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The Evolution of the Eastern North American Isopods of the Genus Asellus (Crustacea: Asellidae)

Part II

by

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This paper is the second in a three part series dealing with the evolution of North American isopods of the genus *Asellus*. It contains a discussion of the generic status of *Asellus*, a generic diagnosis, a list of North American species, a key to North American species and the reduction to synonymy of certain nominal species of the genus *Asellus*. I would like to thank Dr. Perry C. Holt for reviewing this manuscript and Mrs. Patty Lady for typing this manuscript.

DETERMINATION OF THE GENERIC STATUS OF *ASELLUS*

The following discussion will be concerned with opinions, theories and works of some European and Asiatic workers on the asellids. It should be noted that these references will, of necessity, be rather incomplete. Much of their work is not applicable to the eastern North American fauna and only those papers that have a direct bearing on the North American forms will be mentioned.

The family Asellidae is cosmopolitan in distribution and was formerly considered to be composed of five genera of which two are found in eastern North America: *Asellus* (worldwide in distribution) and *Lirceus* (restricted to eastern North America). In 1962, K. Matsumoto of Japan separated the members of the genus *Asellus* found in Japan into three genera (*Asellus* s. str., *Nipponasellus* nov. gen. and *Uenasellus* nov. gen.).

Henry and Magniez (1968a) stated that the genus *Asellus*, as understood by most European or American authors, is an accumulation of species, some of which appear to be unrelated to the others. They felt that several workers in the past had recognized evolutionary groups in this unnatural assemblage of species, but had never challenged the superficial unity of this poorly defined genus. Therefore Henry and Magniez (1968b and 1970), following the initiative taken by Matsumoto, further divided the genus *Asellus* adding five additional genera to the two new ones

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proposed by Matsumoto. This proposed scheme would necessitate the splitting of genus *Asellus* into eight genera.

1. Genus *Asellus* Geoffroy, 1764, n. def.: type-species *Asellus* aquaticus (L.) 1758. This genus contains eurasiatic species.
2. Genus *Nipponasellus* Matsumoto, 1962: type-species *Asellus aioii* Chappius, 1955. This genus contains primarily Japanese species.
3. Genus *Uenasellus* Matsumoto, 1962: type-species *Asellus iyoensis* Matsumoto, 1960. This genus contains primarily Japenese species.
4. Genus *Proasellus* Dudich, 1925: type-species *Asellus meridianus* Racovitaza, 1919. This genus contains species from the Mediterranean and Atlantic regions.
5. Genus *Baicalasellus* Stammer, 1932: type-species *Asellus baicalensis* Grube, 1872. This genus contains Asiatic species.
6. Genus *Bragasellus* Henry and Magniez, 1970: type-species *Asellus peltatus* Braga, 1944. This genus contains Portuguese species.
7. Genus *Conasellus* Stammer, 1932: type-species *Asellus communis* Say 1818. This genus contains North American species, both epigean and hypogean forms.
8. Genus *Pseudobaicalaselus* Henry and Magniez, 1970: Type-species *Asellus henroti* Bresson, 1955. This genus contains only three troglobitic species from caves in Virginia and West Virginia.

It is the purpose of this particular section to present the results of my studies of the validity of these newly established genera through use of comparative anatomical and, where feasible, statistical methods. This is divided into two parts. The first, shorter portion, deals with the presentation of evidence supporting my viewpoint that if "*Pseudobaicalasellus*" is to be considered a valid genus then it must necessarily include the members of the Cannulus Group established by Steeves (1965), which were omitted from it by Henry and Magniez.

The following European workers loaned me specimens for the study:

Drs. Jean-Paul Henry and Guy Magniez
Université de Dijon
Faculté des Sciences
Laboratoire de Biologie Animale et Générale

Dr. Torben Wolff
Department of Marine Invertebrates
Zoological Museum of the University of Copenhagen

Dr. Roger J. Lincoln
British Museum

I feel that the most useful taxonomic characters presented by Henry and Magniez (1970: 357) for identifying a species of "*Pseudobaicalasellus*", are (1) gnathopod of the male lacking processes on the propodite and (2) absence of orifice apophyses of the endopodite of the male second pleopod with the orifice (i.e., the cannula) ending in a tapering tube. Furthermore the species of *"Pseudobaicalasellus"* are restricted to the Appalachian Mountain regions. All members of the Cannulus Group display the two above mentioned taxonomic characters and all members of the Cannulus Group are likewise restricted to the Appalachian Mountains. Figure 1 illustrates the distribution of the Cannulus Group and members of the proposed *"Pseudobaicalasellus"* genus. As can be seen, both groups are restricted to the Appalachian Mountains, and in fact, have an overlapping distribution. If *"Pseudobaicalasellus"* were a valid genus, it would then include the Cannulus Group.

The second portion of this section concerns the determination of the generic status of the eastern North American isopods. To facilitate the application of comparative anatomical methods, use was made of the lists of characters given by Henry and Magniez (1970: 342, 346, 347, 348, 349, 352, 354 and 357) to be utilized in the generic assignment of a species. For determination of the generic status of the proposed North American genus *"Conasellus"* the list, Henry and Magniez (1970: 354), consisted of seven specific characters which I compared among seven species in four of Henry and Magniez's proposed genera. The results of this study are presented in Tables 1, 2, and 3. One character is not included in these tables: the oostegites of the maxillipeds of ovigerous females which in *"Conasellus"* are supposed to be composed of numerous bristles. Two factors prevented use of this character: (1) the numerous collections (especially troglobitic) which lacked females and (2) the almost complete absence of bristles on the oostegites of ovigerous *"Conasellus"* females, with a vast majority of examined specimens displaying the membranous condition considered (see below) to be a characteristic of *"Pseudobaicalasellus."*

For the proposed restricted North American genus *"Pseudobaicalasellus"* the list of specific characters was composed of ten characters, Henry and Magniez (1970: 357), which I compared among nine species in four proposed genera. The results of a comparison of the characters are shown in Tables 4, 5, and 6. Again one character is not included, the above mentioned nature of the oostegites of the maxilipeds of ovigerous females which, in this genus, are supposed to be membranous. In both genera a minimum of four specimens per species was utilized giving a total of 484 measurements.

In Tables 1-6, "+" equals the presence of the expressed character or condition in a species and "-" equals its absence. In Tables 1-3 the first four species belong to "*Conasellus*", the fifth species to the Cannulus Species Group (="*Pseudobaicalasellus*") and the last two species to European genera (*Asellus* s. str. and "*Proasellus*" respectively). In Tables 4-6 the first two species belong to the proposed genus "*Pseudobaicalasellus*". the third species to the Cannulus Species Group (="*Pseudobaicalasellus*"), the fourth through seventh species to "*Conasellus*" and the last two species to European genera (*Asellus* s. str. and "*Proasellus*" respectively).

Table 1 compares four anatomical characters of *"Conasellus"*. Henry and Magniez (1970: 354) stated that the eyed forms of "*Conasellus*" are better developed than those of Paleartic genera with 30 facets or more in some of them. A large amount of variation is present, however, ranging from none to sixty in species of "*Conasellus*". Two species, "*C.*" *scrupulosus* and "*C.*" *racovitzai racovitzai*, both

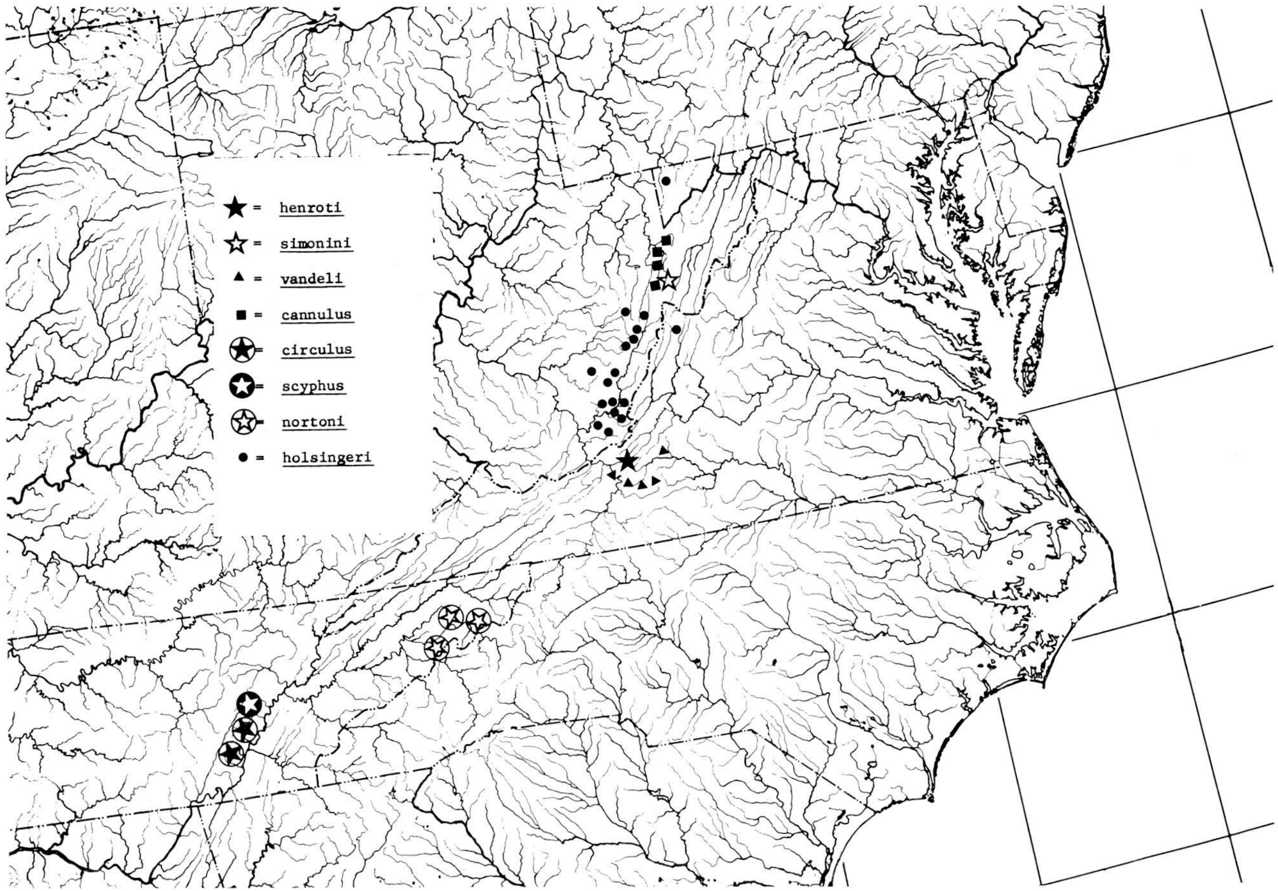

Fig. 1. The distribution of the Cannulus Group of Steeves and the so-called genus "*Pseudobaicalasellus*"

Table 1. A Comparison of some Taxonomix Characters of the genus *"Conasellus"*.

SPECIES	Number of Facets in Eyes	Uropods Elongated	Uropods Regression of Exopodite	Uropods Sexual Dimorphism
obtusus	30-60	+	+	+
laticaudatus	10-30	–	+	–
brevicauda	15-25	–	+	–
alabamensis	0	+	+	+
holsingeri	0	+	+	–
aquaticus	10-15	+	–	+
coxalis	5-10	+	+	+

"+" indicates presence of the character.
"–" indicates the absence of the character.

of which are not shown in the table, range from the epigean to the hypogean environment with concomitant reduction in eye facets from 60 or more to as few as only one or two and in body pigmentation from dark to colorless. The uropods are supposed to be elongated in *"Conasellus."* There should be a tendency towards regression of the exopodite of the uropod and strong sexual dimorphism. A large amount of variation is again evident with two *"Conasellus"* species not having elongated uropods (*laticaudatus* and *brevicauda*) while three other species (each from a separate genus) have elongated uropods. All *"Conasellus"* species display regression of the exopodite, but *holsingeri* (of *"Pseudobaicalasellus"*) and *coxalis* (of *"Proasellus"*) also have reduced exopodites. Sexual dimorphism is lacking in two *"Conasellus"* species (*laticaudatus* and *brevicaudas,)* while it it present in two European forms, (*A. aquaticus* and *"Proasellus" coxalis).*

Table 2 compares three more characters of *"Conasellus"*. Henry and Magniez (1970: 354) claimed that the propodite of the gnathopod should have two or three strong apophyses present and sexual dimorphism. Variation within *"Conasellus"* is noted as *"C." brevicauda* lacks the apophyses and lacks sexual dimorphism. Intraspecific variation is seen in *"C." laticaudatus* and *"C." alabamensis* both of which have, within single populations, specimens that do and specimens that do not exhibit the two characters. Furthermore there should be little specialization of the fourth peraeopod of the male in *"Conasellus"*, but *"C." lacticaudatus* and *"C." brevicauda* do have some specialization while *holsingeri* (*"Pseudobaicalasellus"*) does not have any specialization of the fourth peraeopod.

Table 3 compares five more characters of *"Conasellus"* which were emphasized by Henry and Magniez (1970: 354) who asserted that the protopodite of the first pleopod should have numerous coupling hooks and the exopodite should be quadrangular with the distal external angle indented or swollen. The number of hooks varies greatly from a low of two in *"C." alabamensis* to a high of seven in *"C." laticaudatus*. A European form, *A. aquaticus*, has six hooks which is quite

Table 2. A Comparison of Some Taxonomic Characters of the Genus *"Conasellus"*.

	Propodite of Gnathopod of Male		
SPECIES	Presence of Two to Three Strong Apophyses	Sexual Dimorphism	Little Specialization of Fourth Peraeopod of Male
obtusus	+	+	+
laticaudatus	+–	+–	–
brevicauda	–	–	–
alabamensis	+–	+–	+
holsingeri	–	–	+
aquaticus	–	–	–
coxalis	–	–	–

"+" indicates presence of the character.
"–" indicates the absence of the character.

Table 3. A Comparison of Some Taxonomic Characters of the Genus *"Conasellus"*.

	First Pleopod of Male			Second Pleopod of Male	
SPECIES	Number of Coupling Hooks	Exopodite Quadrangular Shaped	Distal External Angle Indented of Swollen	Presence of Strong Process in External Proximal Region	Number of Orifice Apophyses
obtusus	3	–	–	–	3
laticaudatus	5-7	+	–	+	0
brevicauda	5-6	+	+	–	2
alabamensis	2-3	–	–	+	3
holsingeri	3-4	+	–	+	0
aquaticus	3-6	–	+	–	3
coxalis	3-2	–	+	–	3

"+" indicates presence of the character.
"–" indicates absence of the character.

comparable with the number present in *"Conasellus"*. Also *"C." sinuncus*, not included in the tabulation of characters, is a member of *"Conasellus"* which lacks coupling hooks altogether. The quadrangular shape of the exopod is absent in *"C." obtusus* and *"C." alabamensis*, but is present in *holsingeri* of *"Pseudobaicalasellus"*. The distal external angle is indented or swollen only in *"C." brevicauda*. but it is also present in *A. aquaticus* and *"Proasellus" coxalis,* both European forms. The second pleopod of the male should have a strong process in the external proximal region and the orifice is supposed to be surrounded by several (up to three) apophyses in *"Conasellus"*. The process in the external proximal region is missing in *"C." obtusus* and *"C." brevicauda*, but it is present in *holsingeri* of *"Pseudobaicala-*

sellus". There are no apophyses of the orifice in "*C.*" *laticaudatus*, yet there are three apophyses in *A. aquaticus*, a European form.

Table 4 compares four of the characters of "*Pseudobaicalasellus*". According to Henry and Magniez (1970: 357) the propodite of the gnathopod of the male in "*Pseudobaicalasellus*" should lack the two to three apophyses and have very weak sexual dimorphism. All three of the "*Pseudobaicalasellus*" species have both of the above features, but these characters are also found in "*Conasellus*" *brevicauda*, both European species, and some specimens of "*C.*" *laticaudatus* and "*C.*" *alabamensis*. The fourth peraeopods of the male are supposed to show very little specialization. This is true of all three "*Pseudobaicalasellus*" species as well as "*C.*" *obtusus* and "*C.*" *alabamensis*. The second pleopod of the female should be triangular in "*Pseudobaicalasellus*". This is present in all three species, but also in "*Conasellus*" *laticaudatus*, "*C.*" *brevicauda*, "*C.*" *alabamensis* and "*Proasellus*" *coxalis*.

Table 5 compares six additional characters of "*Pseudobaicalasellus*". Henry and Magniez (1970: 357) stated that the third pleopods of "*Pseudobaicalasellus*" have a slightly oblique suture on the exopodite. All specimens examined exhibit this condition which would be expected in view of the fact that this is one of the most reliable diagnostic characters for the separation of the genus *Asellus* from the genus *Lirceus*. The fourth pleopod of "*Pseudobaicalasellus*" is said to have a small proximal segment and a large expodite. All specimens of the nominal general examined possessed both of these features. The uropods should be elongated, with pronounced regression of the exopodite and strong sexual dimorphism. It has been found that "*Pseudobaicalasellus*" *vandeli* lacks elongated uropods, while "*C.*" *obtusus*, "*C.*" *alabamensis*, *A. aquaticus* and "*Proaselluss*," *coxalis* (last two are European forms) have elongated uropods. No "*Pseudobaicalasellus*" species has

Table 4. A Comparison of Some Taxonomic Characters of the Genus "*Pseudobaicalasellus*".

SPECIES	Propodite of Gnathopod of Male: Lack Two to Three Strong Apophyses	Propodite of Gnathopod of Male: Weak Sexual Dimorphism	Little Specialization of Fourth Peraeopod of Male	Female Second Pleopod Triangular Shaped
vandeli	+	+	+	+
simonini	+	+	+	+
holsingeri	+	+	+	+
obtusus	–	–	+	–
laticaudatus	+ –	+ –	–	+
brevicauda	+	+	–	+
alabamensis	+ –	+ –	+	+
aquaticus	+	+	–	–
coxalis	+	+	–	+

"+" indicates presence of the character.
"–" indicates the absence of the character.

Table 5. A Comparison of Some Taxonomic Characters of the Genus *"Pseudobaicalasellus"*.

SPECIES	Slightly Oplique Suture on Exopodite of Third Pleopod	Fourth Pleopod: Size of Proximal Segment Small	Fourth Pleopod: Size of Expodite Large	Uropods: Elongated	Uropods: Good Regression of Exopodite	Uropods: Strong Sexual Dimorphism
vandeli	+	+	+	–	–	–
simonini	+	+	+	+	–	–
holsingeri	+	+	+	+	–	–
obtusus	+	+	+	+	–	–
laticaudatus	+	+	+	–	+–	+–
brevicauda	+	+	+	–	–	–
alabamensis	+	+	+	+	+	+
aquaticus	+	+	+	+	–	–
coxalis	+	+	+	+	–	–

"+" indicates presence of the character.
"–" indicates the absence of the character.

strong sexual dimorphism of the uropods, but many specimens display slight examples of sexual dimorphism. Of the other species *"C." alabamensis* has strong sexual dimorphism and *"C." lacticaudatus* has some specimens which reveal strong sexual dimorphism of the uropods.

Table 6 compares five more characters of *"Pseudobaicalasellus"* that Henry and Magniez (1970: 357) emphasized: the first pleopod of the male should have multiple coupling hooks, the exopodite should not be quadrangular and the distal external angle should not be indented or swollen. All of the *"Pseudobaicalasellus"* species do have multiple coupling hooks, but this situation is also found in *"C." laticaudatus, "C." brevicauda* and *A. aquaticus*. The exopodite is quandrangular in *"Pseudobaicalasellus" holsingeri* and it is not so in *"C." obtusus* and *"C." alabamensis* as well *A. aquaticus* and *"Proasellus" coxalis*, both European forms. All *"Pseudobaicalasellus"* species do not have the distal external angle of the exopod indented or swollen, but this is also true of *"C." obtusus, "C." laticaudatus* and *"C." alabamensis*. The second pleopod of the male in *"Pseudobaicalasellus"* is supposed to lack a strong process in the external proximal region and there should be no orifice apophyses. It has been found that *"Pseudobaicalasellus" holsingeri* has the strong process in the external proximal region, while *"C." obtusus* and *"C." brevicauda* and the two European forms, *A. aquaticus* and *"Proasellus" coxalis*, lack the strong process. All *"Pseudobaicalasellus"* species lack the orifice apophyses, but *"C." laticaudatus* also lacks the apophyses.

From the data presented above, it is my opinion that it is inadvisable to elevate the previously defined species groups of *Asellus* to the rank of genera. At least it is felt that this is not justifiable based on the characters used by Henry and Magniez (1970) as generic ones. These characters, as shown, exhibit too much inter- and intraspecific variability.

Table 6. A Comparison of Some Taxonomic Characters of the Genus *"Pseudobaicalasellus"*.

	First Pleopod of Male			Second Pleopod of Male	
SPECIES	Number of Coupling Hooks	Exopodite Quadrangular Shaped	Distal External Angle Indented of Swollen	Presence of Strong Process in External Proximal Region	Number of Orifice Apophyses
vandeli	2-3	–	–	–	0
simonini	3-5	–	–	–	0
holsingeri	3-4	+	–	+	0
obtusus	3	–	–	–	3
laticaudatus	5-7	+	–	+	0
brevicauda	5-6	+	+	–	2
alabamensis	2-3	–	–	+	3
aquaticus	3-6	–	+	–	3
coxalis	1-2	–	+	–	2

"+" indicates presence of the character.
"–" indicates the absence of the character.

This view has been supported by data obtained through the statistical analysis of nine characters (ratios of measurements) in nine species, utilizing ten specimens per species. This part of the study was attended by several problems. The European specimens available for examination were greatly limited. Initially sixteen characters were measured in the specimens, but because of missing data in several categories in one or more species only nine characters could be treated in the final analysis. The nine species studied were of four proposed genera as follows: *A. aquaticus,* the single species in the European genus *Asellus* s. str.; *"P." meridianus* and *"P." coxalis* of the European genus *"Proasellus", "Pseudobaicalasellus" holsingeri* and *"Pseudobaicalasellus" vandeli;* and *"Conasellus" obtusus, "C." laticaudatus, "C." brevicauda* and *"C." alabamensis.* The unequal distribution of species per genus was again due to the unavailability of material.

As stated above, the characters used consisted of ratios expressed as indices following Miller's method (1933: 101). The following nine indices were employed: (1) body index (body length, excluding uropods and antennae, divided by the greatest body width); (2) head index (length divided by width); (3) gnathopod index (length divided by width, not including dactylopod); (4) first pleopod index #1 (peduncle length divided by peduncle width); (5) first pleopod index #2 (distal podomere length divided by peduncular proximal podomere length); (6) second pleopod index #1 (endopod length divided by peduncle length); (7) second pleopod index #2 (exopod length divided by peduncle length); (8) second pleopod index #3 (exopod length divided by the endopod length) and (9) second pleopod index #4 (peduncle length divided by peduncle width). All measurements were of males and were taken with an ocular reticule mounted in either a dissecting scope or (when needed) a compound microscope. These characters are those associated with the most useful taxonomic structures, *i.e.,* the gnathopod, first pleopod, and especially the second pleopod. The eliminated characters were those associated with highly variable and unreliable structures, such as: first antennae, seventh peraeopod, pleotelson and uropod.

Each measurement was calculated to four decimal places, placed on IBM punch cards and subjected to two tests. The first test was Bartlett's Test of Homogeneity of Variances. The purpose of this test was to determine if the variances of each character in the ten specimens of a species were homogeneous, *i.e.*, not significantly different. The variances were found to be homogeneous. Therefore, the measurements were then subjected to Multivariate Discriminant Function Analysis (Sokal and Rohlf, 1969). Although the technique of discriminant functions has been known for some time, it ". . .has only recently (due to the availability of digital computers) been much applied in various biological fields, especially in systematics." (Sokal and Rohlf, 1969: 488). The null hypothesis was set as follows: H_0: the values of the characters of a specimen will not overlap with those of another specimen. One point must be clarified before continuing this discussion. The attempt was made statistically to see if, within the old genus *Asellus*, new genera could be formed as proposed by Henry and Magniez (1968b and 1970). All specimens studied possess the necessary characteristics to be placed in the genus *Asellus* as defined and distinguished, in the following section, from its nearest ally *Lirceus*. In order to test the null hypothesis, the species placed in a proposed genus of Henry and Magniez (1970) were tested against each other. If they did belong to a single genus then they should overlap in the values obtained for the nine characters measured. The first group to be tested were the two species placed in the proposed genus "*Proasellus*". It was found that there were no specimens of a species exhibiting values of a single character which overlapped with values derived for the same character in any other specimens of the other species. In other words the two species could not be placed in the newly proposed genus on the basis of the characters analyzed. The next group to be tested were the two species placed in the proposed genus "*Pseudobaicalasellus*". Again no overlap between characters of any specimens in the two species was found. It can again be stated that based on the statistical characters employed the two species could not be placed in the newly proposed genus. The last group to be tested were the four species of the proposed genus "*Conasellus*". In this group only one specimen of a species exhibited a character which overlapped with the values for characters of another species. All other specimens had non-overlapping values. The results of these analyses lead to the acceptance of the null hypothesis. All the species studied are members of the single genus *Asellus*.

Genus *Asellus* Geoffroy-St. Hilaire, 1764

Asellus Geoffroy-St. Hilaire, E.L., 1764, *Hist. Abregee Ins.,* 2: 672 Racovitza, 1924: 83; Birstein, 1951: 51; Henry and Magniez, 1970: 345-6. Type-species, by subsequent designation, *Asellus aquaticus* (Linneaus, 1758). *Sensu* Racovitza, 1919.

Caecidotea Packard, 1871: 752. Type-species, by original designation, *Caecidotea stygia* Packard, 1871.

Nipponasellus Matsumoto, 1962: 163. Type-species, by subsequent designation, *Nipponasellus aioii* (Chappius, 1955). *Sensu* Matsumoto, 1962.

Uenasellus Matsumoto, 1962: 165. Type-species, by monotypy, *Uenasellus iyoensis* (Matsumoto, 1960). *Sensu* Matsumoto, 1962.

Proasellus Dudich, 1925, Henry and Magniez, 1970: 342. Type-species, by subsequent designation, *Proasellus meridianus* (Racovitza, 1919). *Sensu* Henry and Magniez, 1970.

Baicalasellus Stammer, 1932, Henry and Magniez, 1970: 349. Type-species, by subsequent designation, *Baicalasellus baicalensis* (Grube, 1872). *Sensu* Henry and Magniez, 1970.

Bragasellus Henry and Magniez, 1970: 349. Type-species, by subsequent designation, *Bragasellus peltatus* (Braga, 1944). *Sensu* Henry and Magniez, 1970.

Conasellus Stammer, 1932, Henry and Magniez, 1970: 353. Type-species, by subsequent designation, *Conasellus communi* (Say, 1818). *Sensu* Henry and Magniez, 1970.

Pseudobaicalasellus Henry and Magniez, 1970: 357. Type-species, by subsequent designation, *Pseudobaicalasellus henroti* (Bresson, 1955). *Sensu* Henry and Magniez, 1970.

Diagnosis. - Eyes: present, reduced or absent depending on the species; facets can range from 0 to 60 or more. Body pigmentation: ranges from heavy pigmentation in some species to total absence of pigmentation in other species. Size of sexually mature adults: ranging from 2.5 mm. in length to 19.0 mm. in length (excluding antennae and uropods). Cephalothorax: without median frontal carina. Antenna 1: flagellum 5- to 18- merous articles; flagellum tip commonly reaching to midpoint or sometimes slightly beyond distal end of peduncle of second antenna. Antenna 2: lacking rudimentary exopodite; flagellum with 32- to 85- merous articles, and ranging from 1/2 to equal the length of the body (excluding uropods).

Left mandible: with 3-4 teeth in incisor and 4 teeth in lacinia. Right mandible: with 4 teeth in incisor. First maxilla: inner lobe of plate 4-5 setae; outer lobe of plate 10-13 setae. Second maxilla: with 2 laminae; outer lamina with 12-24 setae; inner lamina with 10-15 setae. Maxilliped: with 3-8 coupling hooks; apex of inner plate, distal and outer margin of epipodite, and 4 segments of palp heavily setose; oostegite of maxilliped of ovigerous females bearing numerous setae.

First peraeopod (gnathopod) : sexual dimorphism exhibited with male gnathopod usually larger and better developed than that of female; gnathopod shorter than other peraeopods; palmar margin of propodus of male gnathopod may have from 0 up to 4 processes; opposable margin of dactyl commonly without processes, but often possessing spines or undulations of margin; gnathopod subchelate and shorter than rest of peraeopods. Peraeopods 2-7; slender, uniunguiculate; of remaining 6 pairs of legs in both sexes, the fourth pair is shortest, but a little longer that the first pair; each of other pairs of legs successively longer that preceding pair; all the legs very similar morphologically.

First pleopod: absent in female; in male composed of peduncle, which is generally short and squarish with from 0 to 9 coupling hooks and an exopod which is generally broad and oval with numerous marginal setae. Second pleopod of female: generally subtriangular or subcircular with base broadest narrowing toward apex. Second pleopod of male: with 2-jointed exopod; distal segment of exopod normally with many plumose setae, proximal segment of exopod often with setae on lateral border; nonsegmented endopodite serves as copulatory organ containing endopodial groove (for transfer of spermatozoa) and commonly from 1 to 5 additional processes (processes often very complicated in their ornamentation and are most useful taxonomic structures for determination of species). Third pleopod: no sexual dimorphism; exopod always large and forming operculum (= gill covering) over fourth and fifth pairs of pleopods; suture between proximal and distal segments commonly running from middle of median border to lateral border generally in a perpendicular angle, but often variable being somewhat acute or oblique in various species (never forming a strong oblique angle as in *Lirceus* which runs from distal point of median border obliquely to lateral border); terminal and lateral margins always setose. Pleopods 4-5: partially or totally nonchitinous and serving as gills. Uropods: biramous, with exopod equal to or shorter than endopod.

List of North American Species of *Asellus*

1. *A. communis* Say, 1818
2. *A. styguis* (Packard, 1871)
3. *A. brevicauda* Forbes, 1876
4. *A. intermedius* Forbes, 1876
5. *A. nickajackensis* (Packard, 1881)
6. *A. attenuatus* Richardson, 1900
7. *A. richardsonae* (Hay, 1901)
8. *A. smithii* (Ulrich, 1902)
9. *A. alabamensis* (Strafford, 1911)
10. *A. tridentatus* (Hungerford, 1922)
11. *A. antricolus* (Creaser, 1931)
12. *A. californicus* Miller, 1933
13. *A. macropopodus* (Chase and Blair, 1937)
14. *A. ozarkanus* (Chase and Blair, 1937)
15. *A. dentadactylus* Mackin and Hubricht, 1938
16. *A. montanus* Mackin and Hubricht, 1938
17. *A. hobbsi* (Maloney, 1939)
18. *A. dimorphus* (Mackin and Hubricht, 1940)
19. *A. stiladactylus* (Mackin and Hubricht, 1940)
20. *A. packardi* (Mackin and Hubricht, 1940)
21. *A. spatulatus* (Mackin and Hubricht, 1940)
22. *A. oculatus* (Mackin and Hubricht, 1940)
23. *A. adentus* Mackin and Hubricht, 1940
24. *A. pricei* (Levi, 1949)
25. *A. henroti* Bresson, 1955

26. *A. vandeli* Bresson, 1955
27. *A. simonini* Bresson, 1955
28. *A. recurvatus* Steeves, 1963
29. *A. holsingeri* Steeves, 1963
30. *A. cannulus* Steeves, 1963
31. *A. parvus* Steeves, 1964
32. *A. barri* Steeves, 1965
33. *A. sinuncus* Steeves, 1965
34. *A. nortoni* Steeves, 1966
35. *A. kenki* Bowman, 1967
36. *A. bisetus* Steeves, 1968
37. *A. reddelli* Steeves, 1968
38. *A. pilus* Steeves, 1968
39. *A. incurvus* Steeves and Holsinger, 1968
40. *A. circulus* Steeves and Holsinger, 1968
41. *A. scyphus* Steeves and Holsinger, 1968
42. *A. racovitzai* Williams, 1970
43. *A. forbesi* Williams, 1970
44. *A. obtusus* Williams, 1970
45. *A. laticaudatus* Williams, 1970
46. *A. scrupulosus* Williams, 1970
47. *A. nodulus* Williams, 1970
48. *A. occidentalis* Williams, 1970
49. *A. franzi* Holsinger and Steeves, 1971
50. *A. catachaetus* Fleming and Steeves, 1972
51. *A. cyrtorhynchus* Fleming and Steeves, 1972
52, *A. paurotrigonus* Fleming, 1972
53. *A. metcalfi*, Fleming, 1972
54. *A. steevesi* Fleming, 1972
55. *A. ancylus* Fleming, 1972
56. *A. holti* Fleming, 1972
57. *A. foxi* Fleming, 1972
58. *A. extensolingualus* Fleming, 1972
59. *A. serratus* Fleming, 1972

KEY TO THE NORTH AMERICAN SPECIES OF THE GENUS *ASELLUS*

This key is based only on males of the species and, with but few exceptions, is restricted to the most reliable diagnostic character-the endopodial tip of the second pleopod. The terms lateral, mesial, cannula, caudal and accessory refer to processes on the endopodial tip. *A. smithii* (Ulrich, 1902) is omitted due to insufficient evidence necessary for its identification.

1.	Endopodial tip with single process	2
	Endopodial tip with two or more processes	11
2.	Cannula slender and generally pointed	3
	Cannula short and stout	9

3. Cannula slender and needle-like resembling a stylet 4
Cannula slender and pointed, but not needle-like and not resembling a stylet 5
4. Endopod tapering abruptly at apex narrowing to the stylet cannula extending greatly beyond tip of endopod . . . *A. cannulus* Steeves, 1963
Endopod not tapering at apex, but forming sickle-shaped structure with stylet cannula not exiting from apex of endopod and extending only short distance beyond tip of endopod . . *A. californicus* Miller, 1933
5. Cannula exhibiting some evidence of torsion 6
Cannula not exhibiting evidence of torsion 7
6 Endopod tapering gradually with only distal 3/8 exhibiting some degree of torsion . . . . *A. henroti* Bresson, 1955
Endopod tapering abruptly at apex; entire endopod exhibiting torsion . . . . *A. incurvus* Steeves and Holsinger, 1968
7. Endopod generally slender along whole length with distal part of endopod and entire cannula curving mesiad . . *A. simonini* Bresson, 1955
Endopod generally bulbous at proximal end with distal end of endopod and entire cannula curving laterad 8
8. Endopod abruptly tapering to short cannula . . . *A. vandeli* Bresson, 1955
Endopod gradually tapering to long, slender, pointed cannula . . . . *A. holsingeri* Steeves, 1963
9. Cannula arising from midpoint of apex of endopod 10
Cannula arising from lateral margin of apex of endopod and curving slightly mesiad *A. dimorphus* (Mackin and Hubricht, 1940)
10. Cannula exiting from endopod as narrow tube, but apex flairs forming bulbous tip with slight mesial indentation . . . . *A. serratus* Fleming, 1972
Cannula exiting from endopod as stout deeply grooved structure lacking bulbous tip . . . . *A. laticaudatus* Williams, 1970
11. Endopodial tip with two processes 12
Endopodial tip with three or more processes 22
12. Endopodial tip composed of cannula and lateral process 13
Endopodial tip composed of cannula and either mesial or caudal process 16
13. Lateral process extended in form of distinctive tongue-like lobe . . . . *A. extensolingualus* Fleming, 1972
Lateral process not extended in form of distinctive tongue-like . . . lobe 14
14. Lateral process very large, subtriangular and bent dorsally at tip . . . . *A. occidentalis* Williams, 1970
Lateral process not large or bent dorsally at tip cannula protruding beyond apex of endopod 15
15. Endopod tapering distally, ending in slender, rectilinearly pointed cannula extending greatly beyond tip of endopod; lateral process reduced . . . . *A. foxi* Fleming, 1972

Endopod not tapering distally; cannula not slender but stout and projecting laterad perpendicular to prominent, rounded lateral process . . . . *A. sinuncus* Steeves, 1965

16. Endopodial tip composed of cannula and mesial process 17
Endopodial tip composed of cannula and caudal process 18

17. Exopod with single slender seta; endopod with acute medial and lateral apophyses, bluntly rounded mesial process and short, acute cannula with tip directed laterad . . . . *A. pilus* Steeves, 1968
Exopod with several slender setae; endopod without acute medial and lateral apophyses, elongated slender mesial process and slender pointed cannula directed slightly laterad . . . . *A. nortoni* Steeves, 1966

18. Caudal process and cannula distinctly projecting beyond apex of endopod and approximately subequal in length 19
Caudal process not projecting greatly beyond apex of endopod and caudal process never subequal in length to cannula 20

19. Cannula and caudal process slender, pointed and curving laterad beyond apex of endopod; endopod much larger than exopod . . . . *A. franzi* Holsinger and Steeves, 1970
Cannula and caudal process short, stout and not curving laterad beyond apex of endopod; tip of caudal process often bent into sharp point; endopod not larger than exopod . . . . *A. intermedius* Forbes, 1876

20. Caudal process bluntly rounded, non-sclerotized rugose lobe; cannula seemingly displaced mesially 21
Caudal process bluntly rounded, highly sclerotized non-rugose lobe; cannula not displaced mesially but forming slender, fingerlike lobe . . . . *A. communis* Say, 1818

21. Cannula forming long, thin, stylet-like structure inscribing complete circle arising mesially with tip directed laterad . . . . *A. circulus* Steeves and Holsinger, 1968
Cannula not long, thin or stylet-like, but having cup-shaped basal portion with tip directed mesiad . . . . *A. scyphus* Steeves and Holsinger, 1968

22. Endopodial tip with three processes 23
Endopodial tip with four or more processes 41

23. Endopodial tip composed of cannula, caudal and lateral processes . . 24
Endopodial tip composed of cannula, mesial and either lateral or caudal processes 29

24. Processes of endopodial tip arranged in a coiled or twisted manner; endopod longer than exopod . . *A. montanus* Mackin and Hubricht, 1938
Processes of endopodial tip not arranged in a coiled or twisted manner; endopod not longer than exopod 25

25. Lateral process greatly reduced in size, forming small, rounded projection lying proximal to terminal elements . . . . *A. stygius* (Packard, 1871)
Lateral process not reduced in size forming large distinct process . . . 26

26. Caudal process reduced in size forming bluntly rounded lobe 27
Caudal process not reduced in size but forming large, distinct lobe . . 28
27. Lateral process large and slender with recurved tip projecting distally beyond apex of endopod . . . . *A. ancylus* Fleming, 1972
Lateral process lacking recurved tip but forming lobe-like structure on lateral margin endopod . . . . *A. ozarkanus* (Chase and Blair, 1937)
28. Caudal process large with pointed apex, bearing three to five simple spines on dorsal surface; cannula triangular in shape not reaching beyond caudal process . . . . *A. racovitzai* Williams, 1970
Caudal process large with pointed apex, lacking three to five simple spines on dorsal surface; cannula not triangular in shape but reaching beyond caudal process with apex curving mesiad . . . . *A. paurotrigonus* Fleming, 1972
29. Endopodial tip composed of cannula, mesial and lateral processes . . . 30
Endopodial tip composed of cannula, mesial and caudal processes . . 37
30. Lateral process large, slender and distinctly curved laterad 31
Lateral process not slender and not curved laterad 33
31. Cannula very short and stout; cannula much shorter than lateral and mesial processes and curving slightly mesiad . . . . *A. packardi* (Mackin and Hubricht, 1940)
Cannula long, slender and curving laterad 32
32. Cannula subequal in length to lateral process and curves laterad crossing under lateral process . . . . *A. richardsonae* (Hay, 1901)
Cannula shorter than lateral process and reaches only to distal 1/2 of lateral process . . . . *A. catachaetus* Fleming and Steeves, 1972
33. Lateral process very broad, flat lobe-like structure 34
Lateral process rounded, finger-like lobe 35
34. Lateral process with short spines along sclerotized lateral margin; cannula extended beyond mesial process and curving mesiad; mesial process short . . . . *A. tridentatus* (Hungerford, 1922)
Lateral process lacking short spines along lateral non-sclerotized margin; cannula not extended beyond mesial process and not curving mesiad; mesial process very large and extended greatly beyond other processes . . . . *A. pricei* (Levi, 1949)
35. Cannula, mesial and lateral processes all subequal in length, all forming finger-like lobes tapering gently from endopodial base; lateral margin of lateral process with serrated border . . . . *A. macropropodus* (Chase and Blair, 1937)
Cannula, mesial and lateral processes not all of equal length; variable in shape; lateral margin of lateral process without serrated border 36
36. Mesial process wide and four-toothed distally, lateral process small, narrow and hook-like . . . . *A. scrupulosus* Williams, 1970
Mesial process large, sclerotized, concave distally and lacking four distal teeth; lateral process large, rounded and finger-like . . . . *A. brevicauda* Forbes, 1876

37. Mesial and caudal processes heavily sclerotized and exhibiting some degree of torsion . . . . *A. nodulus* Williams, 1970
Mesial process not heavily sclerotized and endopodial tip not exhibiting any torsion 38
38. Mesial process large, wide and bifid; caudal process dentate. . . . . *A. dentadactylus* Mackin and Hubricht, 1938
Mesial process not bifid; caudal process not dentate 39
39. Mesial process short and wide; cannula wide with recurved outer lip . . . . *A. obtusus* Williams, 1970
Mesial process relatively long and slender; cannula lacking recurved outer lip 40
40. Cannula short and wide . . . . *A. forbesi* Williams, 1970
Cannula long and slender . . . . *A. attenuatus* Richardson, 1900
41. Endopodial tip with four processes 42
Endopodial tip with five processes 57
42. Endopodial tip composed of cannula, lateral, mesial and accessory processes . . . . *A. holti* Fleming, 1972
Endopodial tip composed of cannula, lateral, mesial and caudal processes 43
43. Lateral process very large and distinctive 44
Lateral process not large or distinctive 50
44. Caudal process with few to many rugosities 45
Caudal process smooth lacking rugosities 47
45. Mesial process with two lobes . . . . *A. kenki* Bowman, 1967
Mesial process with only single lobe 46
46. Caudal process large lobe distinctly projecting beyond apex of endopod; mesial process is sickle-shaped and projects laterally . . . . *A. parvus* Steeves, 1964
Caudal process not distinct lobe and not projecting beyond apex endopod; mesial process not sickle-shaped and not projecting laterally . . . . *A. stiladactylus* (Mackin and Hubricht, 1940)
(In normal recumbent position)
47. Cannula not projecting beyond caudal process . . . . *A. hobbsi* (Maloney, 1939)
Cannula projecting beyond caudal process 48
48. Lateral process large and sickle-shaped and curving distinctly mesiad 49
Lateral process large, not sickle-shaped and not curving mesiad. . . . . *A. metcalfi* Fleming, 1972
49. Lateral process distinctly projecting beyond apex of endopod; mesial process lying over all but tip of cannula . . . . *A. nickajackensis* (Packard, 1881)
Lateral process not distinctly projecting beyond apex of endopod; mesial process lying over cannula . . . . *A. spatulatus* (Mackin and Hubricht, 1940)

50. Caudal process slender and tube-like and extending beyond endopodial tip 51
Caudal process not slender or tube-like, but bluntly rounded 54
51. Caudal process extending beyond apex of cannula 52
Caudal process not extending beyond apex of cannula 53
52. Endopod longer than exopod; cannula slender and extending rectilieearly from endopod apex . . . . *A. recurvatus* Steeves, 1963
Endopod shorter than exopod; cannula slender and curving mesiad . . . . *A. barri* Steeves, 1965
53. Caudal process very slender, almost thread-like, and always shorter than cannula . . . . *A. antricolus* (Creaser, 1931)
Caudal process not thread-like and often subequal to cannula in length . . . . *A. alabamensis* Stafford, 1911
54. Caudal process extending beyond other processes 55
Caudal process not extending beyond other processes 56
55. Caudal process with many tiny setae along medial margin; mesial process with hook-shaped apex . . . . . *A. adentus* Mackin and Hubricht, 1940
Caudal process lacking tiny setae along medial margin; mesial process lacking hook-shaped apex . . . . *A. reddelli* Steeves, 1968
56. Mesial process only process extending beyond apex of endopod; mesial process finger-like and curving slightly mesiad; exopod with only two setae . . . . *A. bisetus* Steeves, 1968
Mesial process, lateral process and cannula all extend beyond apex of endopod; mesial process finger-like and curving slightly laterad; exopod with many setae . . . . *A. oculatus* (Mackin and Hubricht, 1940)
57. Endopodial tip undergone 180° torsion causing all processes be oriented mesiad at right angle to endopodial base; accessory process small and triangular-shaped; caudal process broad, flat and plat-like . . . . *A. steevesi* Fleming, 1972
Endopodial tip not undergone torsion; accessory process large, broad and sheet-like; caudal process slender, pointed and hook-like extending beyond apex of endopod . . . .
A. cyrtorhynchus Fleming and Steeves, 1972

SYNONYMIES

Certain names applied to the Asellids of North America are synonymies. There follows a treatment of the synonymy of the species involved.

Asellus tridentatus (Hungerford, 1922)

Caecidotea tridentata Hungerford 1922. *Kan. Univ. Sci. Bull.*, 14(6): 175-181–Creaser 1931: 5–Miller 1933: 102, Table 1–Van Name 1936: 466, 473, Leonard and Ponder 1949: 198-199, plate V, figure 37–Birstein 1951: 52,53.

Asellus tridentatus Birstein 1951: 111–Pennak 1953: 434–Dexter 1954: 256–Bresson 1955: 51–Mackin 1959: 875–Steeves 1969: 52–Williams 1970: 1.

Conasellus tridentatus Henry and Magniez 1970: 356.

Caecidotea acuticarpa Mackin and Hubricht 1940. *Trans. Am. Micros. Soc.*, 59: 383-397–Mackin 1940: 17–Van Name 1942: 299, 317, figure 22–Levi 1949: 3–Birstein 1951: 53.

Type-specimens. - *A. tridentatus* (Hungerford, 1922) collected by William Hoffman from a cistern in Lawrence, Kansas in March, 1919. Hololectotype, allolectotype and single paralectotype deposited in Snow Entomological Museum of the University of Kansas.

Diagnosis. - Dactylus of male gnathopod lacks basal process but possesses heavy spines. Palmar margin of propodus with two heavy, blunt processes.

Peduncle of first pleopod bearing up to eight coupling hooks. Exopod and peduncle of first pleopod approximately equal in size.

Lateral process of second pleopod of male very broad, flat, lobe-like structure with short spines along sclerotized lateral margin. Cannula extended beyond mesial process and curving mesiad. Mesial process short.

Uropods cylindrical, variable in length and proportions and slightly clubbed.

Remarks. - I had not suspected that *A. acuticarpus* is a synonym of *A. tridentatus* until the very recent receipt of type material of *A. tridentatus* from the Snow Entomological Museum of the University of Kansas through the courtesy of Dr. George W. Byers. The material of *A. tridentatus* consists of one jar labelled "*Caecidotea tridentata* Hungerford Type material." Inside this bottle are six vials all labelled "Type Material". No holotype or allotype was designated by Hungerford. There are only two collections with labels: (1) "Hunters Pasture rock quarry Pool – Temporary – exposed. March 23, 1922. H. B. Hungerford", and (2) "scuds found in cistern. April 18, 1919. W. E. H." The species description by Hungerford listed William Hoffman as the collector, March, 1919, as the date, and a cistern in Lawrence, Kansas as the locality for the type material. Therefore one of the least damaged males from the latter collection was designated the hololectotype, a female was designated the allolectotype and the remaining specimen (a male) was designated the paralectotype of *A. tridentatus*. Slides of the hololectotype and a male paralectotype were then prepared. The similarity of *A. tridentatus* to *A.*

acuticarpus was immediately noted. Comparisons were then made between the slides of *A. tridentatus* and the illustrations of *A. acuticarpus* by Mackin and Hubricht (1940) in the description of *A. acuticarpus*. Comparisons were also made with the eight other *A. acuticarpus* collections in the possession of the writer, including one topotypic collection, as well as USNM material composed of *A. acuticarpus* type material (USNM *108232*), plus one additional USNM collection identified as *A. acuticarpus* by L. Hubricht.

All comparisons were of the four reliable diagnostic characters: gnathopod, uropod, and first and second pleopods of the male. These structures examined in all specimens of both nominal species were found to be identical. It must further be stated that the distribution of *A. acuticarpus* it well within that of *A. tridentatus* (no known intervening geographical barriers). Both species have a continuous distributional pattern in the central part of the United States, primarily in the Ozark Plateau region. On the basis of the above observations, *A. acuticarpus* is synonymized with *A. tridentatus*.

Asellus alabamensis (Strafford, 1911)

Caecidotea alabamensis Stafford 1911. *Pomona. Coll. J. Ent.*, 3(3): 572-575–Hungerford 1922: 175-177–Creaser 1931: 5–Miller 1933: table 1, p. 102–Van Name 1936: 468-469, figure 294–Van Name 1940: 133–Van Name 1942: 321–Birstein 1951: 52,53.

Asellus alabamensis Maloney 1939: 458–Birstein 1951: 111–Bresson 1955: 51-58, 59, 65, 70–Chappuis 1957: 37, 39, figure 9, p. 41, 42–Mackin 1959: 875–Warren 1961: 6–Steeves 1964: 503-504–Steeves 1966: 394-396, 401-402, figure 7–Steeves 1969: 52, 60–Williams 1970: 74.

Asellus bicrenatus Steeves 1963: 474-476, 478, 480, figures 7-11–Holt 1963: 99.

Conasellus alabamensis Henry and Magniez 1970: 356.

Asellus jordani Eberly 1966. *Proc. Indiana Acad. Sci.*, 75: 286-288.

Conasellus jordani Henry and Magniez 1970: 356.

Type-specimens. - *Asellus alabamensis* (Stafford, 1911) collected by C. F. Baker from a well in Auburn, Alabama. Type-material has been lost.

Diagnosis. - Palm of propodus of male gnathopod with two processes: median and distal. Opposable margin of dactyl without processes.

First pleopod with three coupling hooks on peduncle. Exopod 1.3 times as long as peduncle.

Second pleopod of male with medial margin of peduncle bearing 2-3 long setae. Basal part of endopodite with small lateral and medial apophyses. Tip of endopodite ending in 4 processes: (1) lateral process, (2) caudal process, (3) mesial process, and (4) cannula.

Uropod as long as pleotelson. Endopodite 0.61 times as long as peduncle. Exopodite 0.44 times as long as endopodite.

Remarks. - The status of *Asellus jordani* as a valid species has been questioned by

Steeves (pers. comm.). In December of 1970 I studied the holotype of *Asellus jordani* which is deposited in the National Museum of Natural History (USNM *113604)*. Comparison of reliable systematic structures of *A. jordani* with those of *A. alabamensis* revealed the two to be conspecific. The *A. alabamensis* material used for comparison was from two sources: (1) the numerous widespread collections of *A. alabamensis* in my care and (2) the topotypic material of *A. alabamensis* placed in the USNM by Dr. H. R. Steeves III. It should also be noted that the type locality for *A. jordani* is well within the range of *A. alabamensis*. I possess one topotypic collection of *A. jordani* and one additional collection from the same county from which *A. jordani* was collected. Both of the collections have been positively identified as *A. alabamensis*. Furthermore I have two collections from Illinois near the type locality (Indiana) of *A. jordani* both identified as *A. alabamensis*. *A. jordani* Eberly is a synonym of *A. alabamensis* (Stafford), since they are within the range of intrapopulational variation in the following respects: (1) similarity in shape, number and orientation of processes on the endopodial tip of the male second pleopod, (2) similarity of first pleopods and (3) similarity in shape and proportions of rami of uropods.

Asellus communis (Say, 1818)

Asellus communis Say, 1818. *J. Acad. Sci. Phil.*, plate I, figure 4-Forbes 1876: 810, figures 17, 18–Harger 1876: 305–Cope and Packard 1881: 880–Hay 1882: 241–Bovallius 1886: 12–Underwood 1886: 358–Herrick 1887: 40––Packard 1888: 19, 30-34, 109, 118, plate II, figure 1–Stebbling 1893: 377–Richardson 1900: 297–Richardson 1901: 551–Hay 1902: 422, 423–Richardson 1905: 419-421, figures 472, 473–Paulmier 1905: 419-421, figures 472, 473–Rathbun 1905: 43–Norton 1909: 250–Banta 1910: 246–Fowler 1912: 239, plate LXXII–Stafford 1912: 118, figures 65, 66–Huntsman 1913: 274–Shelford 1913: 90, figure 55–Pratt 1916: 377, figure 602–Needham and Lloyd 1916: 191–Kunkel 1918: 231, figure 74–Ward and Whipple 1918: 841, figure 1305–Racovitza 1920: 79-95, figures 52-53– Johansen 1920: 146-148–Racovitza 1923: 112–Racovitza 1925: 576, 597, 620, figures 195, 197-199–Johansen 1929: 105–Allee 1929: 14-16, tables 1-2–Stammer 1932: 130–Miller 1933: table 1, p. 102–Pratt 1935: 439, figure 604–Van Name 1936: 453-457, 459-461, figures 284, 285–Van Name 1940: 127, 132–Van Name 1942: 317–Hatch 1947: 171–Hatchett 1947: 50, 51, 58-60, 64, figures 18, 19, 22, 23, tables 7, 12–Birstein 1939: 64, figures 18, 19, 22, 23, tables 7, 12–Birstein 1951: 31, 39, 60, 86, 111–Bresson 1955: 46, 51–Mackin 1959: 875–Ellis 1961: 80-82, 84, 85, 88, 100, figures 9-12, text figure 3–Bowman 1967: 138, 140–Williams 1970: 1-17, 19, 25, 36, 38, 42, 43, 45, 46, 57, 73-78, tables 1, 2, figures 1-10, 57–Henry and Magniez 1970: 337, 353, 359–Ellis 1971: 51-52, 55-58, figure 7.

Asellus militaris Hay 1878: 90.

Conasellus communis Henry and Magniez 1970: 355, 336, 353, 354, 355, 359, 360, plate III.

Asellus puebla Cole and Minckley 1968. *Proc. Biol. Soc. Wash.* 81: 755-760.

Type-specimens. - *Asellus communis* Say, 1818. Topotypic area is Valley Forge, 20 miles north of Philadelphia in the Valley Forge Creek, a tributary of the Schuylkill River. Neotypes deposited in the Academy of Natural Sciences of Philadelphia.
Diagnosis - Dactylus of male gnathopod as long as propodus palm, with numerous

small teethlike spines. Palmar margin of propodus with 2 processes, one much larger than other.

First pleopod 1.26 times as long as second pleopod. Peduncle with 5 coupling hooks. Exopod 1.33 times as long as peduncle.

Peduncle of second pleopod of male with single spine near inner distal angle. Endopod approximately as long as exopod and 2/3 as long as peduncle. Basal part of endopod with large inner and outer apophyses. Endopodial tip ending in 2 processes: (1) caudal process and (2) cannula.

Uropod slightly shorter then pleotelson. Exopod 0.69 times as long as peduncle. Endopod 0.92 times as long as peduncle.

Remarks - In December 1970 (and again in July, 1972), I examined the holotype and some of the paratypes of *Asellus puebla* deposited in the National Museum of Natural History (USNM *123083*) by Cole and Minckley. These specimens were then compared with the neotype and topotypes of *Asellus communis* in the National Museum of Natural History (USNM *7300*), plus the several collections of *A. communis* I possess. The results of these investigations have led to the opnion that *A. puebla* and *A. communis* are conspecific and should be synonymized since the specimens are identical in: (1) shape and armament of the endopodial tip of the male second pleopod, (2) shape of the first pleopod, (3) shape and proportions of rami of the uropod and (4) shape and armament of the male gnathopod. *A. puebla* is not within the previously known range of *A. communis:* the latter is primarily an inhabitant of the northeastern part of the United States and *A. puebla* was collected from Puebla, Mexico. Yet there are western collections of *A. communis.* Williams (1970) lists eight collections of *A. communis* from the Denver area of Colorado and one collection from Echo Lake in King County, Washington. It was further noted by Williams (1970: 14)"... that *A. communis* may occur in a wide variety of inland waters: from creeks, rivers, ponds, lakes, reservoirs, and one instance, from a swamp." It thus seems quite probable that *A. communis* could have migrated from one or more of its northwestern localities to Mexico or vice versa. Furthermore the likelihood exists that *A. communis* will be collected in areas intermediate to its nortwestern and its Mexican localities.

Instead of according Cole and Minckley's discovery the status of a new species, it should be noted as a new distribution record for *A. communis* which extends the southern range of the genus from 30° N. latitude to 20° N. latitude.

Asellus pricei (Levi, 1949)

Caedidotea stygia Richardson 1905: 434 (in part)–Nicholas 1960a: 132 (in part)–Nicholas

Asellus richardsonae Dearolf 1937: 45 (in part).

Asellus new species Dearolf 1941: 170-171.

Caecidotea pricei Levi 1949. *Notulae Naturae* 220: 1-6–Nicholas 1960a: 131–Nicholas 1960b: 51-52.

Asellus pricei Dearolf 1953: 277–Mackin 1959: 876–Holsinger 1963: 29–Steeves 1963b 462–Holsinger 1964: 60–Steeves 1969: 53,55–Holsinger and Steeves 1971: 190,195, 196, 197.

Conasellus pricei Henry and Magniez 1970: 356.

Caecidotea conestogensis Levi 1949. *Notulae Naturae*, 220: 1-6–Nicholas 1960a: 131–Nicholas 1960b: 51-52 (in part).

Asellus conestogensis Steeves 1963b: 462–Steeves 1969: 53, 55–Williams 1970: 1–Holsinger and Steeves 1971:190.
Conasellus conestogensis Henry and Magniez 1970: 356.
Asellus condei Chappuis 1957. *Notes Biospeleologiques* 7(1): 37-43–Holsinger and Steeves 1971: 190.
Conasellus condei Henry and Magniez 1970: 356.

Type-specimens, - *Asellus pricei* (Levi, 1949) collected by J.L. Blum and J. Price in Refton Cave in Lancaster County, Pennsylvania. Holotype and allotype deposited in the Academy of Natural Sciences in Philadelphia.
Diagnosis - The palmar margin of the propodus of the male gnathopod bears 2 medium-sized processes. Dactylus lacks processes but bears row of heavy spines.

Peduncle of first pleopod approximately 0.92 times as long as exopod. Basal area of exopod bears 2 short mesial spines. Peduncle with 5 coupling hooks.

Endopod of male second pleopod bearing large median and lateral apohyses. Exopod rounded. Distal mesial margin of peduncle with 2 long setae. Endopodial tip bearing 3 processes: (1) lateral process, (2) cannula and (3) mesial process.

Uropods flattened, exopodite approximately 0.62 times as long as endopodite.
Remarks. According to Levi (1949) the holotype and allotype of *A. pricei* were deposited in the Academy of Natural Sciences of Philadelphia and paratypes were placed in the USNM and the American Museum of Natural History. Only a single specimen (a male) comprised the type collection of *A, conestogensis*. This holotype was also deposited in the Academy of Natural Sciences in Philadelphia. A search of the isopod collection at the Academy of Natural Sciences of Philadelphia by Mr. C. W. Hart, Jr., revealed that none of the type material of either species was present nor was there any record indicating that it had been removed (Hart, pers. comm. April 18, 1971). It can therefore be reasonable assumed that the type material of both species is lost.

I studied paratypes and topotypes of *A. pricei* in the National Museum of Natural History. There are also collections of *A. pricei* in my possession. Comparison of the above material with the description and illustrations of *A. conestogensis* given by Levi has led to the opinion that the two are conspecific. Furthermore the type locality of *A. conestogensis* is well within the range of *A. pricei.* Although the former species was collected in a creek, Levi (1949: 3) probably correctly assumed that heavy rains the night before the collection was taken had washed the animal out of a sink hole approximately two miles above the type locality.

Asellus condei was described by Chappuis in 1957 from Ogden's Cave in Frederick County, Virginia. Additional material of *A. condei* was collected by Chappuis from Skyline Caverns and many additional collections from the general area. All of these collections have been identified as *A. pricei* from comparisons with paratypic and topotypic material of *A. pricei*. It is not known where type material of *A. condei* was deposited by Chappuis. Examination of the illustrations and descriptions of *A. condei* given by Chappuis together with the evidence gathered from the study of topotypic material leads to the conclusion that *A. condei* is a synonym of *A. pricei*. These two species (*A. conestogensis* and *A.*

condei) are synonyms of *A. pricei*. This opinion has been stated previously by Holsinger and Steeves (1971: 190). Although they did not got into details which gave rise to their statement, they did say that the species (*A. conestogensis* and *A. condei*) were synonymized with *A. pricei* " . . . on the basis of a comparison of pertinent material. . . ." The three nominal species are synonyms for all of the taxonomically valuable characters are identical among them. This is especially true in reference to the shape, processes and orientation of the endopodial tip of the male second pleopod as well as the first pleopod.

SUMMARY

This paper is the second in the three part series dealing with the evolution of the North American isopods of the genus *Asellus*.

The generic status of *Asellus* is discussed with emphasis placed on the newly proposed genera of Henry and Magniez (1968).

Use is made of comparative anatomical and where feasible statistical methods during this investigation.

The first, shorter portion of the study deals with the presentation of evidence supporting the viewpoint that if "*Pseudobaicalasellus*" is to be considered a valid genus then it must include the members of the Cannulus Group of Steeves (1965).

The second portion of the study is concerned with the determination of the generic status of the eastern North American isopods.

From the data presented it is felt that it is inadvisable to elevate species - groups of *Asellus* to the rank of genera.

A generic diagnosis of the genus *Asellus* is presented.

A list of North American species of the genus *Asellus* as well as a key to North American species of *Asellus* is included.

The reduction to synonymy of certain nominal species of the genus *Asellus* is also given.

RESUME

Cet article est le deuzième d'une série de trois, consacrée à la question de l'évolution des Isopodes d'Amérique du Nord, appartenant au genre *Asellus*.

Le statut générique d'*Asellus*, ainsi que la validité des genres proposés récemment par Henry et Magniez (1968), sont discutés.

Au cours de ce travail, des méthodes de comparaisons anatomiques et, lorsque cela était possible, des méthodes statistiques, ont été employées.

La première et la plus courte partie de ce travail montre à l'évidence que, si l'on doit considérer "*Pseudobaicalasellus*" comme un genre valide, on doit inclure dans celui-ci les espèces du groupe Cannulus de Steeves (1965).

La seconde partie traite de la détermination du rang générique des Isopodes de la partie orientale de l'Amérique du Nord.

Des données présentées, on peut penser qu'il est inopportun d'élever les groupes d'espèces du genre *Asellus* au rang de genres.

Une diagnose générique du genre *Asellus* est proposée.

La liste des espèces d'*Asellus* d'Amérique du Nord est établie accompagnée d'une clé de détermination de ces mêmes espèces.

Enfin, la réduction à la synonymie de certaines espèces nominales du genre *Asellus* est donnnée.

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