

MAYFLIES OF THE SIPHLONURUS GROUP.

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The nymphs of two interesting species of mayflies, *Siphonurus* (*Siphurus*) *mirus* Eaton and *Siphonisca ærodromia* Needham, were handed me for description by Mr. C. P. Alexander, who successfully reared them during the summer of 1914 at Northampton, Fulton Co., N. Y. Before describing these nymphs, it seemed desirable to work over the material available in the *Siphonurus* group, and the results of this work are given in the following paper.

THE NAME *Siphonurus*.

The name *Siphonurus* was proposed for a new genus by Eaton in the Ent. Mag., vol. 5, p. 89, 1868. The name was used again by Eaton in the Trans. Ent. Soc., London, 1870, p. 7. But in 1871 in the Trans. Ent. Soc., London, p. 125, the name *Siphurus* is used and *Siphonurus* (err.) Etn., 1868, given as a synonym. The name *Siphonurus* was not preoccupied and therefore according to the International Code of Zoological Nomenclature, the first name used must stand and the name of the genus should be *Siphonurus*.

NEW GENUS.

In 1913 in the Can. Ent., vol. XLV, p. 338, I described a new species which I referred to the genus *Siphonurus*. This species appeared to be nearest to this genus, and as I had no specimens of this genus with which to compare it, I decided to describe it as a *Siphonurus* until other material was available for comparison. Now with such material at hand, I find this species shows characters of sufficient value for the erection of a new genus, and for this I propose the name *Siphloplecton* (defective-feeler, from the defective condition of the labial palpus).

KEYS.

The generic keys which follow are simply those parts of the key published by Dr. Needham, Bull. 86, N. Y. State Mus., referring to the *Siphonurus* group, modified to include the two genera since proposed.

\*Contribution from the Limnological Laboratory of the Department of Entomology in Cornell University.

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## IMAGOS.

- ff. The intercalaries between the first and second anal veins represented by a series of veinlets, often sinuous or forking, extending directly from the first anal to the wing margin (except in *Siphloplecton*); costal angulation of hind wing close to the base ; but two well developed caudal setæ, the median one being rudimentary or wanting; basal joint of hind tarsi evident but not well developed.
- g. Median caudal seta a distinctly segmented rudiment; forceps of male three-jointed; posterior prolongation of sternum of ninth segment of abdomen of female bifid at tip.
- h. Basal segment of fore tarsus of male shortest; claws of each tarsus unlike each to each; hind wing with the costal angulation acute, and the fork of the median vein occupying two-thirds the length of that vein.....*Coloburus*.
- hh. Basal segment of fore tarsus of male longest; claws of each tarsus alike, hind wing with costal angulation obtuse, and the median vein forked through one-third its length ..... *Chirotenetes*
- gg. Median caudal seta more rudimentary or wanting; forceps of the male distinctly four-jointed; sternum of the ninth abdominal segment not prolonged, or if so, entire at tip.
- h. Cubitus 2 with a very pronounced curve at its base ..... *Siphloplecton*.
- hh. Cubitus 2 without such pronounced curve at its base.
- i. Segments 5-9 of abdomen with very broad lateral expansions (onisciform); mid-ventral, meso- and metathoracic spines ..... *Siphlonisca*.
- ii. Segments 5-9 of abdomen without such broad expansions and thorax without ventral spines.

- j. Claws of each tarsus alike; caudal setæ at least one-half longer than body ..... *Siphonurus*.  
 jj. Claws of each tarsus unlike; caudal setæ about as long as the body ..... *Ameletus*.

## NYMPHS.

- e. Postero-lateral angles of the hinder abdominal segments prolonged into thin flat sharp lateral spines.  
 f. Fore legs conspicuously fringed with long hairs; gill-tuft present upon the bases of maxillæ and front coxæ and at bases of lamellæ on abdomen.....*Chirotenetes*  
 ff. Fore legs without conspicuous fringes; no maxillary or coxal gills; no gill-tufts at bases of lamellæ on abdomen.  
 g. Gills double on abdominal segments 1-3; claw of fore tarsus flattened and bifid; terminal segment of labial palpus wanting.....*Siphloplecton*.  
 gg. Gills not double on abdominal segments 1-3; claw of fore tarsus uncinatè; labial palpus normal.  
 h. Abdominal segments with broad lateral expansions; mid-ventral meso- and meta-thoracic spines ..... *Siphlonisca*.  
 hh. Abdomen without such broad lateral expansions and thorax without ventral spines  
 i. Gills double on the first two abdominal segments; end of maxilla fringed with simple hairs.....*Siphonurus*  
 ii. Gill lamellæ all single; end of maxilla fringed with pectinated hooks ..... *Ameletus*

KEY TO THE SPECIES OF *Siphonurus*.

## IMAGOS.

- a. Wings clear, without clouded areas.  
 b. Venter with brown stripes, dots and streaks ..... *S. alternatus*.  
 bb. Venter with U-shaped brown marks.....*S. occidentalis*.  
 bbb. Venter with triangular brown marks.....*S. triangularis*.

- aa. Wings with clouded areas.
- c. Venter with brown markings.
    - d. The hind wing wholly clouded with brown or almost so. Fore wing clear ..... *S. mirus*
    - dd. A small brownish cloud along the axillar fold of fore wing. Hind wing clear ..... *S. typicus*
  - cc. Venter transparent whitish.....*S. femoralis*.

#### NYMPHS.

- a. Setæ dark-banded beyond middle.
  - b. Setæ dark-banded just beyond middle and again across the tips ..... *S. alternatus*.
  - bb. Setæ but once banded.
    - c. Venter with U-shaped dark areas; spines of the 9th abdominal segment just half the length of tergum of 10th segment in the median line ..... *S. occidentalis*.
    - cc. Venter with large dark triangular areas; spines of 9th abdominal segment slightly over half the length of tergum of the 10th segment in the median line ..... *S. triangularis*.
- aa. Setæ unbanded ..... *S. mirus*

#### **Siphonurus alternatus** Say.

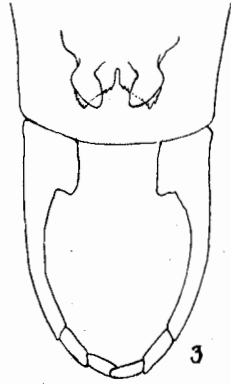
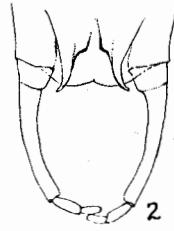
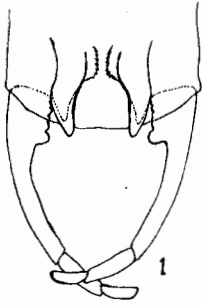
For description of adult see Eaton's Revisional Monograph, p 219, and of nymph, Bull. 47, N. Y. State Mus., 1901.

The nymph shows the same ventral abdominal markings as the adult. See Pl. IX, fig. 8.

#### **Siphonurus occidentalis** Eaton.

The nymphs and adults of this species were taken by Professor T. D. A. Cockerell at Florissant, Colorado, June 30, 1907, at a place where subimagos were emerging in numbers. Other specimens were taken by Prof. Cockerell at Twin Lakes, Col., Upper Lake, July 14, 1902. See Pl. IX, fig. 9.

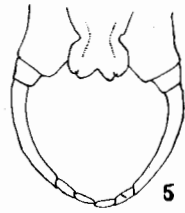
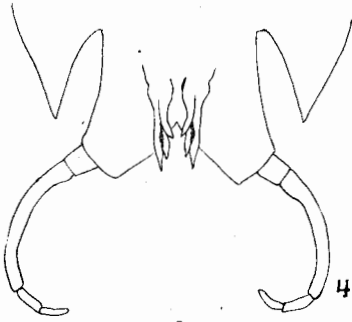
*Nymph.*—Length 13 mm.; leg 4.5 mm.; setæ 5 mm.



*Siphonurus*

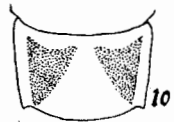
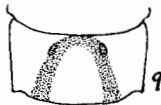
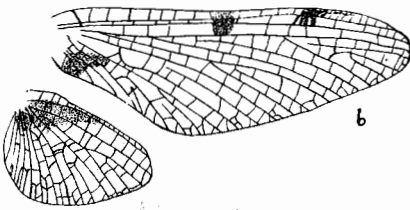
*sp.*

*S. attenuatus*



*Siphonurus*

*sp. flavus*



*S. aff.*

*Siphonurus*

*Siphonurus*

Structurally the nymph is very similar to that of *S. alternatus* except that the lateral abdominal spines are shorter. The setæ are but once banded and there is a very pronounced brownish band at the apical end of each tarsus.

The nymphs show the same U-shaped ventral abdominal brown markings as the adults.

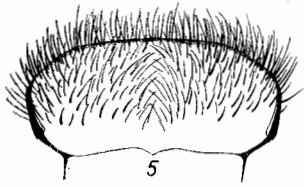
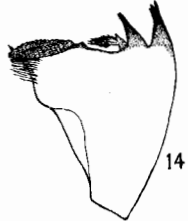
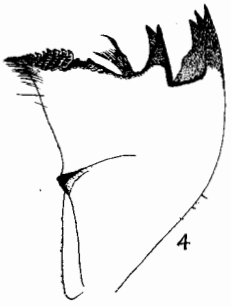
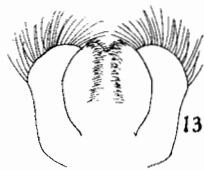
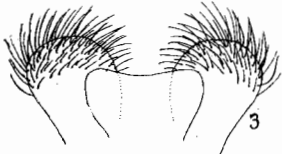
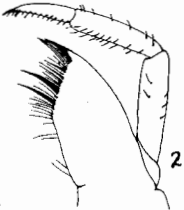
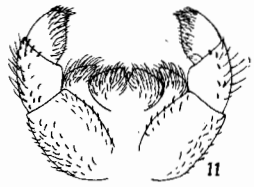
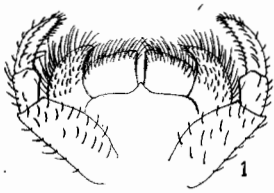
***Siphonurus triangularis* sp. nov.**

*Male subimago*.—Length 12-13 mm. Head mostly deep brown, varied with whitish and yellowish irregular markings. Lower part of face transparent whitish. Thorax above deep brown; sides and ventral surface brown with white areas. Legs uniform light brown, but with darker markings on coxæ and trochanters at joints. Wings rather dull with light brown venation and without clouded areas. Dorsal surface of abdomen deep brown with a pair of lateral light areas on segments 2-7. Ventral surface of abdomen light brown with deep brown triangular areas, See Pl. IX., fig. 10. Lateral setæ 11-12 mm. long, the middle one rudimentary, showing 4-5 segments.

*Female subimago*.—Length 14-15 mm. Similar to male in coloration.

*Female imago*.—Length 15 mm; setæ 15 mm.; fore leg 8 mm. Middle and hind legs 6.5 mm. Very similar in coloration to the male subimago, but lighter and ventral markings of abdomen more pronounced. Wings clear, light brown venation, no clouded areas.

*Nymph*.—Length (mature) 12-15 mm.; setæ 5-6 mm.; leg 5 mm. General colour brown and white. Mouth-parts, see Pl. X, fig. 11-15. Thorax darker on upper surface. Legs whitish, banded with brown as follows: Femur with a basal brown band and another on apical fifth; tibia with a basal band, tarsus with basal and apical bands. Legs covered with numerous small spines and hairs; claws long, slightly curved and very pointed. Each segment of abdomen dorsally, except 1 and 10, usually light coloured in middle with brown band across basal margin from which project caudad two brown streaks. Each segment brownish toward the lateral margins, but with light areas in both anterior and posterior margins. A pair of very dark dots at posterior margin of each



*S. a...* MAYFLIES OF THE SIPHLONURUS GROUP. *S. flavipes* *S. triangularis*

segment. Segments of abdomen ventrally whitish with two somewhat triangular-shaped brown areas on each segment as in case of adult. The gills are of the typical *Siphonurus* type. See Pl. X, fig. 11-15. Setæ once banded beyond middle.

This species is rather larger than *S. alternatus*. It was found emerging at Ithaca from June 5 to the 18th from a quiet spring-fed pond. This pond was very much grown up with aquatic vegetation, especially *Spirogyra*, and many of the nymphs were covered with colonial *Vorticellæ*.

*Transformation.*—The pond was about 40 ft. by 15 ft. with a maximum depth of about 2 ft., but the greater part of it only 6 in. or so. The water was very clear, so that the bottom could be seen in many places through the vegetation. The nymphs could be seen clambering about the water plants, swimming swiftly from place to place by means of the very efficient tail fin and gill lamellæ, or quietly clinging to some object, while the gills moved in gently undulating movements and the abdomen swayed up and down. Most of the nymphs were mature, and subimagos were continually flying up from the pond. One mature nymph swam about with its head up to the surface of the water as though looking for a suitable place for emergence, going from plants, to dead leaves and to twigs. It tried to climb upon a small twig, endeavouring to hang on with its legs and bending its abdomen and setæ around in its attempts to get up on top. It was almost successful, but suddenly abandoned the twig for a dead leaf. The leaf was only partly submerged and the nymph climbed up over the edge and up on top until only the abdomen was left in the water. Thus it remained quietly for two minutes with its gills in constant motion. It then crawled farther up the leaf until entirely out of the water, and remained quietly for about 3 minutes, when the body, especially the abdomen began to move convulsively, and in a couple of seconds the thorax split and the body of the subimago gently slid out over the surface of the leaf. When the legs were freed they were extended and at the same time the wings. Then the subimago took a few steps, leaving only the setæ still in the nymph slough.

It remained on the leaf for about four minutes, moving its legs and wings occasionally, and finally twisted and bent the abdomen



upward and freed the setæ. For six minutes more it stayed in the sunlight on the leaf, apparently getting accustomed to the new world into which it had emerged. Then it took flight, flying upward about thirty feet and coming to rest on a leaf of a tree near the pond. In the meantime three other nymphs emerged within two feet of the first one. One emerged on the side of an almost vertical leaf so that the subimago slid out partly on to the surface of the water and it had considerable difficulty freeing itself, but finally it succeeded and remained clinging to the leaf with its abdomen resting on the water for about six minutes. Its upward flight was accomplished without any difficulty. Another nymph crawled up a blade of grass at the edge of the pond. It took a little longer for this subimago to get out of the old nymph skin. There was a great abundance of life in the pond. Just a few sweeps of a small dipnet brought out salamanders, beetles, beetle larvæ, chironomid, mosquito, crane-fly, and other dipterous larvæ, dragon-fly, and damsel-fly nymphs, and mayfly nymphs of the following genera: *Heptagenia*, *Ephemerella*, *Leptophlebia* and *Cloeon*.

No imagos were observed in flight and repeated trips to the vicinity of the pond for a week and at various times of the day from ten o'clock in the morning to nightfall, failed to find any imagos flying.

### **Siphonurus mirus** Eaton.

*Male imago*.—Length 12-14 mm.; setæ 18 mm.; fore leg 12-14 mm. Wing 12-13 mm. Head and thorax dark brown; a few lighter areas on sides of thorax. Legs uniform brown, a little darker at joints. Hind wing of male usually entirely brown as compared with the hind wing of the female, which is only about two-thirds brown. Each segment of the abdomen 2-9, dorsally light in colour with dark areas toward the lateral margin, along posterior margin and two streaks extending forward from posterior margin. Ventral surface with two lateral longitudinal bands on each segment and a darker area in middle. Genitalia, see Pl. IX, fig. 2.

*Female imago*.—See description, Eaton, p. 221.

*Nymph*.—Length 15 mm.; setæ 6-7 mm.; legs 5-6 mm. General colour brown. Head has a light area in front of the middle ocellus

and a very dark band from margin of this area to eye below antenna. Clypeus and labrum deep brown. Mouth-parts similar to those of *S. triangularis*. Thorax with light areas on ventral surface and sides. Legs light brown, unbanded but apical areas of tarsi darker. Dorsal surface of abdomen brown with a pair of blackish streaks about the middle of each segment, a blackish area lateral to each streak and a pair of black dots at the posterior margin of each segment. Ventral surface of the same general colour as dorsal surface with darker markings similarly arranged to those of adult. Setæ unbanded.

The following notes were given me by Mr. Alexander:

"Sport Island, Sacandaga River. Adults of *Siphonurus mirus* Eaton, appeared on June 6, 1909, and were very common on the 12th. Seven specimens were taken home alive and three lived 51 hours."

See also under *Siphonisca*.

Nymphs of *Siphonurus femoratus* Say, *S. bicolor* Walker, and *S. typicus* Eaton have not been taken as yet, and adults of these species I have not had the opportunity of examining.

### **Siphonisca** Needham.

With more material at hand, including the nymph, the generic characters may be restated as follows:

Caudal setæ two, slightly longer than the body. Claws on all the legs (male and female) hooked and clawlike, and the two of each leg alike. Hind tibia longer than its tarsus, and last segment of tarsus longest. Female fore tibia about same length as its tarsus, last segment of tarsus the longest. Male fore tarsus about 3 times the length of its tibia, the last segment of the tarsus the shortest. Median and cubital veins in the fore wing symmetrically forked. No humeral angulation of hind wing. Mesothorax and metathorax each with a prominent midventral spine. Abdomen with conspicuous lateral expansions of the middle segments. No backward prolongation of 9th abdominal segment in female. Forceps base of male very broad; forceps 4-jointed and strongly divaricate.

The nymph has conspicuous lateral expansions to the segments of the abdomen and has prominent mid-ventral meso- and metathoracic spines. Gills on segments 1-7 and all single. The terminal segments of the labial and maxillary palpi pointed and the lateral lobes of the hypopharynx rounded.

### **Siphonisca aerodromia** Needham.

The description given in Bull. 134 N. Y. State Mus. errs in two minor points, namely, the claws of the fore leg of the female are normal, i.e., similar to those on the other legs, and there is a metathoracic mid-ventral spine as well as a mesothoracic one.

*Nymph.*—Length 19-20 mm.; setæ 8-9 mm.; legs 4.5 mm. General colour a dark brown. Antennæ longer than head, light in colour, but terminal joint tipped with dark brown. Mouth-parts, see Pl. IX, fig. 1-5. Thorax darker above. Prominent mid-ventral meso- and metathoracic spines. Legs comparatively short and stout. Tarsi and tibiæ of about equal length. Abdomen dark brown dorsally, tending to be darker along median line and along a line just inside the line of gills. Segments 5-9 greatly expanded laterally and each expansion produced backward into a spine. Two longitudinal lateral dark brown lines on ventral surface. Gills on segments 1-7 and all single, see Pl. IX, fig. 1-5. Three setæ, the middle one very slightly shorter than the outer ones, which are fringed on the inner sides only. Setæ brown, but with white tips.

*Ecological Notes.*—The following are Mr. Alexander's notes in regard to this species:

"The type specimen, a female, was taken on June 6, 1908, on rank vegetation at the south end of Sport Island in the Sacandaga River. Careful search on that day failed to locate other specimens."

"On June 6, 1909, at 5.20 p.m., there were scores of specimens flying over the bridge, several of these were in copulation and a large series of both sexes were taken. As it grew dark, the insects mounted higher in the air. At dusk the species could be distinguished high up in the air by the remarkable breadth of the abdomen. It is probable that the type taken in 1908 was the last

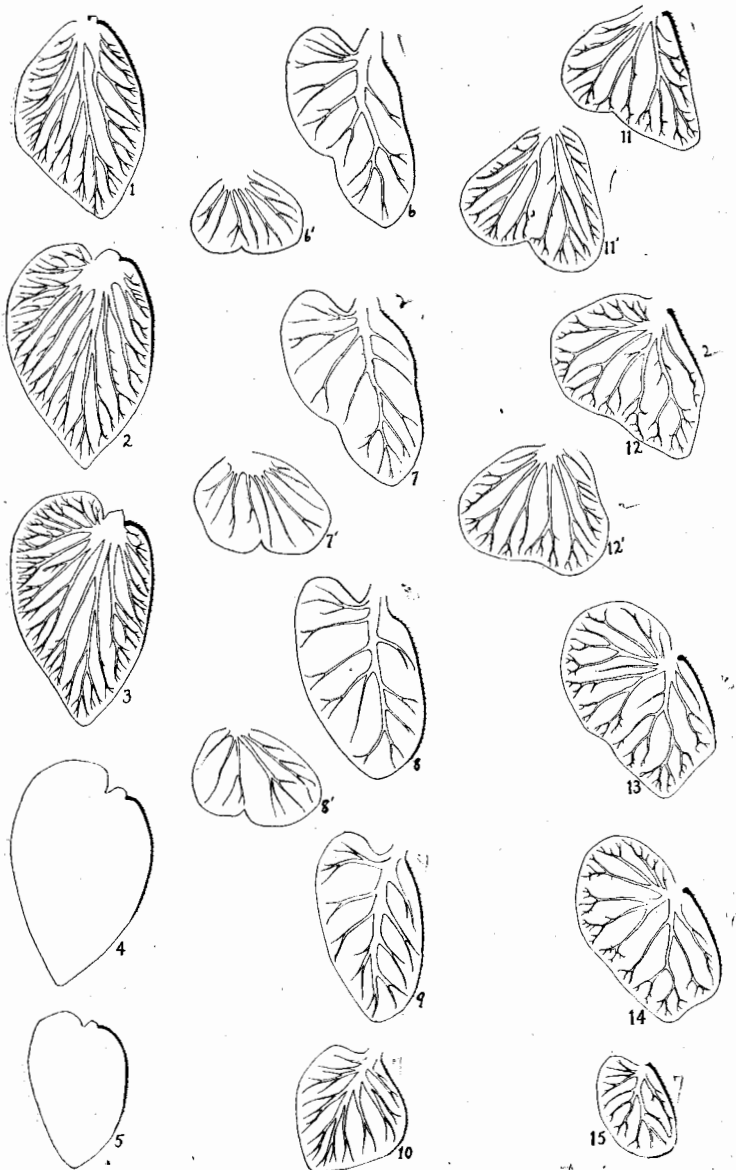
of that season's brood and the main emergence of the year took place in late May. This probably shows that the males die first, the females surviving longer in order to complete oviposition."

"The following field notes were made at Northampton (Fish-house) in Fulton County, New York State, from May 25 to 29, 1914, where adults were reared from nymphs taken in small temporary pools left by the vernal overflow of the Sacandaga River:"

"*Siphonisca* was first noted as a subimago in a tent-trap set on May 25th. The contents of the trap were examined on the following day and the catch included a subimago of *S. ærodromia*. After determining the habitat of the nymph, it was a simple matter to obtain the later stages. The nymphs crawl up the rush stems in order to emerge, usually leaving the cast skins three to four inches above the water level. Occasionally the cast skins are found on the upper surface of flat leaves."

"The nymphs of *Batisca obesa*, *Siphylurus mirus*, and *Siphonisca ærodromia* occurred together in company with a great abundance of other mayfly nymphs of smaller and less conspicuous habit. The pools evaporated rapidly, and on May 27th, only two days after the first observations were made, had dwindled to one-half of their former size. The water became very warm and tepid towards midday, and this was more apparent each day as the amount of water decreased and the abundant animal life became more concentrated."

"Nymphs of the various mayflies were isolated and reared through to the imago. The most abundant species in the pools, with the exception of some of the smaller and less conspicuous species, was *Batisca obesa*. In an area of a few square yards, there were hundreds of cast skins of the species adhering to the rush stems long after the subimagoes had flown away. The cast skins of *Siphonisca* were almost as common, on some of the rush stems there being as many as four of the cast skins on a single stalk, arranged end to end and crowding one another. *Batisca* was found to emerge at midday or slightly after, specimens being observed at 2 p.m. *Siphonisca* came out at all hours of the day, but more abundantly in the late forenoon."



*S. angustatus*      *S. flexus*      *S. triangularis*  
 MAYFLIES OF THE SIPHLONURUS GROUP.

"By May 28th, the water in the temporary pools was entirely evaporated, but the larger mayfly nymphs had matured so rapidly or were timed so opportunely that not a single nymph was left. An immense number of the nymphs of smaller species and the plankton (a large red ostracod in great abundance; *Daphnia* and a great number of other Entomostraca; Planarians of two species, one being a small light green form; Mollusca, (*Aplexa hypnorum*, *Segmentina*, *Pisidium* sp.; etc.) of the pools were exposed and perished. The stench of their decaying bodies attracted many carrion-loving insects such as *Lucilia*, *Silpha inaequalis*, etc."

**Siphloplecton** gen. nov.

Caudal setæ tw9, middle one rudimentary. Fore tarsus of male with 2nd segment about equal to 1st, the 3rd slightly longer than 1st, the 4th slightly shorter than 1st, the 5th about half the length of 1st. Female fore tarsi 1, 2 (3 and 5) equal, 4. Hind tarsi of both male and female in order of decreasing lengths 1, (2 and 5) equal, 3, 4. Hind tibia shorter than its tarsus. Claws of each tarsus unlike. Wing without dependent intercalaries from the 1st anal, and cubitus 2 strongly curved at base. Penes lobes rounded with slight indentations. Sternum of ninth abdominal segment of female produced slightly and entire at tip.

Nymph with hind claws hooked and claw-like, but fore claws flattened and bifid. Labial palpus with but two segments. Gills double on segments 1, 2, and 3.

*Type species*—*Siphilurus flexus* Clemens (Can. Ent., 1913, vol. XLV, p. 338), Go Home Bay, Georgian Bay, Ont.

Besides the Georgian Bay material I have seen specimens from Douglas Lake, Michigan, Nov. 25, 1904, from Walnut Lake, Mich., April 12, 1906, and from the Michigan Agricultural College campus, East Lansing, Mich., July 15, 1910.

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#### EXPLANATION OF PLATES.

##### PLATE IX.

Fig. 1.—Genitalia male *Siphonurus occidentalis*.

Fig. 2.—Genitalia male *Siphonurus mirus*.

- Fig. 3.—Genitalia male *Siphonurus alternatus*.  
 Fig. 4.—Genitalia male *Siphonisca ærodromia*.  
 Fig. 5.—Genitalia male *Siphloplecton flexus*.  
 Fig. 6.—Wings *Siphloplecton flexus*.  
 Fig. 7.—Claws fore leg female *Siphonisca ærodromia*.  
 Fig. 8.—Ventral colour-pattern on segment of abdomen of *S. alternatus*.  
 Fig. 9.—Ventral colour-pattern on segment of abdomen of *S. occidentalis*.  
 Fig. 10.—Ventral colour-pattern on segment of abdomen of *S. triangularis*.

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PLATE X—Mouth-parts.

- Fig. 1-5.—Labrum, maxilla, hypopharynx, mandible and labrum, respectively, of nymph of *Siphonisca ærodromia*.  
 Fig. 6-10.—Labrum, maxilla, hypopharynx, mandible and labrum, respectively, of *Siphloplecton flexus*.  
 Fig. 11-15.—Labrum, maxilla, hypopharynx, mandible and labrum, respectively, of *Siphonurus triangularis*.

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PLATE XI.—Gills.

- Fig. 1-5.—Gills from Segments 1, 2, 3, 4 and 7, respectively, of right side of nymph of *Siphonurus ærodromia*.  
 Fig. 6-10.—Gills from Segments 1, 2, 3, 4 and 7, respectively, of right side of nymph of *Siphloplecton flexus*.  
 Fig. 11-15.—Gills from Segments 1, 2, 3, 4 and 7, respectively, of right side of nymph of *Siphonurus triangularis*.