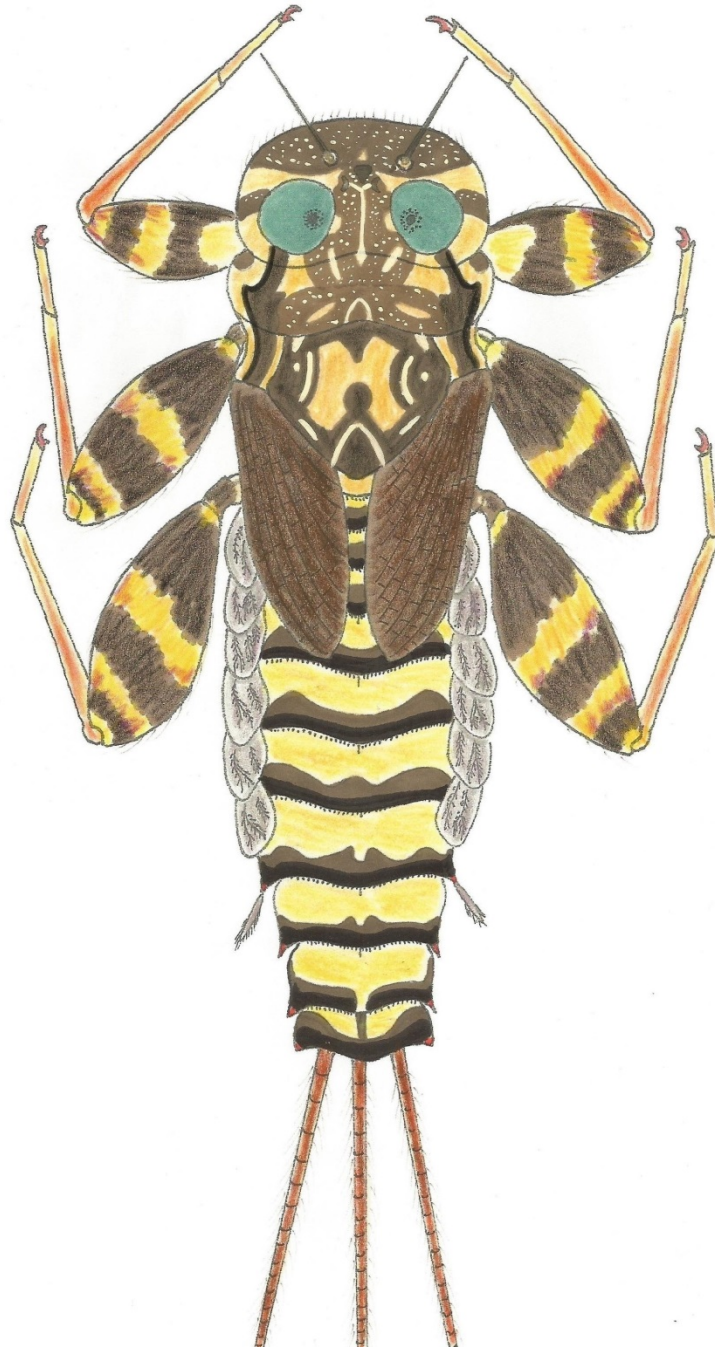


(Ephemeroptera: Heptageniidae)

Maccaffertium vicarium, concept.



Mack A Beacon 2020

(Ephemeroptera: Heptageniidae)

Maccaffertium vicarium, concept.

Contribution to the understanding of the *M vicarium* concept

Maccaffertium vicarium valid species (Walker, 1853) [CAN:FN,NE,NW;USA:NE,SE]

Stenonema fuscum (Clemens, 1915) Jr (syn) now (syn)

Stenonema rivulicolum (McDunnough, 1933) Jr (syn) now (syn)

Author; Mack A Beacon © 2020. Open book reference paper. If you wish to use any of this content contact me and I will grant it, but it must be cited. Contact; Stenacron.books@gmail.com

Opening; in this paper we will review and come to a very clear conclusion. This paper will confirm that the past construction of this concept is correct, but will more so allow everybody to see why this is the correct standing, especially the fly fishing community.

Abstract; Mayflies and Fly fishing are very well tied together thought out history. Here in North America from the Catskill Mountain range of upper NY State, *vicarium* carries a common name (March Brown). The former species *fuscum* has carried the common name (The Grey Fox). Quoting Dr Jeff Webb to me "the bug is the same bug only the name change". You are free to use the historical common names just be sure you are applying it to the correct sample.

Materials and methods; all past documentation and a rearing program by us from one locality with all samples dissected, reared, and validated in my lab. The most critical document on the construction of this concept is (Bednarik & McCafferty 1979) Biosystematic of *Stenonema* Mayflies. The reading of their discussion of *vicarium* must be read as well as the descriptions. Within this paper we will clarify that discussion and prove it correct. **Bold Systems** information lists "Found (100) published records, with (100) records with

sequences, forming (3) BINs (clusters), with specimens from (2) countries, deposited in (9) institutions. Of these records, (100) have species names, and represent (1) species". Having (3) forms in the concept and (3) DNA clusters first verifies (Bednarik & McCafferty) synonyms from 1979 as correct. Study area Bronte Creek Ontario Canada.

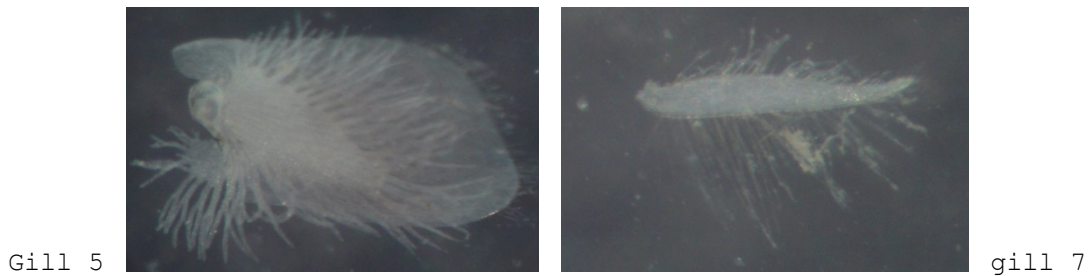
Lineage; as we stated and proved in my Stenacron 2020 book, variation is a big factor that can now be explained in part. Reading the chapter ("The Leopard Changed its Spots" page 45). We showed that the darker the substrate the darker the larva the darker the adult stages.

From a taxonomic stated point certain features have been use as keys to clarify species concepts. For example this is the very first time we have seen that denticulate fore claws are not used as a key. However they may only be in my locality. There are many Maccaffertium that are in part defined by denticulate fore claws. The largest problem occurs in the adult stages. (Bednarik & McCafferty 1979) in discussion clearly indicate that *rivulicolum* is the median between *vicarium* and *fuscum* by usage of the genitals. They stated finding *vicarium* genitals on *fuscum* and vice versa, and either of the above on *rivulicolum*.

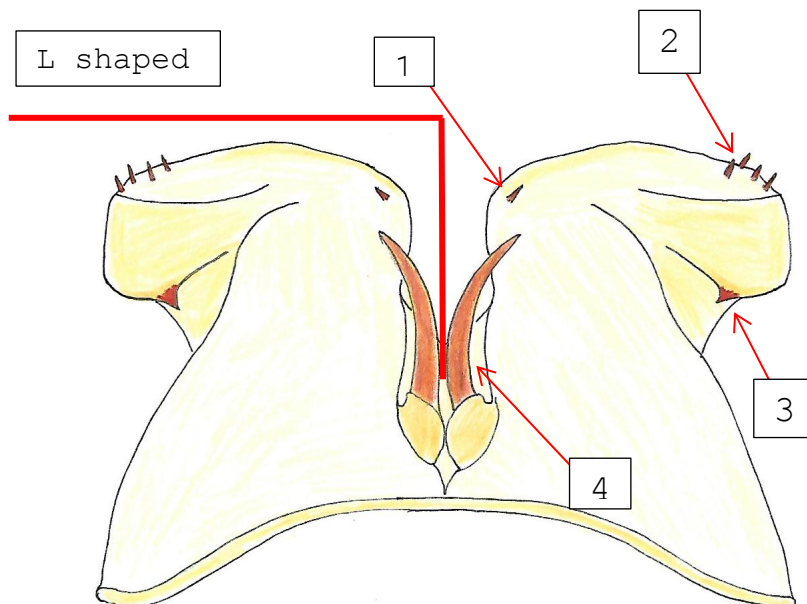
In my study we to have seen the same phenomenon with reared samples, so there was no denial that the genitals are interchangeable. The only problem we saw putting this concept together was the larva of *rivulicolum* can have denticulate fore claws on larva with (2) present on some samples not all, and *vicarium* and *fuscum* never have them. So rightfully they needed to reduce or remove the usage of that character with the following statement that was not made. "With or without denticulate fore claws" in the new description

but their larvae may not have had that feature on the samples in their series; the denticulate may be just a geographical anomaly.

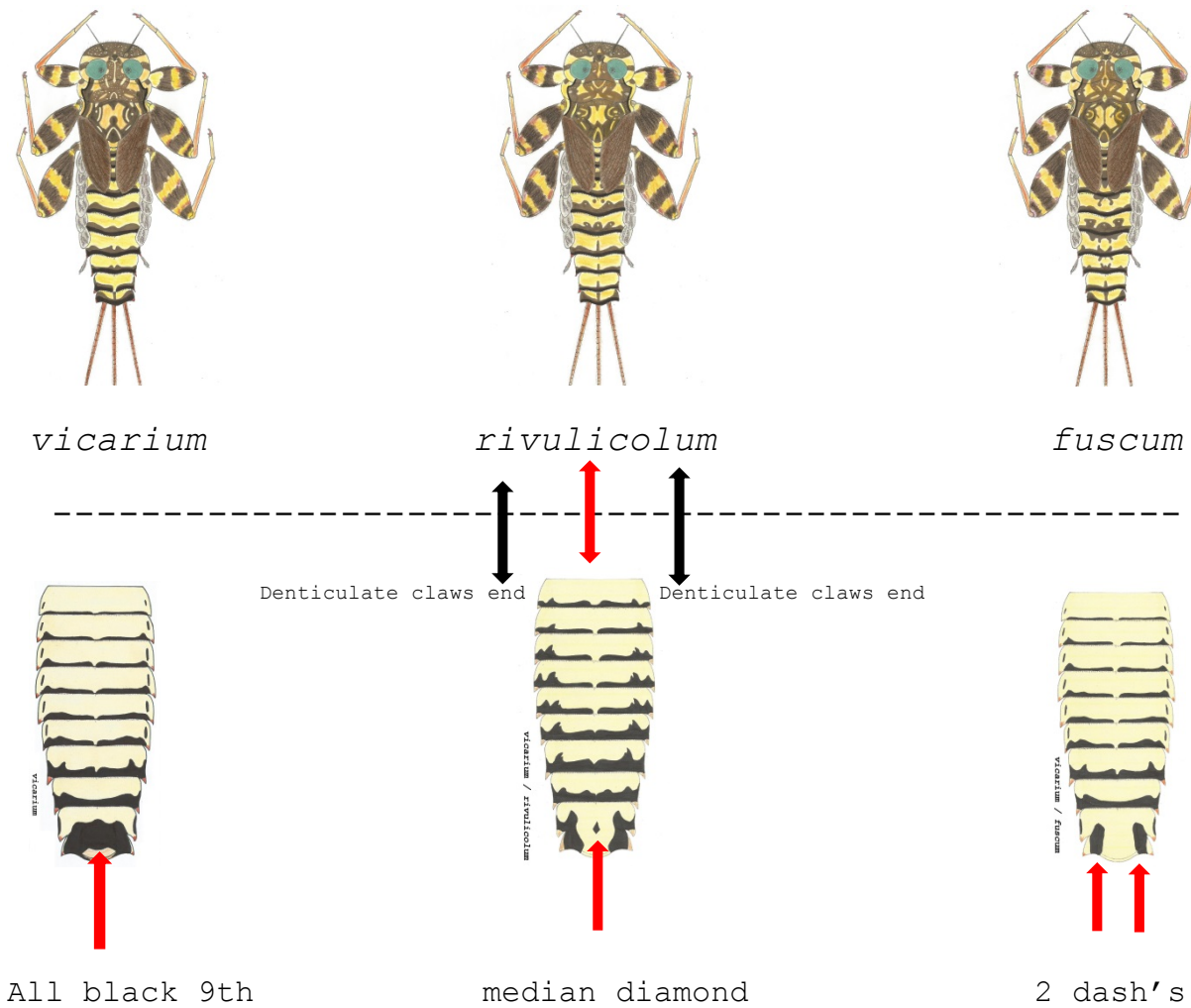
Key to larvae; description, from (Webb 2008) in part Heptageniidae of the World part II; lamellae flat with a submarginal anal rib on the gills from 1-6 truncated, also with ventral fibrilliform gills; gill 7 thread like without internal trachea and fringed with setae.



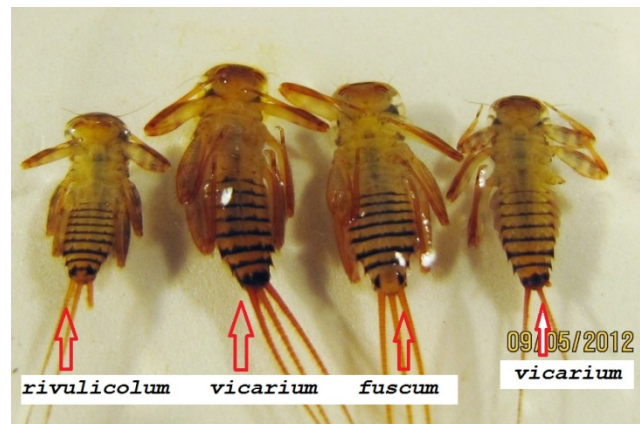
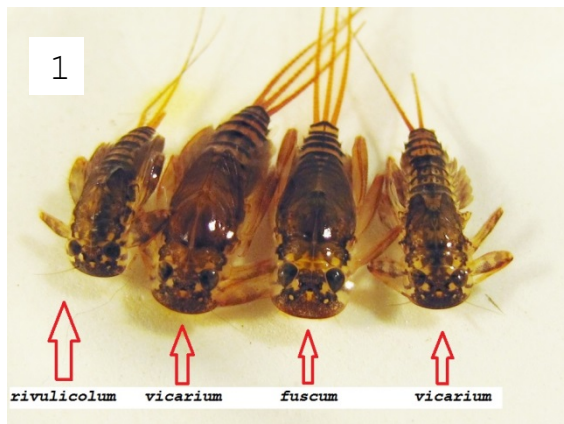
Key adult male genitals; (L) shaped, or tradition called boot shaped. 1; apical spine, 2; minute lateral apical spines, 3; terminal spine, 4; mesal spine.



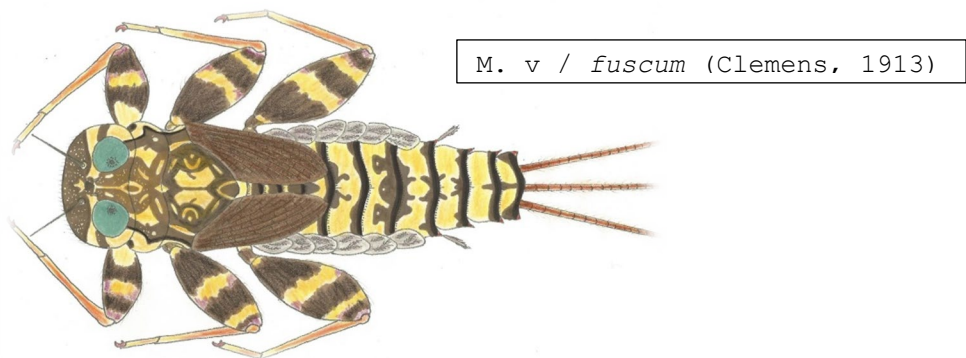
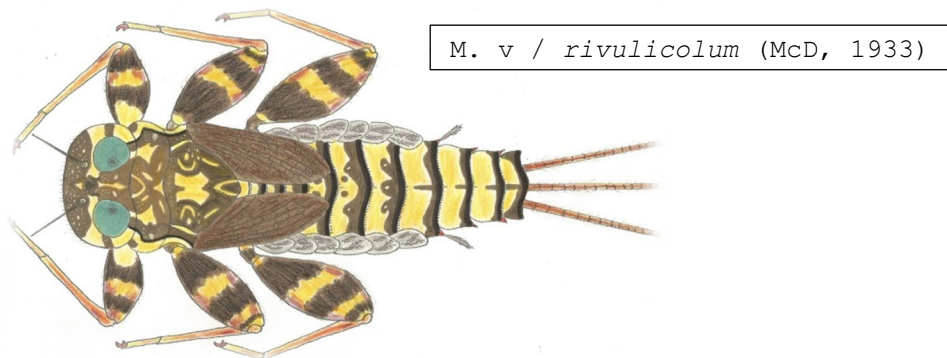
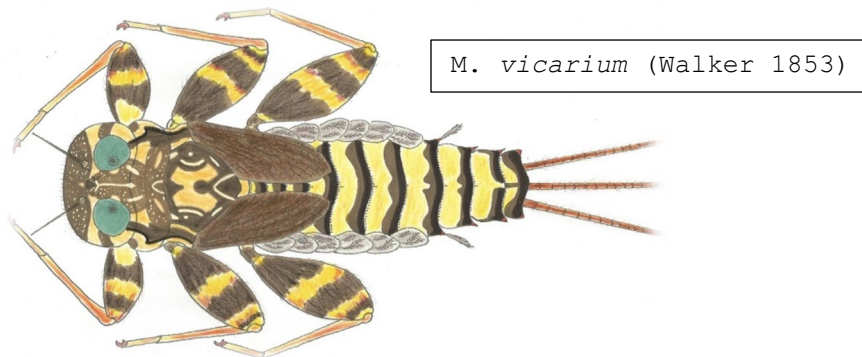
Here is the line of division in the concept;



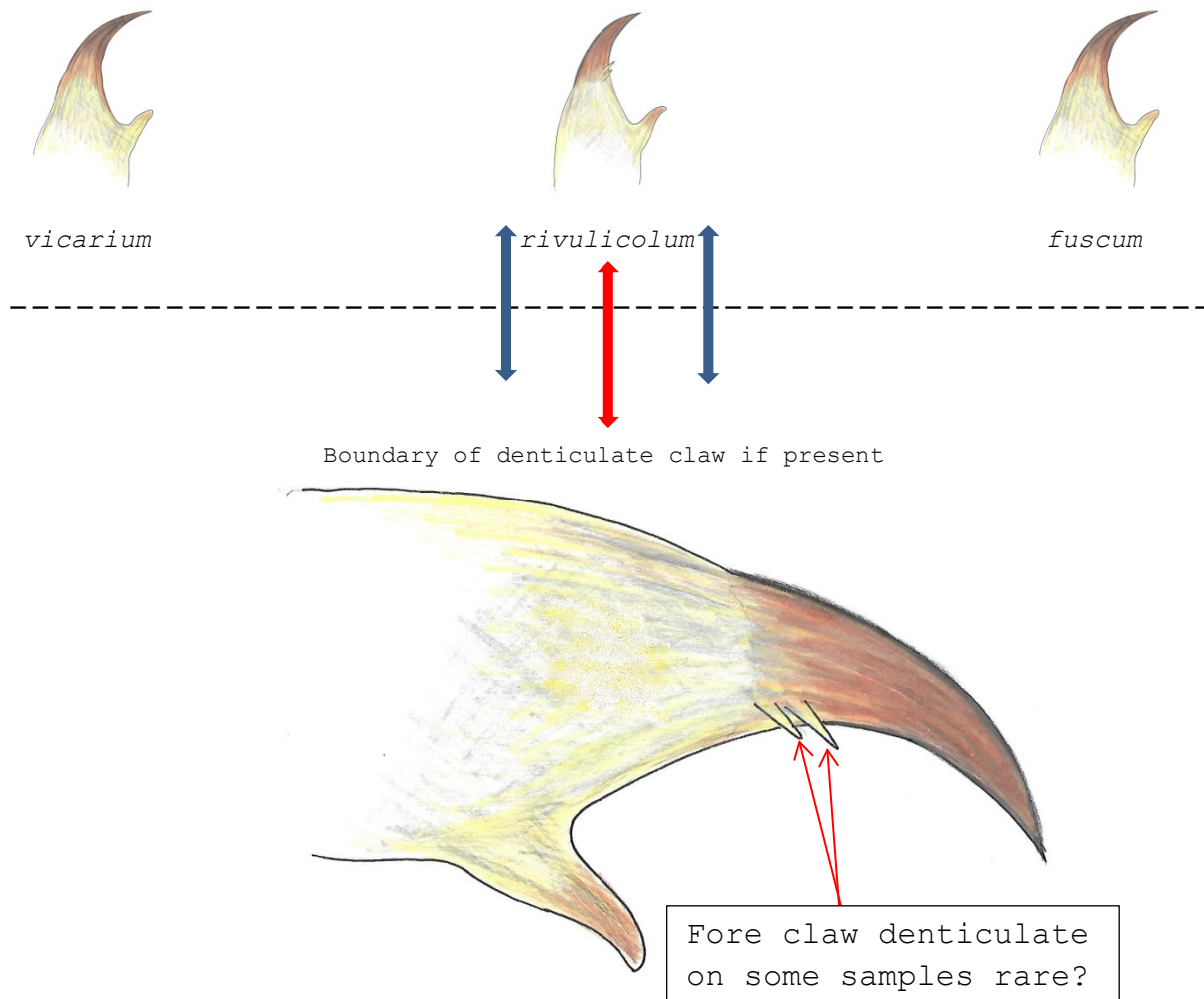
Ventral signature markings marked by red arrows



As it can be seen within this photo dorsal abdominal maculation is variable more than most *Maccaffertium*. Notice in the photos above regarding the (2) *vicarium* samples both were taken same day, same time, from the very same general area. The one on the right in picture (1) you likely would not view it as *vicarium*, but in fact it is. The ventral maculation seems to be more reliable, but that is not always the case. Here are all (3) larvae in their most common dorsal pattern.



Fore claw lineage throughout the concept;



Mouthparts; from (Bednarik & McCafferty 1979), (Lewis 1974a) and my study combined. (Burks 1953) did synonymize *rivulicolum* to *fuscum* and (Lewis 1974a) agreed.

Mandibles with 5-10 typically 7 or 8 teeth on the inside of the outer canine. Maxillae 2-5 typically 2-4 comb like setae on the crown, with 12-40 typically 20-35 setae on the crown of the maxillae, 15-35 setae in the submedial row. All of this should help you confirm your sample as *M vicarium* and or a Jr synonym.

Let's look at the maxillae in the concept.

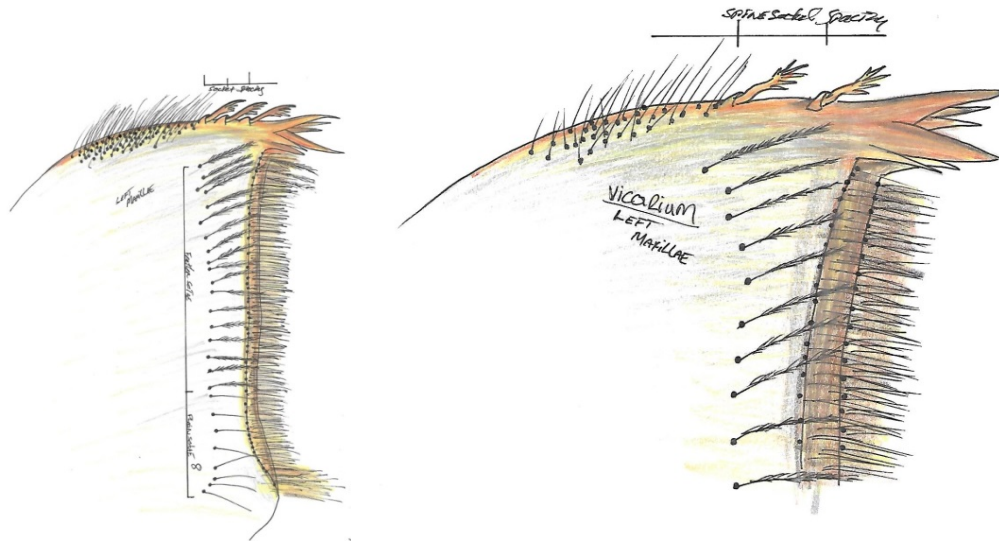


Chart 1

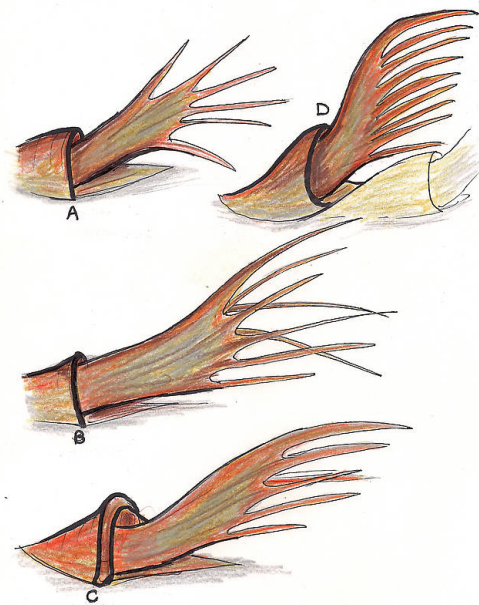
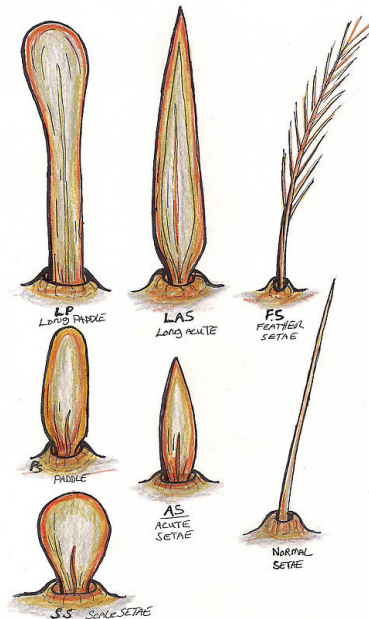


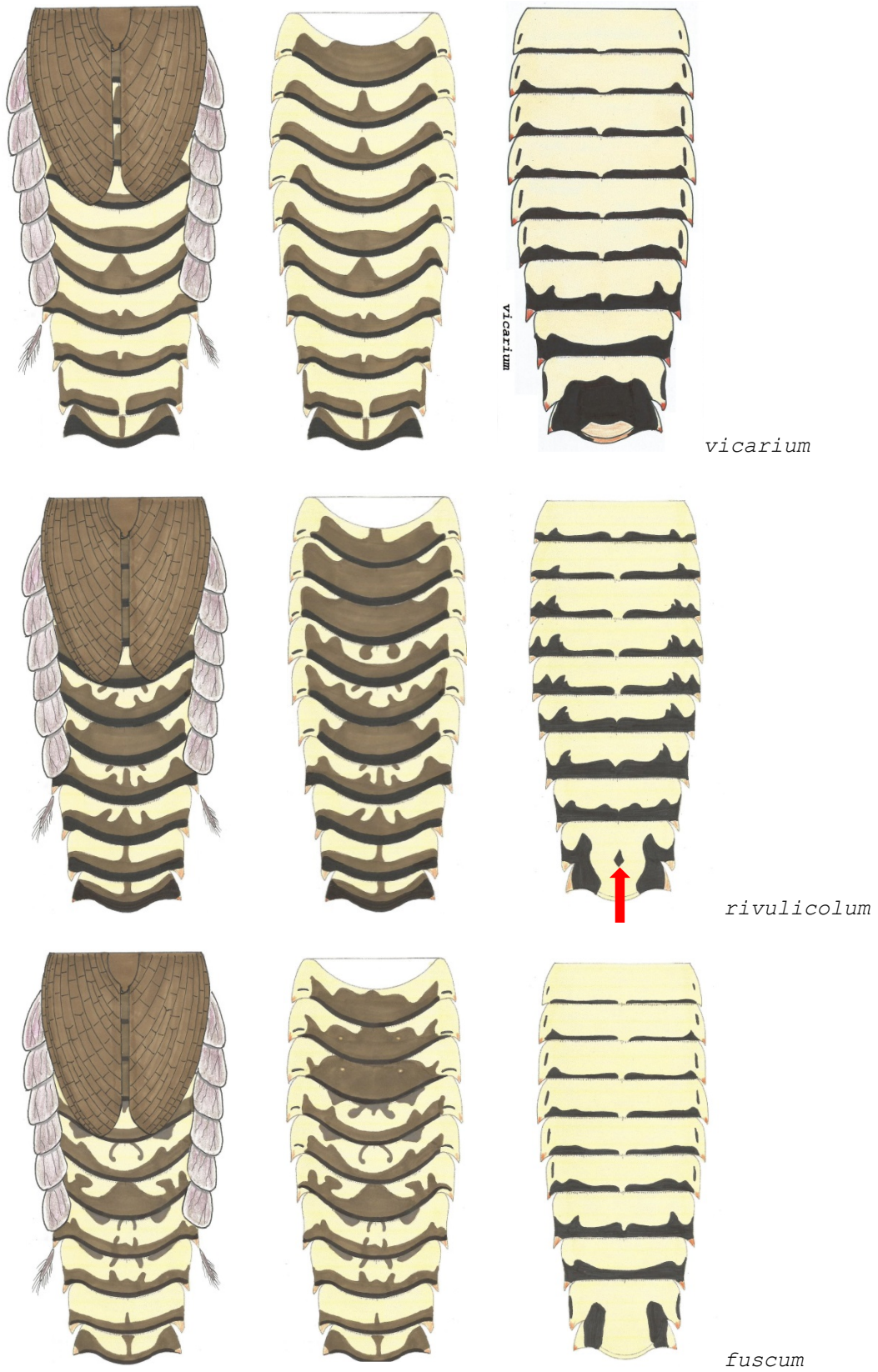
Chart 2



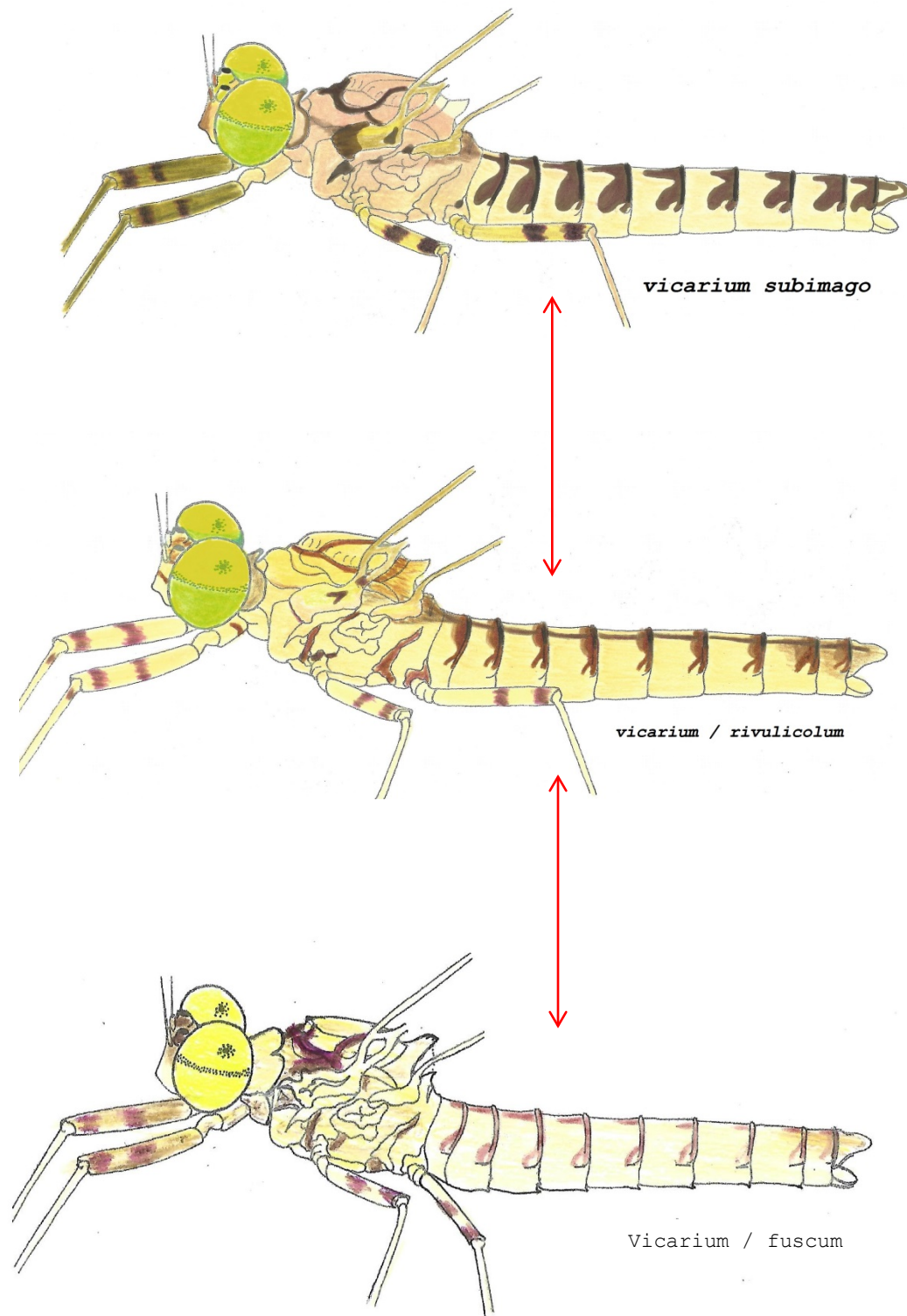
All *Maccaffertium* use style (B) & (C) on the crown of the maxillae. *M. vicarium* utilize style (C) for the pectinate setae combs' on chart 1.

Throughout the body, legs, head and mouthparts. *Maccaffertium* uses all setae styles on chart 2.

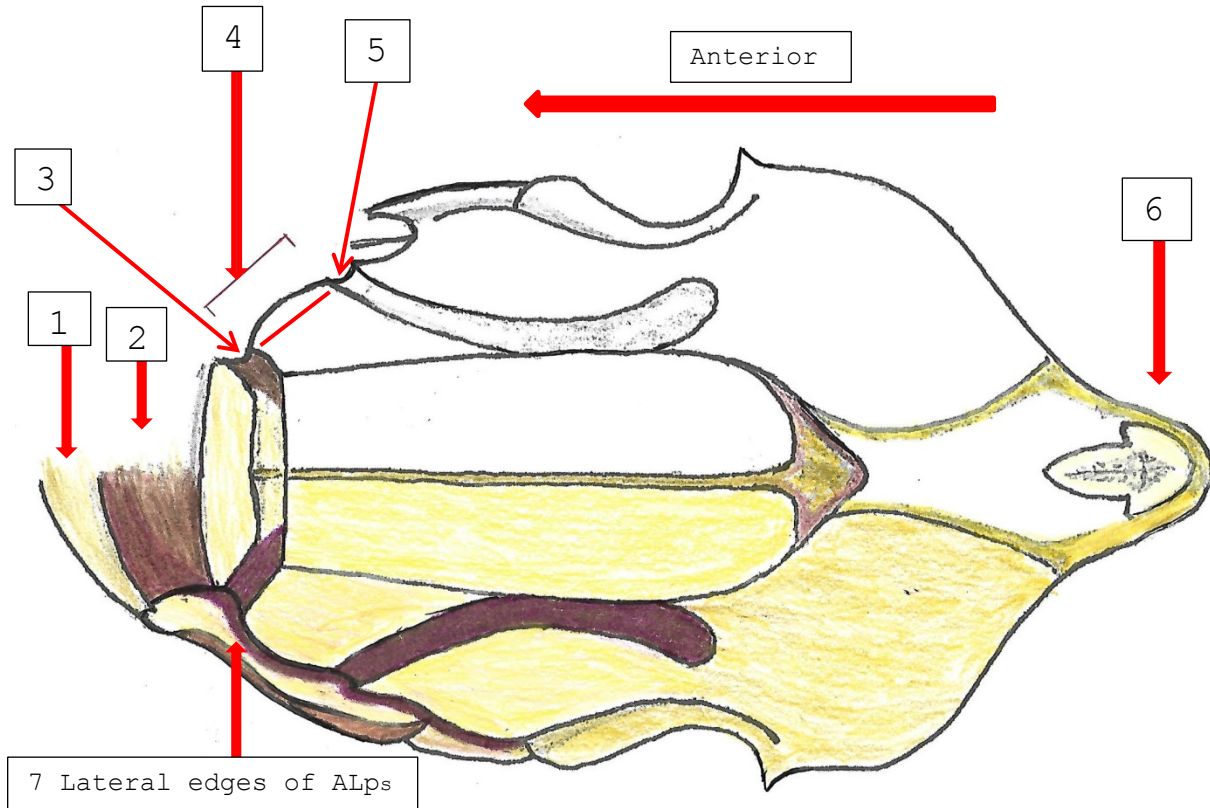
Larva with, and without gills plus venter.



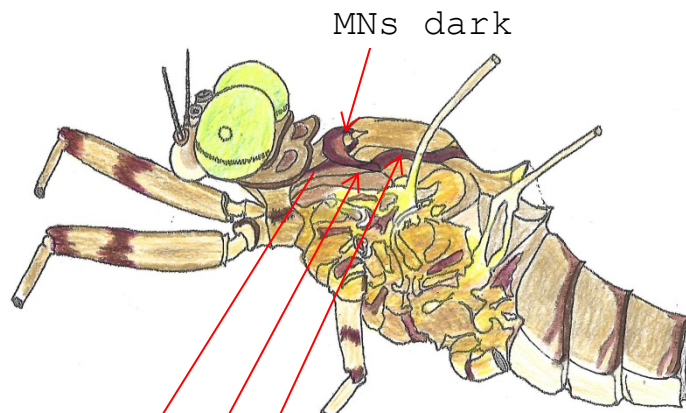
Moving into the adults. First we will show all (3) then go into detail using (N J Kluge's 2004).



Using (Kluges the Phylogenetic System of Ephemeroptera 2004) focused on the entire notum.

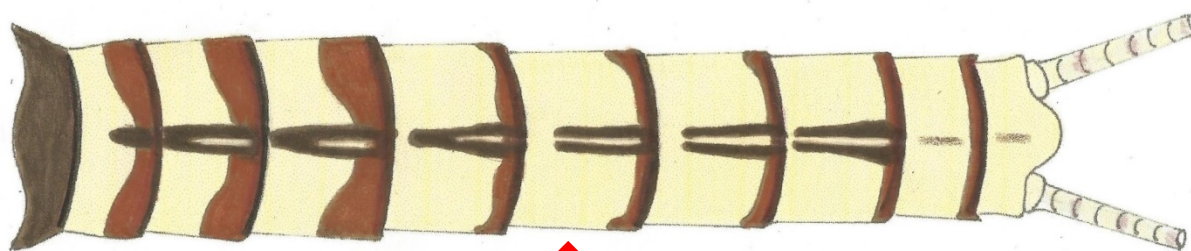


1; ANp, Anteronotal protuberance, 2; ANi anteronotal transverse impression, 3; MNs mesonotal structure, 4 distance from MNs to LPs, 5; LPs lateroparasidal structure, 6; scutellum, 7; ALps lateroparasidal structure lateral edge.

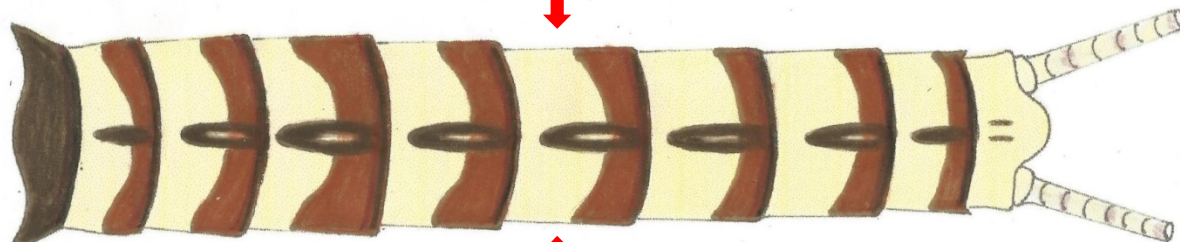


All darkened areas are major clues to this species concept; they all have the same markings. No other in the genus does but *pudicum* and that can be removed by description and being very dark overall.

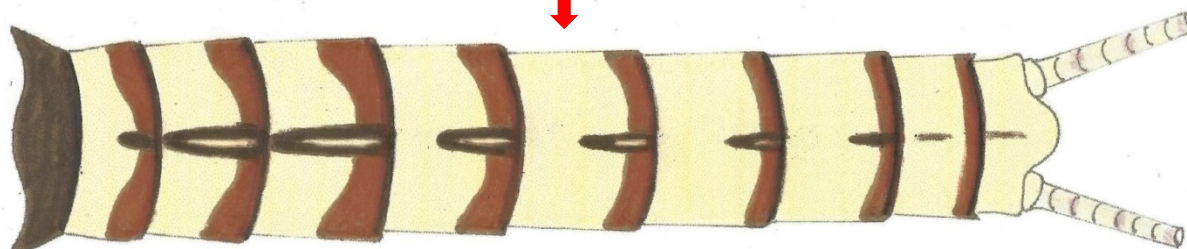
Dorsal view lineage of the 3 adult male abdomens;



vicarium

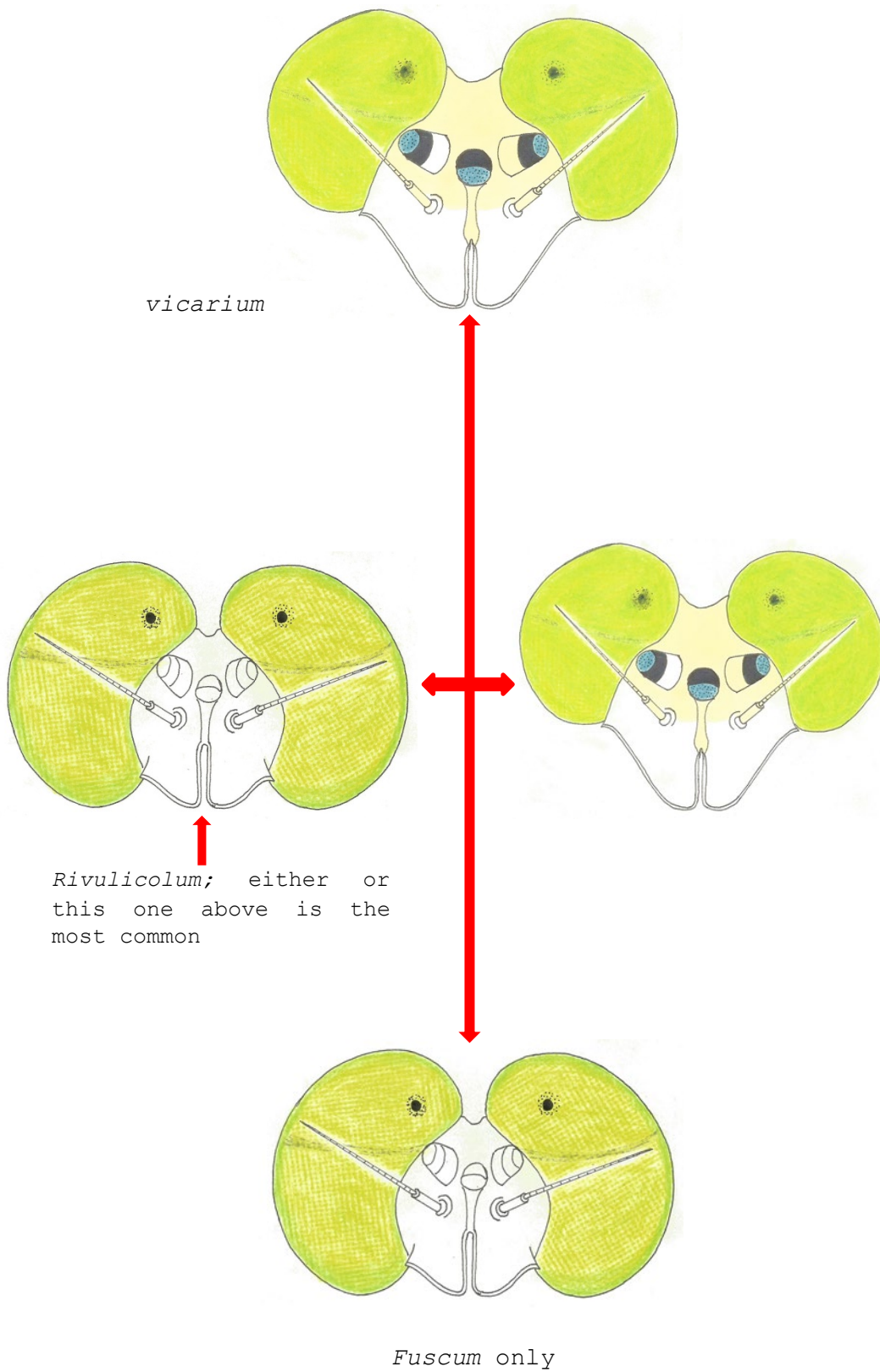


rivulicolum



fuscum

Lineage line for head shapes;



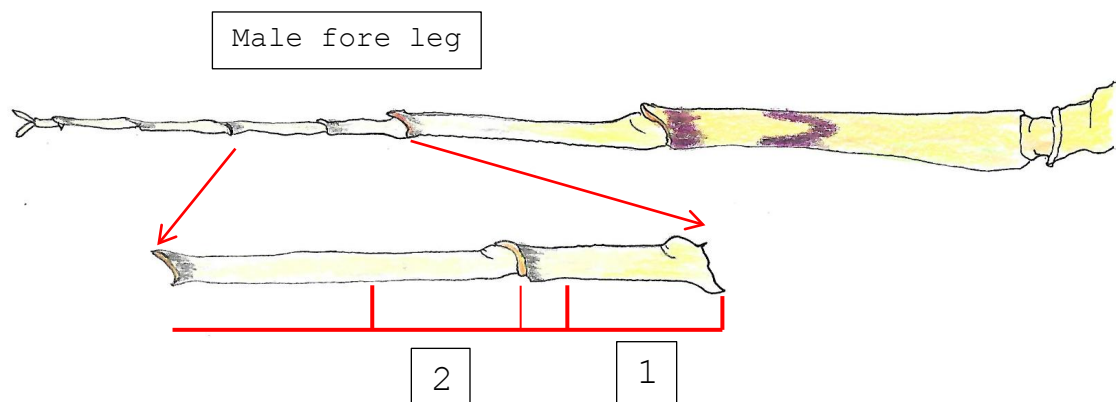
On all forms in the *vicarium* concept all have dark to lighter (**brown-purple-blackish**) lines and shading on the following as per notum above. ANi, MNs, LPs, ALPs in the subimago and imago state.

The distance from (MNs to LPs) is variable within the genus but is specific to each species. Looking at (Kluge 2004) page 171, figure (M), is a general genus representation of which we believe was made from *M terminatum* / *terninatum*.

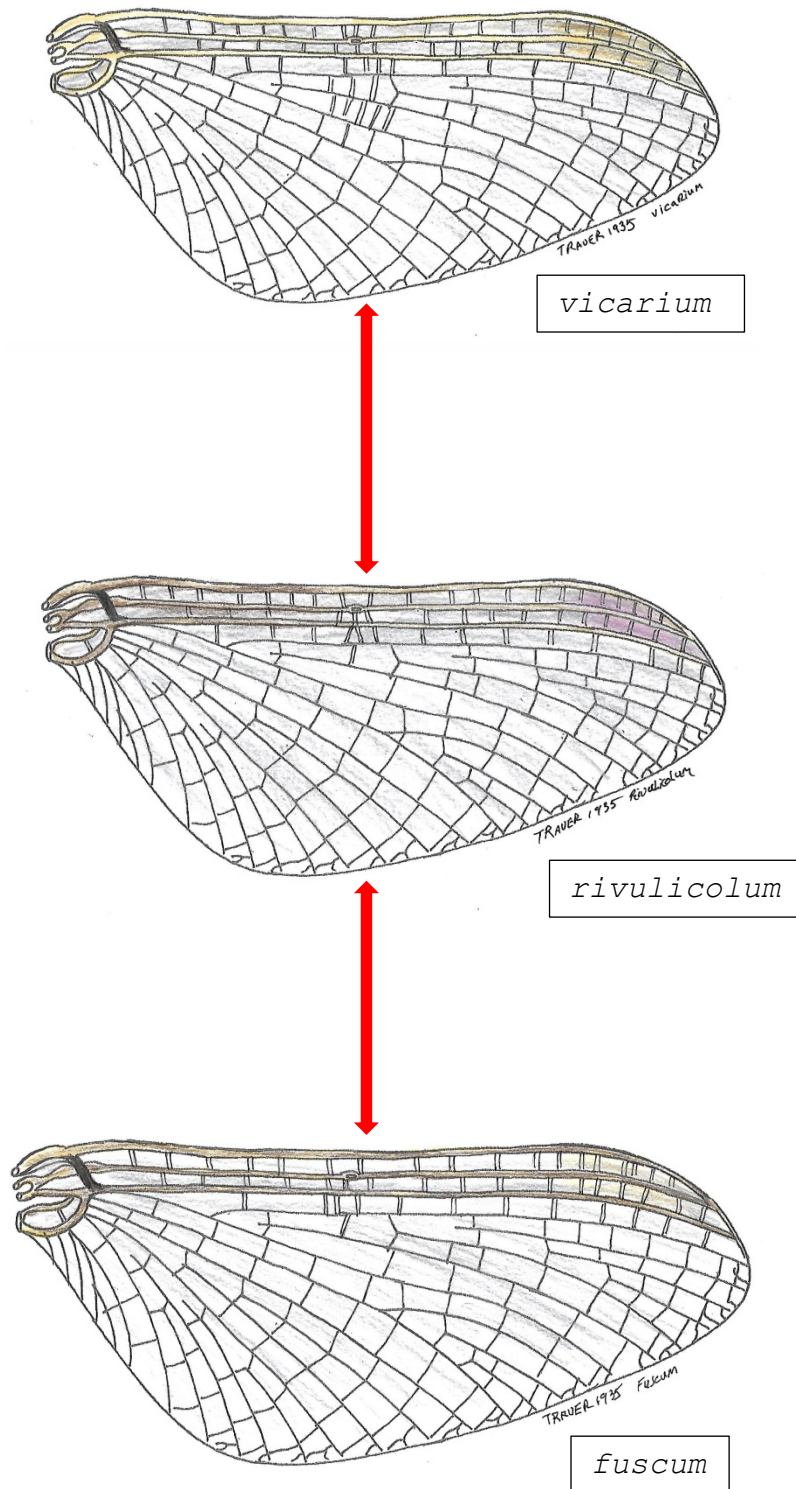
As you can see *M vicarium* has less distance than others. Next to the general notum (Kluge 2004) page 171 figure (L) there are many differences allowing sepperation of *Stenonema* Fig L, from *Maccaffertium*.

Reading (Traver 1935) we have independent descriptions for all (3) forms. From those descriptions we can make a estimation of the fore tarsal ratio.

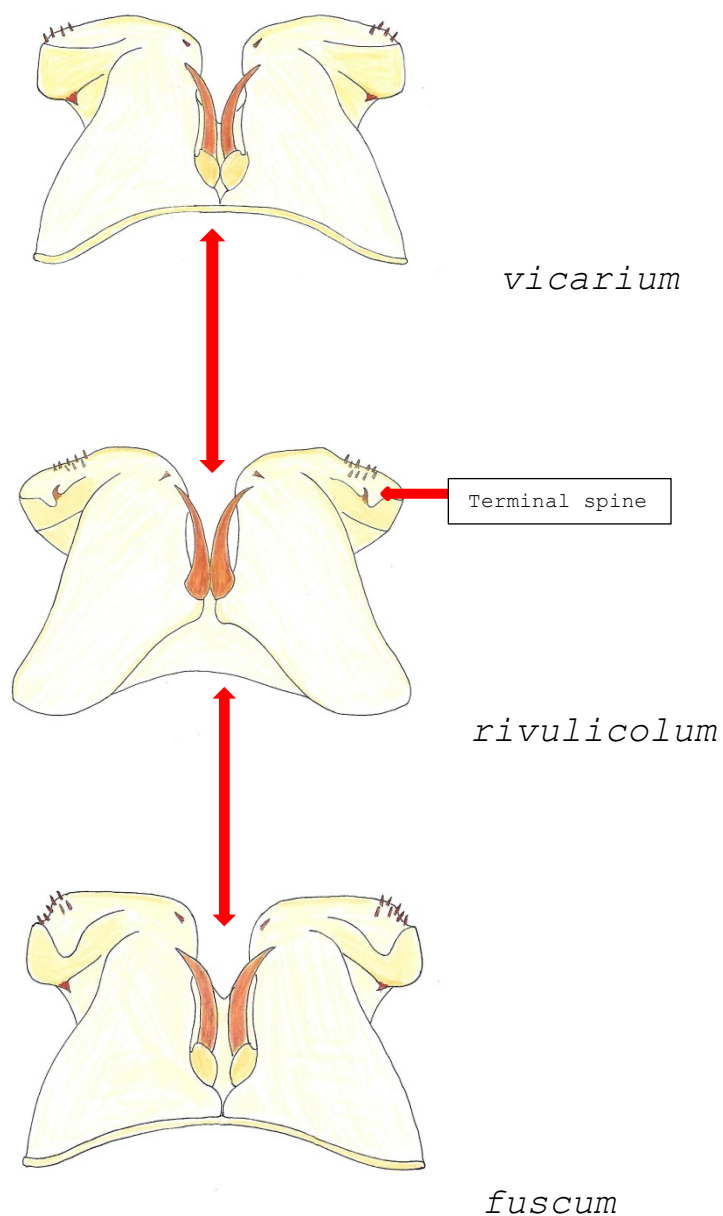
She states that *fuscum* is slightly less than $1/3^{\text{rd}}$, *rivulacolum* $1/2$, and *vicarium* slightly larger that $1/3^{\text{rd}}$.



Forewings are based on (Traver 1935) and reared samples



Lineage of the male genitals, *rivulicolum* is slightly different by have an upward or posteriorly facing terminal spines on the lobes. But we must remember that any of these can be found on any sample they are interchangeable.

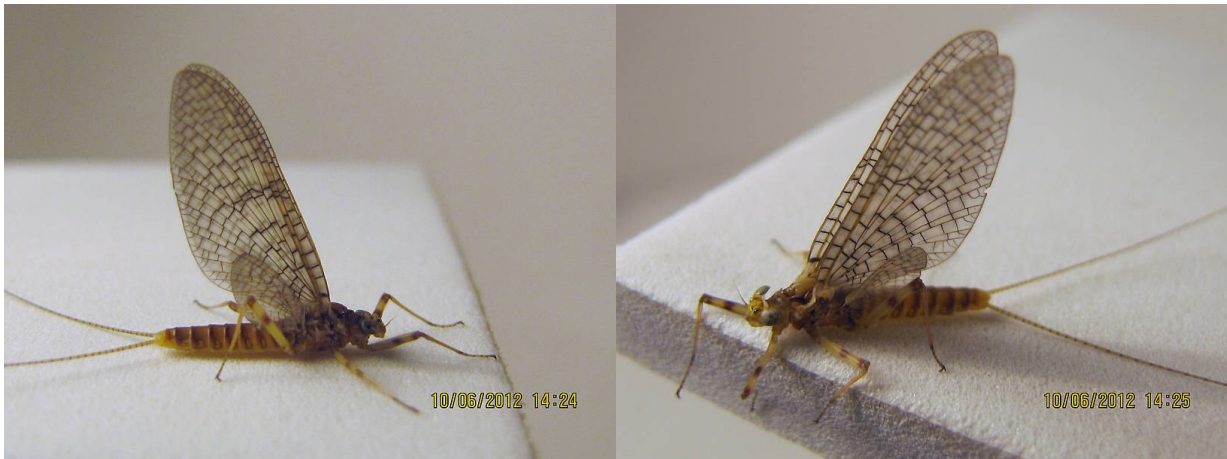


All these illustrations were made on our reared samples. Note; as mentioned in (Bednarik & McCafferty 1979) stated (Burks 1953) his *fuscum* and *vicarium* genitals are reversed, and we also agree.

We will end with reared photos from my collection.



Male *vicarium* with the correct genitals.



Reared *rivulicolum* exuvia dissected and slide mounted.

rivulicolum with exuvia



Fuscum



This final sample is known to me as the (JW vicarium). Jeff Webb said it was a *vicarium* and after dissection it is a classic example genitals and all.



Selected bibliographies

Beacon MA. 2020. Stenacron mayflies. Online resource, self-published.

Bednarik AF. 1979. Subgeneric classification of *Stenonema* (Ephemeroptera: Heptageniidae). Journal of the Georgia Entomological Society 14(3):190-191.

Bednarik AF; McCafferty WP. 1979. Biosystematic revision of the genus *Stenonema* (Ephemeroptera: Heptageniidae). Canadian Bulletin of Fisheries and Aquatic Sciences 201:1-73

Burks BD. 1953. The mayflies, or Ephemeroptera, of Illinois. Bulletin of the Illinois Natural History Survey 26(1):1-216.

Clemens WA. 1915. Life-histories of Georgian Bay Ephemeridae of the genus *Heptagenia*. Contributions to Canadian Biology 1911-1914, Fasc. II:131-143, pl. 15-18.

Kluge NJu. 2004. The Phylogenetic System of Ephemeroptera. Kluwer Academic Publishers, Dordrecht, 442 pp

Lewis PA. 1974a. Taxonomy and ecology of *Stenonema* mayflies (Heptageniidae: Ephemeroptera). USEPA National Environmental Research Center, Cincinnati, OH. 89 pp.

McDunnough J. 1933. Notes on the Heptagenine species described by Clemens from the Georgian Bay Region, Ont. (Ephemerop.). Canadian Entomologist 65:16-24, 33-43.

Walker F. 1853. Ephemerinae. List of the specimens of neuropterous insects in the collection of the British Museum. Part III - (Termitidae- Ephemeridae). pp. 533-585.

Webb JM; McCafferty WP. 2008. Heptageniidae of the world. Part II. Key to the genera. Canadian Journal of Arthropod Identification 7:1-55.

Always remember every sample here are in fact all *vicarium*.