTATTACAGCTCTTTTACTACTCTTATCCCTTCCAGTTTTAGCTGGAGCTATCACAATATTATTAACTGATCGAAATCTAAATACTTCATTTTTCGACCCCGCTGGAGGAGGAGATCCTATTTTATACCAACATTTATTC	LepF1|LepR1
SMTRI005-10	*Cheumatopsyche gyra*	adult male			United States	North Carolina	David Etnier	JL Robinson	University of Tennessee, Knoxville	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTAGGATCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACCCCAGGATCCTTAATTGGGAATGACCAAATTTATAACGTAATTGTTACTTCCCACGCATTTATTATAATTTTTTTCATAGTTATACCCATTATAATTGGAGGGTTTGGAAACTGATTAGTTCCTTTAATATTAGGATCACCAGATATAGCTTTCCCTCGAATAAATAACTTAAGATTTTGATTTTTACCCCCCTCTCTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGAACAGGTTGAACTGTTTACCCTCCTTTATCGTCTAACCTTTCTCATTTAGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGGGCCATTAATTTTATCACTACATCCTTCAATATAAAAATTAATAAATTAAATTACGAAATCCTTCCCCTCTTTGTCTGATCAGTTGCTATTACTGCTGTTCTTCTTCTCTTATCCCTTCCTGTATTAGCCGGTGCAATTACTATATTATTAACAGATCGTAATTTAAATACATCTTTCTTTGACCCAGCTGGAGGGGGTGACCCCATCTTATACCAACATTTATTT	LepF1|LepR1
CBCAD232-10	*Polycentropus centralis*	adult	46.64	-60.944	Canada	Nova Scotia	Xin Zhou	D.Baird	Centre for Biodiversity Genomics	AACCTTATATTTTATTTTCGGAATCTGATCAAGAATTTTTGGTTCTACTTTAAGATTTATTATTCGAATTGAACTAAGAACATCAAGATCATTATTAAGAAATGATCAAATTTATAATTCAATTGTTACTCTTCATGCTTTTATTATAATTTTTTTTATAATTATACCTATAATAATTGGAGGATTTGGAAATTGATTAATTCCATTAATATTAATAGCTCCAGATATGGCATTCCCTCGAATAAACAATATAAGATTTTGATTATTACCTCCATCCATTTTTTTTCTTATTTCAGGAATTTTTATAGATAATAGAGTAGGAACAGGATGAACTGTATACCCTCCTTTATCAAATAACTTATTCCACTCAGGAAAGGCAGTTGATATCTCAATTTTTTCTCTTCACATAGCAGGTATTTCCTCAATTTTAGGAGCTATTAATTTTATTTCAACAATCCTTAACATAAAACTTAAAAATATCCCTTTAAGAATAATTCCATTATTTGTCTGATCAATTAAAATCACAGCAATTTTATTATTAATTTCATTACCTGTTTTAGCAGGAGCTATTACAATATTATTAACTGATCGAAATTTAAATACCTCCTTTTTTGATCCTGCAGGAGGAGGAGACCCAATTTTATATCAACATTTATTT	LepF1|LepR1
HIEPT144-10	*Cheumatopsyche pinaca*	adult male	34.9192	-83.1687	United States	Georgia	John Morse	J. Morse	Smithsonian Institution National Museum of Natural History	AACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGATCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACTCCTGGATCTTTAATTGGAAATGATCAAATTTATAACGTAATTGTTACTTCACATGCATTTATTATAATTTTTTTTATAGTTATGCCTATTATAATTGGGGGATTCGGCAATTGATTAGTTCCTTTAATATTAGGCTCACCAGACATAGCCTTTCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTCTAATTTTAAGAAGAATAATAAACTCAGGAGCTGGTACAGGTTGAACTGTTTACCCCCCTCTATCATCTAATTTATCCCACCTTGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAACTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTTTATTACTTCTATCTCTCCCTATTCTCGCAGGCGCAATTACTATATTACTGACAGATCGTAATTTAAATACATCTTTTTTTGATCCAGCTGGAGGAGGAGATCCTATTTTATACCAACATTTATTT	C_LepFolR|C_LepFolF
HIEPT156-10	*Cheumatopsyche etrona*	adult male	34.9192	-83.1687	United States	Georgia	John Morse	J. Morse	Smithsonian Institution National Museum of Natural History	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTGATAGGGTCATCTTTAAGATTTCTTATTCGAATTGAACTTAGAACCCCAGGATCTTTAATTGGAAACGACCAAATTTATAATGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTTGGAAATTGATTAGTTCCTTTAATATTAGGATCACCAGACATAGCTTTCCCTCGAATAAATAATCTAAGATTCTGATTTTTACCCCCCTCACTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGTGCTGGCACAGGTTGAACCGTTTACCCTCCTCTATCATCTAATCTCTCTCACCTAGGTAGTTCTGTAGACTTAACTATTTTTTCTCTTCATTTAGCTGGAATCTCATCAATTTTAGGGGCTATTAATTTTATTACTACATCTTTCAATATAAAAATTAATAAATTAAATTACGAAATCCTTCCTCTTTTTGTATGATCCGTTGCTATCACTGCTATTCTCCTTCTTTTATCCCTGCCTGTCTTAGCCGGCGCAATTACAATATTATTAACAGATCGTAATTTAAATACATCTTTCTTTGACCCAGCAGGTGGAGGAGACCCTATTCTATACCAACATTTATTT	C_LepFolR|C_LepFolF
ECCAC495-09	*Cheumatopsyche oxa*	imature	45.9151	-66.6169	Canada	New Brunswick	Xin Zhou	DB, KH, AP	Biodiversity Institute of Ontario	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCCTACCCCCCTCATTACTTCTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCGTCTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTCTATTACTTCTATCTCTCCCAGTTTTAGCTGGCGCAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCGGGAGGAGGGGATCCTATTTTATATCAACATTTATTT	M13F|M13R
SMCAD220-07	*Cheumatopsyche harwoodi*	adult male	35.6528	-83.698	United States	Tennessee	David Etnier	C. Parker	University of Tennessee, Knoxville	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTCGGATCCTCTTTAAGATTTCTTATTCGAATTGAACTCAGAACCCCAGGGTCTCTAATCGGTAACGACCAAATTTATAATGTAATTGTTACTTCTCACGCATTTATTATAATTTTTTTTATAGTTATACCTATTATGATTGGAGGATTTGGAAACTGATTAGTTCCTTTAATATTAGGATCACCAGACATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCTTCATTACTTCTTCTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCCTTATCATCTAATCTATCACATCTAGGCAGATCAGTAGACTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAATTTTATTACTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAAATTCTTCCCCTCTTTGTTTGATCAGTTGCTATTACTGCCATTTTATTACTTCTGTCCCTCCCTGTTTTAGCTGGTGCAATTACTATACTATTAACAGATCGCAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGGGGAGACCCTATTTTATATNNNNNNNNNNNNN	LepF1|LepR1
BHMKK113-12	*Ecnomus pseudotenellus*	adult male	19.25	98.483	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AATTTTATATTTTATTTTTGGTATTTGGGCAAGAATAATTGGATCATCATTAAGATTAATTATTCGAATAGAATTAAGATCCCCAAATTCAATAATTAATAATGATCAAATCTATAATTCAATTATTACAATCCATGCATTTATCATAATCTTCTTTATAATTATACCAATTATAATTGGAGGATTTGGAAATTGATTAGTTCCATTAATATTAGGAGCACCCGATATAGCATTCCCACGAATAAATAACATAAGATTTTGATTGCTACCACCATCATTATCATTTTTAATTTCAAGAATATTTATAGATAACAGTTTAGGAACAGGATGAACAGTATATCCTCCATTATCTAACTATGAATATCACCTTGGTAAAGCAGTAGATATCTCAATTTTTTCATTACATCTAGCAGGAATTTCCTCAATTCTTGGTGCAATTAACTTTATTTCAACAATCATAAACATAAAAATTAAGTTTATTTCAATAAACTTAATTCCTTTATTTGTTTGATCAATTAAAATCACAGCAATTTTATTATTATTATCTCTTCCTGTTCTAGCAGGAGCAATTACAATACTATTAACAGATCGAAACTTAAATACTTCATTTTTTGAACCATCAGGAGGAGGAGATCCAATTCTTTATCAACATTTATTTNNNNNNNNN	LCO1490|HCO2198

LEPTO1484-13	*Cheumatopsyche enigma*	imature	40.421	-75.708	United States	Pennsylvania	Trevor Bringloe	T. Bringloe, V. Harvey, S. Ripley, K. Rondollo	Centre for Biodiversity Genomics	-ACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAG	C_LepFolR
BHMKK141-12	*Pseudoleptonema quinquefasciatum*	adult male	19.35	98.45	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AACTCTATATTTTATTTTTGGTATTTGATCAGGATGTTTAGGAACATCAATAAGAATTTTAATTCGTATTGAATTATCTTCCCCTTTTAGAATAATTGGTAATGATCAAATCTATAATGTAACAGTTACAGCTCATGCTTTTATCATAATTTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGAAACTGACTTGTTCCATTAATATTAGGAGCCCCTGATATAGCATTCCCACGAATAAATAATATAAGATTTTGATTACTCCCCCCTTCATTAATTTTCCTTATTACTAGAAGATTAACCAATATAGGAGCAGGAACAGGATGAACTGTTTATCCTCCATTATCATCAAATTTATCACATAGAGGTAATGCTGTTGATTTAACAATTTTTTCTTTACATCTTGCAGGTATTTCTTCTATTCTTGGAGCCATTAATTTTATTTCAACAATTTTAAATATAAAAATTTTCAATTTAACATCAGATAAACTTCCTTTATTTGTTTGATCTGTTTTAATTACAGCAGTTTTACTTCTTCTTTCCTTACCTGTTCTTGCAGGAGCAATCACAATATTATTAACTGATCGTAATTTAAATACTTCTTTTTTTGATCCAGCAGGAGGAGGAGACCCTATTTTATATCAACACTTATTTNNNNNNNNN	LCO1490|HCO2198
BKCAD016-08	*Cheumatopsyche oxa*	adult male			United States	New York	David Ruiter	J. Mihuc	Centre for Biodiversity Genomics	AACTCTTTACTTTATTTTCGGAATTTGATCCGGGTTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCCTACCCCCCTCATTACTTCTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCGTCTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTCTATTACTCCTATCTCTCCCAGTTTTAGCTGGCGCAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCGGGAGGAGGGGATCCTATTTTATATCAACATTTATTT	LepR1|LepF1
DRCAD241-09	*Homoplectra doringa*	adult male	38.917	-78.833	United States	West Virginia	David Ruiter	D. Smith	University of Minnesota Insect Collection	AACCCTCTATTTTTTATTTGGCATCTGATCTGGTCTTATTGGATCTTCCATAAGAATAATTATCCGAACTGAACTAAGAACCCCAGGATCTCTTATCGGAAACGATCAAATTTATAATGTAATTGTTACAGCCCATGCATTTATTATAATTTTCTTTATAGTAATACCCATTATAATTGGAGGATTTGGTAATTGACTTGTCCCCCTCATACTTGGGTCTCCTGATATAGCCTTCCCCCGAATAAATAATATAAGATTCTGATTTCTTCCCCCCTCTTTAATTTTTCTTCTTTCAAGAAGACTAATAAACTCAGGAGCAGGAACAGGATGAACTGTATACCCACCCCTCTCCTCCAATTTATGTCACCTCGGAAGCTCCGTAGACCTGACAATTTTCTCCCTACATTTAGCAGGAATTTCATCTATTTTAGGAGCCATTAATTTTATTACTACAATTTTAAACATAAAATTTAATAATTTAAATTATGATATAATCCCCCTATTTGTGTGATCAGTATTAATTACCGCTGTTTTACTTCTTTTGTCCCTCCCAGTTCTTGCAGGAGCAATTACAATACTTCTAACTGATCGTAACCTAAATACCTCCTTCTTTGATCCAGCAGGAGGGGGAGACCCAATTCTATATCAACACCTATTT	LepF1|LepR1
ELPYO396-08	*Cheumatopsyche analis*	adult male	43.627	-80.448	Canada	Ontario	Xin Zhou	Xin Zhou	Centre for Biodiversity Genomics	AACTCTTTATTTTATTTTCGGAATTTGATCTGGATTAGTAGGATCCTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCTGGGTCTTTAATTGGAAATGACCAAATTTATAATGTAATTGTCACTTCTCATGCATTTATTATAATTTTCTTTATAGTTATACCCATTATAATTGGAGGATTTGGAAATTGATTAGTTCCTTTAATATTAGGATCCCCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTTTTACCTCCTTCATTACTCCTTCTAATTTTAAGAAGAATAATAAATTCAGGGGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCATCAAATCTATCTCACCTTGGGAGATCAGTAGATTTAACTATTTTCTCTCTTCATTTAGCTGGTATCTCATCAATTCTAGGAGCAATTAACTTTATTACTACATCTTTTAACATAAAAATTAATAAATTAAATTATGAAATTCTTCCTCTCTTTGTTTGATCAGTAGCCATTACTGCCATTCTACTTCTATTATCTCTGCCTGTTTTAGCCGGCGCAATTACTATATTACTAACAGATCGTAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGGGGAGACCCTATTTTATATCAACATTTATTT	LepF1|LepR1
KJTRI020-13	*Pseudoneureclipsis thestios*	adult male	0.4	116.052	Indonesia		Hans Malicky	J. Hajeck, J Schneider & P. Votruba	University of Minnesota	NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNTCACTAAGAATAATAATTCGACTAGAATTAAGAATCCCTGGATCACTTTACAACAATGAACAACTATATAACTCCATAGTTACAATTCACGCATTCATTATAATCTTCTTCATAATTATACCAATCATAATTGGAGGATTCGGAAACTGAATAGTCCCACTTATACTAAGATCACCAGATATAGCATTTCCACGAATAAACAATCTTAGATTCTGACTTTTACCCCCATCCCTTTTTTTTCTAATTTCAAGAATATTCATAAATAATAGACTAGGAACAGGATGAACTATATACCCACCCCTATCCAATAACTTATTCCACAGAGGAAAATCAGTAGATATAGCAATTTTCTCCCTGCATCTAGCAGGAATTTCATCAATTCTAGGAGCAATTAATTTCATTTCAACAATCTTAAATATAAAACTGAAATCCTTACCCCTTAATAACCTTACTTTATTTTCTTGATCAATTATAATCACAGCAATTTTACTACTTCTATCTCTTCCCGTTCTAGCAGGAGCAATTACCATAATCCTAACTGATCGAAACCTAAATACCTCATTTTTTAATCCTATAGGAGGAGGAGACCCAATCCTCTTCCAACACTTATTT	
CAUTR091-09	*Macrostemum radiatum*	adult male	41.0702	125.015	China	Liaoning	Xin Zhou	Junchao Wang	China Agricultural University	AACTTTATATTTTATTTTCGGTATTTGATCAGGACTCGTAGGGTCTACTCTTAGCCTTTTAATTCGTATTGAATTAAGAACACCTAATACTCTTATTGGCAATGACCAAATTTATAATGTAATTGTCACAGCTCATGCCTTTATTATAATTTTCTTTATAGTAATACCCATTATAATTGGAGGATTTGGCAATTGACTTGTTCCCCTAATACTAGGAGCTCCAGATATAGCATTCCCTCGAATAAATAATATAAGTTTCTGACTACTTCCCCCTTCTCTTACATTTTTAATTTTTAGAAGATTAGTTAATAATGGAGCTGGAACAGGATGAACTGTATACCCCCCTCTCTCTTCTAATCTCTCTCATATAGGAAGATCCGTAGATTTAGCTATTTTTTCTCTTCATCTTGCTGGTATTTCTTCAATTCTTGGATCAATTAACTTTATTACTACTATCTGTAATATAAAAATTAATCACTTAAAAATAGATAAACTACCTCTCTTTATTTGATCAATTCTAATTACTACTGTTCTCTTACTACTTTCTCTCCCAGTCCTAGCCGGAGCTATTACTATACTTTTAACTGATCGTAATCTAAATACCTCCTTCTTTGACCCTGCAGGAGGAGGAGATCCTATTCTTTACCAACATCTTTTT	LepR1|LepF1
NBCAD008-08	*Cheumatopsyche harwoodi*	adult female	46.8225	-66.1092	Canada	New Brunswick		X. Zhou, D. Baird	Centre for Biodiversity Genomics	AACTCTTTATTTTATTTTCGGAATTTGATCCGGATTAGTCGGATCCTCTTTAAGATTTCTTATTCGAATTGAACTCAGAACCCCAGGATCTTTGATCGGTAATGACCAAATTTATAATGTAATTGTTACTTCTCACGCATTTATTATAATTTTTTTTATAGTTATACCCATTATGATTGGAGGATTTGGAAACTGACTAGTCCCTTTAATGTTAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCTTCATTACTTCTTCTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTTTATCATCTAATCTATCACATCTAGGCAGATCAGTAGACTTAACTATTTTTTCCCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAATTTCATTACTACATCTTTTAACATAAAAATTAATAAATTAAATTATGAAATTCTTCCCCTCTTTGTTTGATCAGTTGCTATTACTGCCATTTTATTACTTCTGTCCCTCCCTGTTTTAGCTGGTGCAATTACTATACTATTAACAGATCGCAATTTAAATACATCTTTTTTTGACCCAGCAGGAGGAGGAGATCCTATTTTATACCAACATTTATTT	LepR1|LepF1

BBEPT667-11	*Potamyia flava*	adult	41.95	-82.517	Canada	Ontario	BOLD ID Engine	T.F.Mitterboeck, C.Vandermeer, V.Junea, C.Sobel	Centre for Biodiversity Genomics	AACTTTATATTTTATTTTTGGAATCTGATCAGGATTAGTAGGATCTTCCCTAAGATTTCTTATTCGTTTAGAATTAAGAACTCCAGGATCCTTGATTGGAAATGACCAAATTTATAACGTTATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCAATTATAATTGGAGGATTTGGAAATTGATTAGTTCCTTTAATATTAGGATCTCCAGATATAGCTTTCCCTCGAATAAATAATATAAGATTTTGATTTTTACCCCCCTCTCTCCTTTTCCTTCTTTTTAGAAGAATAATTAACTCAGGAAGAGGAACAGGATGAACAGTTTACCCTCCTCTTTCTTCTAATTTATCTCATATAGGAAGATCTGTAGATTTAACTATTTTCTCTTTACATTTAGCGGGAATTTCTTCAATTTTAGGTGCTATCAATTTTATTTCAACTATTATAAATATAAAATTTAATAATTTAAATTACGAAATAATTCCTCTTTTTGTATGATCAGTACTTATCACAGCAGTACTTCTTTTATTATCACTCCCAGTTTTAGCTGGAGCTATTACTATATTATTAACTGATCGAAATTTAAACACTTCTTTCTTTGACCCTGCAGGTGGAGGAGACCCAATTCTATACCAACATTTATTT	C_LepFolR|C_LepFolF
BHMKK131-12	*Ecnomus totiio*	adult male	19.35	98.45	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AATTCTTTATTTTATCTTTGGAATTTGATCTAGATTAGTAGGATCTTCTTTAAGAATAATCATTCGAATAGAACTTAGATCCCCAAATTTAATAATTATAAATGATCAAATTTATAATTCAATTATTACAATTCATGCATTTATTATAATTTTTTTTATAATTATACCAATTATAATTGGAGGTTTTGGAAATTGATTAGTACCACTAATATTAGGAGCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTATTACCTCCATCATTAACATTTTTAATTTCAAGAATATTTATAGATAATGGATTAGGTACAGGATGAACAGTATACCCTCCATTATCTAATTATAATTATCATTTAGGTAAAGCTGTTGATATCTCAATTTTTTCATTACATTTAGCTGGAATTTCATCAATTTTAGGAGCAATTAATTTTATTTCAACTATCATAAATATAAAAATTAAATTCATTTCATTAAATTTAATTCCATTATTTGTTTGATCTATTAAAATTACAGCAATTTTATTACTTTTATCTCTACCAGTATTAGCAGGTGCAATTACTATACTTCTTACTGATCGTAATTTAAATACTTCATTTTTTGAACCAGCAGGAGGAGGAGATCCAATTCTTTATCAACATTTATTTNNNNNNNNN	LCO1490|HCO2198
GMFRO053-15	*Cheumatopsyche enigma*	adult	38.892	-78.167	United States	Virginia	Kate Perez	Kristina J. Anderson	Smithsonian Institution	TTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGATCTTTAATCGGGAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTACCCTCCTCTATCATCTAATCTATCCCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTACCAGTTCTAGCTGGCGCAATTACTATATTATTAACA--	C_LepFolR
NBCAD605-08	*Cheumatopsyche oxa*	adult male	47.1107	-65.3858	Canada	New Brunswick	Xin Zhou	D.B. and S.R.	Centre for Biodiversity Genomics	NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNTAGTTGGATCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATGTTAGGGTCACCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCCTACCCCCCTCATTACTTCTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCGTCTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTCTATTACTCCTATCTCTCCCAGTTTTAGCTGGCGCAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN	LepR1|LepF1
NBCAD036-08	*Cheumatopsyche oxa*	adult male	46.8225	-66.1092	Canada	New Brunswick	Roger J. Blahnik	X. Zhou, D. Baird	Centre for Biodiversity Genomics	AACTCTTTACTTTATTTTCGGAATTTGATCCGGATTAGTTGGATCTTCTTTAAGATTCCTTATTCGAATTGAACTTAGAACTCCAGGGTCTTTAATCGGAAATGACCAAATTTATAACGTAATTGTTACTTCTCATGCATTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGATTCGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGAATAAATAATTTAAGATTTTGATTCCTACCCCCCTCATTACTTCTCCTAATTTTAAGAAGAATAATAAATTCTGGAGCTGGCACAGGTTGAACTGTTTACCCACCCCTATCGTCTAACCTATCTCATCTCGGAAGATCCGTAGATTTAACTATTTTTTCTCTTCATTTAGCTGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCCATTACTGCCATTCTATTACTCCTATCTCTCCCAGTTTTAGCTGGCGCAATCACTATATTATTAACAGACCGTAATTTAAATACATCTTTTTTCGACCCAGCGGGAGGAGGGGATCCTATTTTATATCAACATTTATTT	LepR1|LepF1
COCAD006-07	*Leptonema sinuatum*	adult			Costa Rica	Puntarenas	Wills Flowers	Wills Flowers	Florida Agricultural and Mechanical University	AACCTTATACTTTATTTTAGGTATTTGATCTGGTATTATAGGATCCTCCCTCAGATTGATTATTCGCATCGAATTAAGTACCCCCACCACTTTAATTGGTAACGATCAAATTTATAATGTTGTTGTTACTGCTCACGCTTTTATTATAATTTTTTTCATAGTTATACCTATTATAATCGGGGGATTTGGGAATTGATTAGTCCCTTTAATACTAGGGGCTCCTGATATAGCTTTCCCTCGTATAAATAACATAAGATTCTGATTTCTTCCCCCATCTCTAATCTTCCTTACTTTTAGAAGTCTTGTAAATAGAGGCGCAGGCACTGGATGAACTGTTTATCCCCCTCTCTCCTCAAATCTCTCCCACAGAGGGAGTTCGGTTGATTTAGCAATTTTTTCCCTTCACTTAGCTGGGATCTCATCAATTTTAGGGGCCATCAACTTTATTACCACAATTTTAAACATAAAACCAAATAACATTCAATTAAGTATAATTCCCCTTTTTGTTTGGTCTGTCTTAATTACTGCCGTTCTCTTATTACTCTCCCTCCCAGTTCTAGCTGGAGCTATTACTATACTATTAACTGATCGTAATCTAAATACCTCCTTTTTTGATCCTGCTGGAGGGGGTGATCCTATCCTCTATCAACATCTATTT	M13F|M13R
KJTRI152-13	*Pseudoneureclipsis abia*	adult male			Thailand	Nan	Hans Malicky	C. Wieser	University of Minnesota	AACACTATACTTCATACTAGGAATCTGATCTAGATTAATTGGAACTTCACTAAGAATAATAATTCGACTCGAACTAAGAATCCCAGGATCGTTTTATAATAATGAACAACTTTATAACTCCATAGTTACAATCCACGCATTCATTATAATTTTTTTCATAATTATACCAATTATAATTGGAGGATTTGGAAACTGAATAGTACCATTAATAATAGGATCACCAGACATAGCTTTCCCACGAATAAATAATCTTAGATTCTGACTCCTACCCCCATCCCTATTTTTCTTAATTTCAAGTATATTCATAAATAATAGATTAGGTACAGGATGAACAATATACCCCCCACTATCAAATAATTTATTCCATAGAGGAAAATCAGTAGACATAGCCATCTTCTCCTTACACCTAGCAGGAATTTCATCAATCCTAGGAGCCATTAACTTTATCTCAACAATCCTGAATATAAAACTCAAATCCTTACCCCTCAACAACCTAACTCTATTTTCCTGATCAATTATAATTACAGCAATCCTATTACTATTATCCCTTCCCGTTCTTGCCGGAGCAATTACTATAGTACTAACAGACCGAAATATAAATACATCATTCTTCAATCCCATAGGAGGAGGGGATCCTTTACTATTCCAACACCTATTC	
HMCAD217-08	*Dipseudopsis benardi*	adult male	19.267	98.45	Thailand	Mae Hong Son	Hans Malicky	H. Malicky	Rutgers, The State University of New Jersey	AACTCTCTACTTCATTTTTAGAATCTGATCAAGACTAATTGGTACTTCATTAAGAATAATCATTCGAATCGAACTTTCTAGTCCTAATTCATTTATCGGAAATGATCAAATCTATAATGCAATTGTTACAATTCATGCTTTCATTATAATTTTCTTTATAATTATACCAGCAATAATTGGAGGATTTGGAAATTGACTAGTACCTCTAATACTAGGAGCCCCTGACATAGCCTTTCCACGAATAAATAATCTTAGATTTTGACTTTTACCTCCCTCTATTCTATTTCTACTCTCATCAATATTTTTAAATAATGGAGCAGGAACAGGTTGAACTGTTTATCCCCCTCTATCTAATAACCTCTTCCATTCAGGAAAAGCAATTGATGTATCAATTTTCTCACTACATCTTGCAGGTATTTCATCCATTCTTGGTGCTATTAATTTTATTACAACTTCATTAAACATAAAATTAATA---ATAAACTCCAGAATAATACCTTTATTTGTATGATCAATTCTTATTACTGCCATTCTTCTCCTCCTCTCTCTCCCAGTTCTTGCAGGAGCAATTACAATACTTCTAACAGATCGAAACATTAATTCTTCATTTTTTGATCCAGCAGGAGGAGGAGATCCAATTCTATTTCAACACCTATTC	LepF1|LepR1

UMNEB807-08	*Parecnomina resima*	adult male	-33.9483	22.9192	South Africa	Western Cape	Roger J. Blahnik	Kjer & Blahnik	University of Minnesota Insect Collection	AATTTTATATTTTATTTTCGGAATTTGATCTAGATTAATTGGTTCATCATTAAGAATAATTATTCGACTAGAATTAAGATCAACTAAATCAATAATTATAAATGACCAAATTTATAATTCAATTATTACTATCCATGCATTTATTATAATTTTCTTTATAATTATACCACTAATAATTGGAGGATTTGGTAATTGATTAGTACCATTAATAATTGGAGCACCAGATATAGCATTTCCACGAATAAATAATATAAGATTTTGATTATTACCACCATCGCTATTATTCCTAATTTCAAGAATATTTATAGATAATAGAATAGGAACAGGATGAACAGTATATCCTCCATTATCTAATTATAATTTCCATATAGGAAAAGCCGTAGATATTTCAATTTTCTCTCTCCATCTTGCAGGAATTTCATCAATTTTAGGAGCAATCAATTTTATTACAACTATTCTAAACATAAAATCAAGATTTATATCTTTAAATATAATTCCACTTTTCGTCTGATCAATTAAAATTACTGCTATTCTTCTTCTTCTATCTTTACCAGTTCTTGCTGGAGCAATTACTATACTATTAACAGATCGTAATTTAAACACCTCATTCTTTGAACCAGCTGGAGGAGGAGATCCTATTCTCTATCAACATTTATTT	LepR1|LepF1
GMFRO047-15	*Cheumatopsyche enigma*	adult	38.892	-78.167	United States	Virginia	Kate Perez	Kristina J. Anderson	Smithsonian Institution	TTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTATAGTTATACCCATTATAATTGGGGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAGATTTTGATTTTTACCCCCCTCATTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGCACAGGTTGAACTGTTTATCCTCCTCTATCATCTAATCTATCCCATCTCGGAAGATCAGTAGATTTAACTATTTTTTCTCTTCATTTAGCCGGTATTTCATCAATTTTAGGGGCAATTAATTTTATTACTACATCTTTTAATATAAAGATTAATAAATTAAATTATGAAATTCTTCCTCTTTTTGTTTGATCAGTTGCTATTACTGCCATCTTATTACTTCTATCCCTNCCAGTTCTAGCTGGCGCAATTACTATATTATTAACAGAT---	C_LepFolR
BHMKK045-12	*Cheumatopsyche chrysothemis*	adult	19.383	98.383	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	CACTCTATATTTTATTTTTGGAATTTGATCAGGTTTAATAGGATCATCACTAAGTTTTCTAATTCGAATTGAATTAAGAACTCCTGGTTCCCTTATTGGAAATGATCAAATTTATAATGTTATTGTAACTTCTCATGCTTTTATTATAATTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGAAACTGATTAGTTCCTTTAATACTTGGATCTCCTGATATAGCTTTTCCTCGTATAAATAATTTAAGTTTCTGATTTTTACCACCTTCACTGATTTTATTAATTTTAAGTAGAATAATAAATTCAGGAGCAGGAACTGGATGAACAGTTTATCCTCCTTTATCATCAAATCTTTCCCACCTTGGGAGATCTGTTGATCTAACTATTTTTTCTCTTCATTTAGCTGGAATCTCTTCAATTTTAGGAGCTATTAACTTTATTTCTACATCTTTTAATATAAAAATTAATAAATTAAATTATGAGATTCTTCCTTTATTTGTCTGATCTGTCGCCATTACTGCTGTTTTACTTCTTTTATCCTTACCTGTTCTTGCAGGAGCAATCACAATACTTTTAACTGACCGAAATCTAAATACCTCATTTTTCGACCCTGCTGGAGGAGGGGACCCTATTTTATACCAACATTTATTTNNNNNNNNNN	LCO1490|HCO2198
LEPTO1999-13	*Cheumatopsyche enigma*	imature	40.704	-75.998	United States	Pennsylvania	Trevor Bringloe	T. Bringloe, V. Harvey, S. Ripley, K. Rondollo	Centre for Biodiversity Genomics	-ACTCTTTATTTTATTTTCGGAATTTGATCAGGATTAGTCGGGTCTTCTTTAAGATTTCTTATTCGAATTGAACTTAGAACACCAGGATCTTTAATCGGAAATGATCAAATTTATAACGTAATTGTTACTTCCCATGCGTTTATTATAATTTTTTTATAGTTATACCCATTATAATTGGAGGATTTGGCAATTGATTAGTCCCTTTAATATTAGGGTCACCAGATATAGCTTTCCCTCGGATAAATAATCTAAG	C_LepFolR
BHMKK086-12	*Pseudoneureclipsis josia*	adult male	18.433	98.867	Thailand		Hans Malicky	Hans Malicky	University of Minnesota	CACCCTATACTTCATACTAGGAATCTGATCAAGACTAATCGGAACATCCCTAAGAATAATAATTCGACTAGAACTAAGAATCCCTGGATCATTATATAACAATGAACAACTATACAATTCAATCGTTACAATCCACGCCTTCATTATAATCTTCTTCATGATTATACCAATCATAATTGGAGGATTCGGAAATTGGATAATCCCTCTCATATTGGGATCACCAGACATAGCATTCCCACGAATAAATAACCTCAGATTCTGACTTCTCCCGCCATCCCTATTCTTCCTAATCTCAAGAATATTCCTAAATAATAGATTAGGAACAGGATGAACTATATACCCCCCACTATCAAACAACCTTTTCCATAGTGGAAAATCAGTAGATATATCAATTTTCTCTCTACATCTAGCAGGAATCTCATCAATCCTAGGTGCAATTAACTTCATTTCAACAACCCTAAACATAAAACTAAAATCCATACCCCTTAACAACCTAACACTATTCTCCTGATCAATCATAATTACAGCAATTCTATTACTCCTATCACTACCAGTACTTGCAGGAGCAATCACTATAGTCCTAACAGACCGAAACATAAATACCTCATTCTTCAACCCAATAGGAGGAGGAGATCCCCTTCTATTTCAACATCTATTCNNNNNNNNNN	LCO1490|HCO2198
ABCAD026-08	*Parapsyche elsis*	adult	49.049	-113.913	Canada	Alberta	Xin Zhou	BIObus 2008	Centre for Biodiversity Genomics	CACTCTCTATTTTATTTTTGGATTATGATCAGGATTAATTGGATCTTCTCTCAGATTAATTATTCGAACTGAACTCAGCACTCCAGGCAGACTAATTGGAAATGACCAAATTTATAACGTTATCGTTACCGCACATGCTTTTATTATAATTTTTTTATGGTTATACCCATTATAATTGGAGGATTTGGCAACTGACTAGTTCCTCTTATACTAGGAGCCCCAGATATAGCTTTTCCTCGCATAAATAATATAAGATTTTGATTCCTGCCCCCTTCTCTAATACTATTACTATTCAGTAGTGTAATTAACAGCGGGGCAGGCACTGGGTGAACGGTCTACCCCCCCTTATCCTCTAATCTTTCCCACTTAGGCAGATCAGTCGATCTAACAATTTTCTCTCTCCACCTCGCCGGAATCTCCTCTATTCTAGGAGCTATCAATTTTATTACCACAATTATAAATATAAAGTTTAAAAATATAAACTACGATATTATACCCCTTTTTGTTTGATCTGTTTTAATCACAGCTATTCTGCTACTTTTATCCTTACCTGTATTAGCAGGAGCTATTACAATATTACTAACTGACCGAAATCTCAATACATCTTTCTTCGACCCCGCAGGGGGAGGGGATCCAATTCTATATCAACATCTATTT	M13R|M13F
ABCAD004-08	*Arctopsyche grandis*	adult	51.193	-115.533	Canada	Alberta	Xin Zhou	BIObus 2008	Centre for Biodiversity Genomics	CTCTTTATATTTTATTTTTGGAATATGATCTGGGATAATCGGATCATCCATAAGATTAATTATTCGAACAGAACTCAGCACTCCTGGGAGACTAATTGGAAATGATCAAATTTATAATGTAATTGTTACAGCTCATGCATTTGTTATAATTTTTTTCATAGTTATACCAATTATAATTGGAGGATTTGGAAATTGATTAATTCCTTTAATAATAGGGGCTCCTGATATAGCATTCCCTCGAATAAATAACATAAGATTCTGGTTACTCCCCCCATCACTTAGTTTCCTGATTTTTAGAAGTCTAATTAATAACGGAGCAGGAACGGGATGAACAGTTTACCCACCTCTTTCGTCTAATCTTTCTCACATAGGAAGATCTGTAGATCTTACTATTTTTTCTCTCCACCTCGCAGGAATTTCGTCAATTCTAGGAGCTATTAACTTTATTACAACAATTTTTAATATAAAATTTAAAAATATAAACTTAGATTTAATACCACTATTTGTATGATCTGTCTTAATCACAGCAGTTCTTTTATTATTATCCTTACCAGTATTAGCTGGAGCTATCACTATACTATTAACAGATCGAAATATTAATACTTCTTTTTTTGATCCAGCTGGAGGAGGAGATCCAATTTTATATCAACATTTATTC	M13F|M13R|LepF1|LepR1
FLCAD077-08	*Phylocentropus placidus*	adult	30.189	-84.409	United States	Florida	Andrew Rasmussen	A.K. Rasmussen, J. Rasmussen	University of Minnesota Insect Collection	AACAATTTACTTTATATTCGGAATCTGATCAGGAATATTAGGAACATCACTAAGAATAATTATTCGAATAGAATTATCTATTCCAGGATCATTCATCGGAAATGATCAAATCTACAATTCTATTGTAACAATCCACGCCTTCATTATAATTTTCTTTATAGTAATGCCCACAATAATTGGAGGATTTGGAAATTGACTCCTTCCATTAATAATTGGAGCACCAGATATAGCATTCCCACGAATAAATAATCTTAGATTTTGATTACTACCTCCCTCAATTCTATTCCTTCTATCAGGAATACTTATAGATAGAGGAGCAGGAACAGGATGAACAGTATACCCACCCCTCTCAAACAATATATTCCACTCAGGAAAGGCAGTTGATATTTCAATCTTTTCTTTACACCTTGCAGGAATTTCATCAATTTTAGGTGCAATTAATTTTATCACCACTTCAATTAATATAAAACCTTCA---ATTAAATTCTCCACTATCCCACTCTTTGTTTGATCAATCTTAATTACCGCAATTCTACTTCTTCTCTCTTTACCGGTACTAGCCGGTGCTATTACCATACTTTTAACAGACCGAAATTTAAATACATCATTCTTTGACCCAGCAGGAGGAGGGGATCCAATTCTTTACCAACATTTATTT	LepF1|LepR1

CRTRI116-15	*Cheumatopsyche harwoodi*	imature	54.388	-122.633	Canada	British Columbia	Kate Perez	D.Huber,D.Erasmus,C.Shrimpton	Centre for Biodiversity Genomics	TTTATTTTCGGAATTTGATCCGGATTAGTCGGATCCTCTTTAAGATTTCTTATTCGAATTGAACTCAGAACCCCAGGATCTTTGATCGGTAATGACCAAATTTATAATGTAATTGTTACTTCTCACGCATTTATTATAATTTTTTTATAGTTATACCTATTATGATTGGAGGATTTGGAAACTGACTCGTCCCTTTAATGTTAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAGATTTTGATTTTTACCCCCTTCATTACTTCTTTTAATTTTAAGAAGAATAATAAATTCAGGAGCTGGTACAGGTTGAACTGTTTACCCTCCTTTATCATCTAATCTATCACATCTAGGCAGATCAGTAGACTTAACTATTTTTTCCCTTCATTTAGCTGGTATTTCATCAATTTTAGGAGCAATTAATTTCATTACTACATCTTTTAACATAAAAATTAATAAATTAAATTATGAAATTCTTCCCCTCTTTGTTTGATCAGTTGCTATTACTGCCATTTTATTACTTCTGTCCCTCCCTGTTTTAGCTGGTGCAATTACTATA--	C_LepFolR
LEPTO1037-13	*Cheumatopsyche harwoodi*	imature	40.385	-75.752	United States	Pennsylvania	Trevor Bringloe	T. Bringloe, V. Harvey, S. Ripley, K. Rondollo	Centre for Biodiversity Genomics	-------------ATTTTCGGAATTTGATCCGGATTAGTCGGATCCTCTTTAAGATTTCTTATTCGAATTGAACTCAGAACCCCAGGATCTTTGATCGGTAATGACCAAATTTATAATGTAATTGTTACTTCTCACGCATTTATTATAATTTTTTTATAGTTATACCTATTATGATTGGAGGATTTGGAAACTGACTAGTCCCTTTAATGTTAGGATCACCAGATATAGCTTTCCCTCGAATAAATAATCTAAG	C_LepFolR
OFTRI523-10	*Antillopsyche tubicola*	adulty			Puerto Rico		Oliver S. Flint, Jr.	E.C. Masteller	Smithsonian Institution National Museum of Natural History	AACATTATATTTTATATTAGGAATTTGATCAAGATTAATTGGAACATCATTAAGAATAATTATTCGATTAGAATTAAGAATTCCAGGGTCATTTATTAATAATGAACAACTTTATAATTCTATAGTAACAATCCACGCTTTTATTATAATTTTCTTTATAATTATACCTATTATAATTGGAGGATTTGGAAATTGATTAATTCCTCTTATACTTGGATCCCCTGATATAGCTTTCCCCCGAATAAATAATTTAAGATTTTGATTATTACCCCCATCTCTTTTATTCTTAATTTCTAGAATTTTTATAAATAATAGATTAGGAACAGGCTGAACTGTATATCCACCTTTATCAAACAATTTATTTCATAGAGGGAAGGCTGTAGATATTTCAATTTTTTCGTTACATCTAGCAGGAATTTCTTCAATTTTAGGAGCCATTAATTTTATTTCAACAATTCTAAATATAAAATTAAATTTTATTCCTATAAATAATCTAAGATTATTTTCATGATCTATTATTATTACAGCAATTTTACTTTTATTATCACTTCCAGTCCTTGCAGGGGCAATTACAATACTATTAACAGATCGAAACTTAAATACATCATTTTTTAATCCAGCTGGAGGTGGAGACCCCCTATTATTCCAACATTTATTT	C_LepFolF|C_LepFolR
GBMIN18525-13	*Kambaitipsyche hykrion*								Mined from GenBank, NCBI	TACATTATATTTTATATTTGGAATTTGAGCAAGACTTCTAGGAACATCCCTAAGTATATTAATCCGTATTGAATTAAGAACTCCAAGATCTTTTATTAATAATGATCAAATTTATAATTCTATTATTACCATCCATGCTTTTATTATAATTTTCTTTATAGTTATACCCATTATAATTGGAGGATTTGGAAACTGATTAGTTCCTTTAATACTCGGCGCCCCTGATATGGCATTCCCTCGTATAAATAACTTAAGATTTTGATTTCTTCCTCCATCTCTACTTTTTTTAATTTCTAGAATATTTATAGATAATAGAATAGGAACTGGATGGACCGTTTATCCCCCCCTATCTAATAATTTATTCCATATAAGTAAAGCAATTGATATTTCAATTTTCTCTTTACATATAGCAGGAATTTCATCTATTTTAGGAGCTATTAATTTTATTACAACTATCCTAAATATAAAATTAAATTCCCTATCTAATGAAATAATCCCTCTATTTGTTTGATCAATCGGTATTACTGCCCTTCTTCTTCTCCTTTCTCTTCCTGTATTAGCAGGGGCAATTACTATACTTTTAACTGACCGTAACTTAAATACATCATTTTTTGACCCATCAGGGGGAGGAGATCCAATTTTATACCAACATTTATTT	
BHMKK123-12	*Pseudoneureclipsis ramosa*	adult male	19.35	98.45	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	AACACTATACTTCATACTAGGAATCTGATCTAGATTAATTGGAACTTCACTAAGAATAATAATTCGACTCGAACTAAGAATCCCAGGATCGTTTTATAATAATGAACAACTTTATAACTCCATAGTTACAATCCACGCATTCATTATAATTTTTTTCATAATTATACCAATTATAATTGGAGGATTTGGAAACTGAATAGTACCATTAATAATAGGATCACCAGACATAGCTTTCCCACGAATAAATAATCTTAGATTCTGACTCCTACCCCCATCCCTATTTTTCTTAATTTCAAGTATATTCATAAATAATAGATTAGGTACAGGATGAACAATATACCCCCCACTATCAAATAATTTATTCCATAGAGGAAAATCAGTAGACATAGCCATCTTCTCCTTACACCTAGCAGGAATTTCATCAATCCTAGGAGCCATTAACTTTATCTCAACAATCCTGAATATAAAACTCAAATCCTTACCCCTCAACAACCTAACTCTATTTTCCTGATCAATTATAATTACAGCAATCCTATTACTATTATCCCTTCCCGTTCTTGCCGGAGCAATTACTATAGTACTAACAGACCGAAACATAAATACATCATTCTTCAATCCCATAGGAGGAGGGGATCCTTTACTATTCCAACACCTATTCNNNNNNNNN	LCO1490|HCO2198
BHMKK071-12	*Kisaura consagia*	adult male	19.433	98.333	Thailand	Mae Hong Son	Hans Malicky	Hans Malicky	University of Minnesota	TACACTATATTTTATTTTTGGTATTTGATCTAGAATATTAGGATTATCCTTAAGATTATTAATTCGTACTGAACTATCAATGCCAGGATCCCTAATTGGAAACGATCAAATTTTTAATTCTATTGTTACAGCTCATGCTTTTATTATAATTTTCTTTATAGTTATACCTATTATAATTGGTGGATTTGGTAACTGACTAGTCCCTTTAATACTAGGGGCTCCTGACATAGCTTTCCCACGAATAAATAATATAAGATTTTGATTCCTCCCCCCCTCATTATTTTTCCTAATTTTTGGGATATTAATAGATAATGGGGCTGGAACTGGATGAACTGTTTACCCCCCTCTTTCCTCAAATATTTCTCATATAGGAAAAGCTGTCGATCTAACAATTTTTTCTCTCCATATAGCAGGAATTTCCTCAATTCTTGGAGCTGTCAACTTTATTACAACAATTATCAATATACGTTCTAATTTTATAAGATTCGATCGAATACCTTTATTTGTATGATCAGTTGGAATTACTGCTATTTTATTATTATTATCCCTACCAGTTTTAGCAGGAGCTATTACAATACTATTAACTGATCGTAATCTAAATACTTCATTTTTTGACCCTGCAGGTGGGGGAGACCCAATTTTATACCAACATTTATTTNNNNNNNNN	LCO1490|HCO2198
GBA20165-14	*Drepanocentron sp. NHRS BS4*								Mined from GenBank, NCBI	AACCTTATATTTTTTATTTGGAATTTGATCCAGATTAATTGGAACATCACTAAGTATAATTATTCGAATTGAATTATCAACTCCTAATTCTTTTTTAGGTAATGATCAAATTTATAATTCTATTGTTACAATTCATGCTTTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGAGGGTTTGGAAACTGATTAGTTCCATTAATACTATCAGCTCCAGATATAGCTTTCCCACGTATAAATAATTTAAGATTTTGATTTCTTCCCCCTTCACTTTTATTTTTAATTTCTAGAATATTTATAGATTCAAGTATAGGAACAGGATGAACAGTATACCCACCACTATCTAATAATCTATTTCATTCAGGAAAAGCTGTAGATATTTCAATTTTTTCATTACACTTAGCTGGTATCTCTTCAATTTTAGGAGCTATTAACTTTATTACAACTATCATTAATATAAAACTTAAAAGAATTTCATTTGATTCTCTTCCTTTATTTGTTTGATCAGTAGGAATTACTGCTCTATTACTTCTTTTATCCCTCCCAGTATTAGCAGGAGCAATCACAATACTTCTAACAGATCGTAATTTAAATACTTCATTTTTTGACCCTAATGGAGGAGGTGATCCAATCCTATATCAACA	
GBA22208-14	*Xiphocentron sp.*								Mined from GenBank, NCBI	AACATTATACTTTATATTTGGAATTTGATCAAGATTAATTGGAACATCATTAAGTCTAATTATTCGTATTGAACTTAGATCTCCTAATTCATTTTTAGGAAATGATCAAATTTATAACTCAATCGTTACTATTCATGCATTTATTATAATTTTCTTTATAGTTATGCCAATTATAATTGGAGGGTTTGGAAATTGATTAGTACCCCTAATATTATCAGCACCAGATATAGCTTTCCCACGAATAAATAATTTAAGATTTTGAATGTTACCTCCATCTCTACTTTTCCTAATCTCAAGAATATTCATAGATTATAGAATAGGAACTGGATGGACAGTATACCCACCATTATCTAATAACCTTTTCCATTCAGGAAAAGCAGTTGATATTTCAATTTTCTCTCTTCATCTAGCTGGAATTTCCTCCATTCTAGGAGCAATCAATTTTATTACTACAATTATTAATATAAAATTAAAAATAATATCATTTGATATAATTCCTTTATTTGTATGATCAGTAGGAATCACAGCTCTTCTATTATTATTATCTCTTCCCGTACTAGCAGGAGCTATTACTATATTATTAACTGATCGAAACTTAAATACCTCATTTTTTGATCCTAATGGAGGAGGAGATCCTATTTTATATCAACATCTA	
BHMKK006-12	*Rhyacophila excavata*	adult male	29.833	102.05	China	Sichuan	Hans Malicky	Kyselak	University of Minnesota	AACATTATATTTTATTTTTGGAATCTGAGCTGGAATAGTGGGATCATCTTTAAGAATAATTATTCGAACTGAATTAGGGACACCTGGTTCATTAATTGGAAATGATCAAATCTATAATGTTGTAGTAACAGCTCATGCATTCATTATAATTTTTTTATAGTTATACCAATTATAATTGGAGGATTCGGTAATTGACTTGTTCCTTTAATATTGGGAGCACCTGATATAGCTTTTCCCCGAATAAATAATATAAGATTCTGACTTCTTCCCCCCTCAATTACTTTATTAACTTTAAGAAGAATTGTAGAAAATGGAGCAGGAACCGGATGAACGGTTTACCCCCCTCTATCATCTAATATTGGTCATAGAGGCAGTTCTGTAGATTTAACAATTTTTTCACTCCATTTAGCGGGAGTTTCTTCAATTTTAGGGGCTATTAATTTTATTACAACTGTTTTAAATATACGATCAAAAGGAATAAATCTTGATCAAATACCCTTATTTGTTTGATCAGTAGTAATTACTGCTATTCTTTTATTAATTTCTTTACCAGTTTTAGCAGGTGCTATCACAATACTTTTAACTGATCGAAATTTAAATACGTCATTTTTTGACCCAGCAGGGGGTGGAGACCCAATTCTTTATCAACACTTATTTNNNNNNNNN	LCO1490|HCO2198

BKCAD028-08	*Pycnopsyche guttifera*	adult female	43.653	-73.923	United States	New York	David Ruiter	L. Myers	Centre for Biodiversity Genomics	AACTATTTATTTTATTTTTGGAATTTGAGCAGGAATAATTGGAACTTCATTAAGAATAATTATCCGCACTGAATTAGGTACTACTGAATCATTAATTAAAAATGATCAAATTTATAATGTATTAGTAACAGCCCATGCTTTTATTATAATTTTCTTTATAGTAATACCAATTATAATTGGAGGATTTGGTAATTGACTTGTCCCCCTAATAATTGGAGCCCCCGATATAGCTTTCCCCCGAATAAATAATATAAGATTTTGACTTCTGCCCCCCTCCTTAAATCTTCTTTTAATTAGAGCTTTAATTGAAAGAGGAACAGGAACTGGCTGAACAGTTTATCCCCCTCTTTCTAGAAATCTAGCTCATGCAGGAAGATCTGTAGATATCTCCATTTTCTCACTTCATTTAGCTGGAATTTCTTCAATTTTAGGAGCAATTAATTTCATCTCTACTACCCTAAATATACGAAATAACTTAATAACATTAGATCGAATTCCTCTATTTGTCTGATCTGTAGCTATTACTGCCCTTCTTTTACTTCTTTCTCTTCCCGTTCTTGCAGGAGCAATTACTATACTTTTAACTGACCGCAATTTAAATACCTCTTTTTTCGACCCCTCAGGAGGGGGAGATCCCATCCTATATCAACATTTATTT	LepF1|LepR1

REFERENCES

Banks, N. 1931. XVIII.—Some Neuropteroid Insects from the Malay Peninsula. *Journal of the Federated Malay States Museums*. 16: 377–409.

Barbour, M.T., J Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish. Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. Available from https://nepis.epa.gov/Exe/ZyPDF.cgi/20004OQK.PDF?Dockey=20004OQK.PDF .

Blahnick, R.J. and R.W. Holzenthal. 2004. Collection and curation of Trichoptera with an Emphasis on pinned material. Nectopsyche: Neotropical Trichoptera Newsletter. 1: 8–20.

Blahnik, R.J., R.W. Holzenthal, and A. Prather. 2007. The lactic acid method for clearing Trichoptera genitalia. *Proceedings of the XIIth International Symposium on Trichoptera*. 9-14.

Brauer, F. 1865. Zweiter bericht uber die auf der Weltfahrt der kais. Fregatte Novara gesammelten Neuroptera. Verhandlungen der Kaiserlich-Königlichen *Zoologischen-Botanischen Gesellschaft in Wien*. 15: 415–422.

Burington, Z.L. 2011. Larval Taxonomy, Phylogeny and Historical Biogeography of the Genus *Cheumatopsyche* (Trichoptera: Hydropsychidae) in North America. MS Thesis, Clemson University, SC.

Caterino, M.S. and A.K. Tishechkin. 2006. DNA identification and morphological description of the first confirmed larvae of Hetaeriinae (Coleoptera: Histeridae). *Systematic Entomology*. 31: 405–418.

Chantaramongkol, P., and H. Malicky. 1995. Drei neue asiatische Hydromanicus (Trichoptera: Hydropsychidae). *Entomologische Zeitschrift mit Insektenboerse* 105(5): 92-96.

Connell, J.H. 1978. Diversity in Tropical Rain Forests and Coral Reefs. *Science, New Series*. 199(4335): 1302-1310.

Curtis, J. 1835. Hymenoptera, Part II, Neuroptera, Trichoptera. Vol IV, p. 65, 66, pl. 544, 601, in the 8 vol systematic binding. *In*, British Entomology; being illustrations and descriptions of the genera of insects found in Great Britain and Ireland: containing coloured figures from nature of the most rare and beautiful species, and in many instances of the plants upon which they are found. London, E. Ellis and Co.

de Moor, F.C. and V.D. Ivanov. 2008. Global diversity of caddisflies (Trichoptera: Insecta) in freshwater. *Hydrobiologia*. 595: 393–407.

Denning, D.G. New Species of Nearctic Caddis Flies 1948. *Bulletin of Brooklyn Entomological Society*. 44(2): 37–48.

Dudgeon, D. 1999. *Tropical Asian Streams, Zoobenthos, Ecology, and Conservation*. Hong Kong University Press, Aberdeen, Hong Kong.

Edwards, S.W. 1961. The Immature Stages of *Xiphocentron mexico* (Trichoptera). The Texas Journal of Science. 13(1): 51–56.

Eldredge, N & J. Cracraft. 1980. *Phylogenetic Patterns and the Evolutionary Process. Method and Theory in Comparative Biology*. New York: Columbia University Press.

Frandsen, P.B. X. Zhou, O. Flint, K.M. Kjer. 2016. Using DNA barcode data to add leaves to the Trichoptera tree of life. *Zoosymposia*. 10: 193–199.

Gordon, A.E. 1974. A synopsis and phylogenetic outline of the Nearctic members of *Cheumatopsyche*. *Proceedings of the Academy of Natural Sciences of Philadelphia.* 126: 117–160.

Hanh, P.T. Minh, S. Sthiannopkao, K. Kim, D.T. Ba. D.T., and N.Q. Hung. 2010. Anthropogenic influence on surface water quality of the Nhue and Day sub-river systems in Vietnam. *Environmental Geochemistry and Health.* 32(3): 227-36.

Hennig, W. 1965. Phylogenetic systematics. Annual review of entomology, 10(1): 97–116.

Holzenthal, R.W., R.J. Blahnik, A.L. Prather, and K.M. Kjer. 2007. Order Trichoptera Kirby, 1813 (Insecta), caddisflies. *Zootaxa.* 1668: 639–698.

Holzenthal, R.W. 2008. Digital Illustration of Insects. *American Entomologist*. 54(4): 218–221.

Holzenthal, R.W. 2015. Adobe Illustrator: a tutorial for trichopterologists. Workshop presented at the 15th International Symposium on Trichoptera, Rutgers, New Jersey, June 2105. pp 1–27.

Huelsenbeck, J.P. 1995. The robustness of two phylogenetic methods: four-taxon simulations reveal a slight superiority of maximum likelihood over neighbor joining. *Molecular Biology and Evolution*. 12(5): 843–849.

ICZN (International Commission on Zoological Nomenclature). 1999. International Code of Zoological Nomenclature, 4th edition. International Trust for Zoological Nomenclature c/o The Natural History Museum, London, UK.

Kachalova, O.L. 1998. 27. Order Trichoptera (Caddisflies). *In*: G.S. Medvedev (Ed.) *Keys to the Insects of the European Part of the USSR IV Part 6*. Science Publishers Inc, Enfield, New Hampshire, USA.

Kjer, K.M., J.A. Thomas, X. Zhou, P.B. Frandsen, E. Prendini, and R.W. Holzenthal. 2016. Progress on the phylogeny of caddisflies (Trichoptera). *Zoosymposia*. 10: 248–256.

Lenat, D.R. 1993. A biotic index for the southeastern United States: derivation and list of tolerance values, with criteria for assigning water-quality ratings. *North American Benthological Society*. 12(3): 279–290.

Lenat, D.R. and D.L. Penrose. 1996. History of the EPT taxa richness metric. *Bullitin of the North American Benthological Society*. 13(2): 305–307.

Mackay, R.J. 1978. Larval Identification and Instar Association in Some Species of Hydropsyche and Cheumatopsyche (Trichoptera: Hydropsychidae). *Annals of the Entomological Society of America*. 71(4): 799–509.

Madden T. 2002. Chapter 16— The BLAST Sequence Analysis Tool. *In*: McEntyre, J and J. Ostell J, (Eds.). The NCBI Handbook. Bethesda (MD): National Center for

Biotechnology Information, USA. Available from: https://www.ncbi.nlm.nih.gov/books/NBK21097/

Maddison, D. R., and W.P. Maddison. 2015. Zephyr: a Mesquite package for interacting with external phylogeny inference programs. Version 1.1.

Malicky, H. and P. Chantaramongkol. 1992. Neue Köcherfliegen (Trichoptera) aus Thailand und Angrenzenden Ländern. *Braueria*. 19: 13–23.

Malicky, H and P. Chantaramongkol. 1993. Neue Trichopteren aus Thailand. Teil 1: Rhacophilidae, Hydrobiosidae, Philopotamidae, Polycentropodidae, Ecnomidae, Psychomyidae, Arctopsychidae, Hydropsychidae. *Linzer Biologische Beitraege*. 25(1): 433–487

Malicky, H. and P. Chantaramongkol. 1996. Neue Köcherfliegen aus Thailand (Trichoptera). *Entomologische Berichte Luzern*. 36: 119-128.

Malicky, H. 2010. *Atlas of Southeast Asian Trichoptera*. Chiang Mai University, Chiang Mai, Thailand.

Malm, T., K.A. Johanson, and N. Whalberg. 2013. The evolutionary history of Trichoptera (Insecta): A case of successful adaptation to life in freshwater. *Systematic Entomology*. 38: 459–473.

Martynov, A.V. 1935. On a collection of Trichoptera from the Indian Museum. Part I. Annulipalpia. *Records of the Indian Museum.* 37: 93–209.

Meier, R., K. Shiyang, G.Vaidya, and P.K.L. Ng. 2006. DNA Barcoding and Taxonomy in Diptera: A Tale of High Intraspecific Variability and Low Identification Success. *Systematic Biology*. 55(5):715–72.

Miller, G. T., Jr. 1988. *Living in the Environment: an Introduction to Environmental Science*. 5th edition. Wadsworth, Belmont, California.

Milne, M. J. 1938. The "metamorphotype method" in Trichoptera. Journal of the New York Entomological Society 46: 435–437.

Morse, J.C., Y. Lianfang, and T. Lixin (Eds.) 1994. *Aquatic Insects of China Useful for Monitoring Water Quality*. Hohai University Press, Nanjing, China.

Morse, J.C. 2004. Insecta: Trichoptera. *In*: C.M. Youl, and Y.H. Sen (Eds.). *Freshwater Invertebrates of the Malaysian Region*. Academy of Sciences Malaysia, Kuala Lumpur, Malaysia.

Morse, J.C. and R.W. Holzenthal. 2008. Chapter 18—Trichoptera Genera. *In:* R.W. Merritt, K.W Cummins, and M.B. Berg (Eds.). *An Introduction to the Aquatic Insects of North America*, 4th Edition. Kendall Hunt Publishing Company, Dubuque, IA.

Morse, J.C. 2009. Chapter 8. Biodiversity of aquatic insects *In*: R.G. Foottit, R.G. *and* P.H. Adler (Eds.), *Insect Biodiversity*: *Science and Society*. Wiley-Blackwell, Oxford, United Kingdom, pp. 165–184.

Morse, J.C., R.W. Holzenthal, and O. Yadamsuren 2017. Chapter 4–Trichoptera. *In*: Morse, J.C., W.P. McCafferty, B.P. Stark, and L.M. Jacobus (Eds.), *Larvae of the Southeastern USA Mayfly, Stonefly, and Caddisfly Species.* PSA Publishing, Clemson University, Clemson, SC.

Morse, J.C. 2017. Chapter 8— Biodiversity of Aquatic Insects. *In:* Foottit, R.G., and P.H. Adler (Eds.), *Insect Biodiversity Science and Society*. Volume 1, Second Edition. John Wiley *and* Sons, Oxford, UK.

Morse, J. C. 2018. Trichoptera World Checklist. Clemson University, Clemson, South Carolina. (http://www.clemson.edu/cafls/departments/esps/database/trichopt/)

Mosely, M. E. 1948. Trichoptera. Expedition to South-West Arabia 1937-8. British Museum (Natural History). 1: 67–86.

Moulton, S.R. II, and K.W. Stewart. 1997. A new speices and first record of the caddisfly genus *Cnodocentron* Schmid (Trichoptera: Xiphocentronidae) north of Mexico. Proceedings of the 8th International Symposium on Trichoptera. 343-347.

North Carolina Department of Environmental and Natural Resources, Division of Water Quality, Section Environmental Sciences Branch. 2001. Standard Operation Procedures for Benthic macroinvertebrates Biological Assessment Unit.

Pes, A.M., N. Hamada, J.L. Nessimian, C.C. Soares. 2013. Two new species of Xiphocentronidae (Trichoptera) and their bionomics in Central Amazonia, Brazil. *Zootaxa*. 3636(4): 561–574.

Pictet, F.J. 1834. Recherches pour servir à l'histoire et l'anatomie des Phryganides. Geneva, A. Cherbuliez.

Prommi, T, S. Permkam, and H. Malicky. 2006. Description of *Hydatomanicus klanklini* Malicky & Chantaromongkol and *H. Adonis* Malicky & Chantaramongkol (Trichoptera: Hydropsychidae) from southern Thailand. *Braueria*. 33: 31–36.

Prommi, T.O, and S. Permkam. 2015. Larvae of *Hydromanicus* (Insecta: Trichoptera: Hydropsychidae) from Thailand. *Zootaxa*. 3914(4): 467-482.

Resh, V.H. and J.D. Unzicker. 1975. Water quality monitoring and aquatic organisms: The importance of species identification. Water Pollution Control Federation. 47(1): 9–19.

Ross, H.H. 1938. Descriptions of Nearctic Caddis Flies (Trichoptera) with special reference to the Illinois species. *Bulletin of the Illinois Natural History Survey*. 21(4): 101–183.

Ross, H.H. 1941. Descriptions and Records of North American Trichoptera. Transactions of the American Entomological Society. 67: 35–126.

Ross, H. H. 1944. *The caddis flies or Trichoptera of Illinois*. Bulletin of the Illinois Natural History Survey. 23: 1–326.

Ross, H.H. 1949. Xiphocentronidae, a New Family of Trichoptera. *Entomological News*. 60 (1): 1-7.

Ross, H.H., J.C. Morse, and A.E. Gordon. 1971. New species of Cheumatopsyche from the southeastern United States (Hydropsychidae, Trichoptera). *Proceedings of the Biological Society of Washington*. 84 (37): 301-306.

Ruiter, D.E., E.E. Boyle, and X. Zhou. 2013. DNA barcoding facilitates associations and diagnoses for Trichoptera larvae of the Churchill (Manitoba, Canada) area. *BMC Ecology*, 13: 5.

Schefter, P.W. and G.B. Wiggins. 1987. Setal characters in larval diagnoses for some Nearctic species of *Cheumatopsyche* (Trichoptera: Hydropsychidae). *In*:

Bournaud, M, and H. Thachet (Eds.) *Proceedings of the 5th international symposium on trichoptera.* Lyone, France.

Scherborn, C.D. and J.H. Durrant. 1911. Note on John Curtis' British Entomology, 1824–1839: 1828–1840: and 1862. *The Entomologist's Monthly Magazine*. 47: 84–94.

Schmid, F. 1982. La famille des Xiphocentronides (Trichoptera: Annulipalpia). Memoires de la Société Entomologique du Canada 121(36): 1–126.

Schmid, F. 1998. *The Insects and Arachnids of Canada. Part 7. Genera of the Trichoptera of Canada and the Adjoining or Adjacent United States*. NRC Research Press, Ottawa, Canada.

Sievers, F, A. Wilm, D.G. Dineen, T.J. Gibson, K. Karplus, W. Li , R. Lopez, H. McWilliam, M. Remmert, J. Söding, J.D. Thompson, D.G. Higgins. 2011. Fast, scalable generation of high-quality protein multiple sequence alignments using Clustal Omega. *Molecular Systems Biology*. 7:539 doi:10.1038/msb.2011.75

Smith, M.H. 1984. A Morphological Distinction between the Larvae of *Cheumatopsyche campyla* and *C. pettiti* (Trichoptera: Hydropsychidae*). Journal of the New York Entomological Society*. 92(4): 407–410.

Stamatakis, A. 2014. RAxML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. *Phylogenetics*. 30(9): 1312–1313.

Ratnasingham, S and P.D.N. Hebert. 2007. BOLD: The Barcode of Life Data System (www.barcodinglife.org). *Molecular Ecology Notes*. 7(3): 355–364.

Swofford, D. L. 2002. PAUP*. Phylogenetic Analysis Using Parsimony (*and Other Methods). Version 4. Sinauer Associates, Sunderland, Massachusetts.

Ulmer, G. 1906. Neuer beitrag zur kenntnis aussereuropäischer Trichopteren. *Notes from the Leyden Museum.* 28: 1–116.

Ulmer, G. 1913. Über einige von Edw. Jacobson auf Java gesammelte Trichopteren, Zweiter Beitrag. *Notes from the Leyden Museum.* 35: 78-101.

Wallengren, H.D.J. 1891. Skandinaviens Neuroptera. Andra afdelningen. *Kongliga Svenska Vetenskaps-Akademien Handlingar.* 24: 1–173.

Wiggins, G. B. 1996. *Larvae of the North American caddisfly genera (Trichoptera)*. 2nd edition. University of Toronto Press, Toronto, Ontario, Canada.Ottawa, Ontario, Canada.

Wiggins, G.B. and D.C. Currie. 2008. Chapter 17—Trichoptera Families. *In:* R.W. Merritt, K.W Cummins, and M.B. Berg (Eds.). *An Introduction to the Aquatic Insects of North America*, 4th Edition. Kendall Hunt Publishing Company, Dubuque, IA.

Xu, J., C. Sun, and B. Wang. 2015. A new species of Stenopsyche, with descriptions of larvae and females of some species associated by gene sequences (Insecta: Trichoptera). Zootaxa 4057 (1): 063–078.

Xu, J., C. Sun, and B. Wang. 2018. Descriptions of larvae of three species of *Hydropsyche* (Trichoptera, Hydropsychidae) from China. *Zootaxa.* 4374 (1): 001–024.

Zhou, X., K.M. Kjer, and J.C. Morse. 2007. Associating larvae and adults of Chinese Hydropsychidae caddisflies (Insecta: Trichoptera) using DNA sequences. *Journal of the North American Benthological Society*, 26(4): 719–742.

Zhou, X., S.J. Adamowicz, L.M. Jacobus, R.E. DeWalt, and P.D.N. Herbert. 2009. Towards a comprehensive barcode library for arctic life – Ephemeroptera, Plecoptera, and Trichoptera of Churchill, Manitoba, Canada. *Frontiers in Zoology*, 6: 30.

Zhou, X., J.L. Robinson, C.J. Geraci, C.R. Parker, O.S. Flint, D.A. Etnier, D. Ruiter, R.E. DeWalt, L.M. Jacobus, and P.D.N. Hebert. 2011. Accelerated construction of a regional DNA-barcode reference library: Caddisflies (Trichoptera) in the Great Smoky Mountains National Park. *Journal of the North American Benthological Society*, 30(1): 131–162.