

LICE AFFECTING THE DOMESTIC FOWL.

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LICE AFFECTING THE DOMESTIC FOWL.

BY A. W. BAKER, GUELPH, ONT.

The lice affecting the Domestic Fowl are members of the order Mallophaga and are commonly called Biting or Bird Lice to distinguish them from the sucking lice of mammals. The name "Biting Lice" is applied because of the fact that the mouth-parts of the insects are fitted for biting. The food consists of bits of feathers and epidermal scales—the lice never feeding on the blood of the host save possibly where it may have dried around wounds. The injury to chickens arises from the irritation produced by the constant feeding and probably also to a considerable extent by the sharp claws.

The loss occasioned to poultry keepers through the attacks of lice is of course difficult of estimation, but it is certain that it is much greater than is usually supposed to be the case. The injury to chicks is especially great, proper growth being prevented through the restless activity of the bird. It is even quite possible that much of the mortality of small chicks is due directly to the attacks of lice. More mature birds are also prevented from making proper growth and egg-laying is doubtless checked to a considerable extent by the weakened and restless condition of the birds. Where setting hens are used there are often losses in hatching as a result of the abnormal activity of the bird. In addition to these direct losses birds as a result of their weakened condition are more susceptible to the various diseases to which poultry are at all times a prey.

One point which makes the biting lice of great importance as ectoparasites is that the whole life of the insect is passed on the body of the host. The female attaches her eggs to the feathers of the bird and each young louse escapes by pushing off a cap-like structure at the free end of the egg. The rest of the life of the

louse is then spent on the body of this bird with the exception of course that migration may take place from bird to bird during contact on the perches or in nesting boxes.

Control Measures.

1.—*Lice Powders.*

There are many different lice powders on the market. Many are costly and some are not extremely effective. One of the most successful powders is that known as the "Lawry Lice Powder." This is not a proprietary powder and can be prepared cheaply by the poultry man. It will give extremely satisfactory results. This powder is made by adding to 3 parts of gasoline and 1 part of crude carbolic acid 90-95% enough plaster of paris to take up all the liquid. The plaster should be stirred in gradually so that a dry pinkish powder results.

This powder should be worked into the feathers of the bird especially on the more heavily infested parts of the body, that is in the region of the vent, wings and under side of the body. It must be borne in mind that this powder will not kill the eggs or "nits" of the lice, and it will accordingly be necessary to give another dusting and in severe cases even a third at intervals of 5-7 days, to kill those young lice which have hatched since the last dusting.

There are several grades of crude carbolic acid on the market. That of 90-95% must be used in the powder to obtain satisfactory results. The Poultry Department of the Maine Agricultural Experiment Station state that they have used cresol in place of the crude carbolic acid with good results where the carbolic could not be obtained.

2.—*Blue Ointment.*

Prof. W. R. Graham, of the Ontario Agricultural College, states that he has used Blue Ointment with success where setting hens are heavily infested with lice. The ointment is worked into the feathers of the bird by hand, but it must be used *sparingly and very carefully.*

3.—*Dust Baths.*

Baths containing a mixture of road dust and tobacco dust may be kept in the poultry house or in the run. Birds will make

free use of these baths and the chances of infestation will be to a great extent reduced.

It will be found advisable also where brood hens are used to set them on tobacco stems which may be obtained cheaply from any cigar factory. The possibilities of infestation of the chicks will thus be greatly reduced.

4.—*Carbolized Sweet Oil.*

Dusting young chicks will be found to be a difficult practice. Where head lice are very bad on young chicks it may be found necessary, however, to treat them. In this case a little carbolized Sweet Oil may be rubbed into the infested regions. The oil, however, must be used *only in extreme cases and then very sparingly*, as its use in any quantity may endanger the life of the chick.

A much surer method is to protect young birds from infestation by thoroughly treating all old birds with which they may come in contact.

5.—*Disinfection of Houses.*

If incubator and brooder-raised chicks are kept free from contact with old birds during their development, and are then placed in houses which have been thoroughly cleansed and disinfected, the danger of infestation is reduced to a minimum. Under these conditions any old birds which must be introduced into the house should, of course, be given two or three thorough dustings before they are allowed to run with the young birds.

Before the introduction of the young pullets the whole house, nests, perches, walls and floor should be thoroughly scraped and scrubbed and then well painted or sprayed with a mixture of 3 parts of Kerosene and 1 part of Crude Carbolic Acid 95%. This ensures absolutely lice-free surroundings for the young birds and also checks to a great extent, if it does not entirely eradicate, an infestation of red mites if such be present.

Following are the species of lice which are known to infest the Domestic Fowl in Canada with brief descriptions to aid in their identification.

The Common Hen Louse (*Menopon pallidum* N.).

This louse is about .04 to .06 inches in length. The body is compact, the head is long and the legs short. The abdomen

tapers strongly and regularly to the posterior end and is beset with numerous bristles. The whole body is a light straw colour.

This is in Canada as elsewhere the most common species affecting the Domestic Fowl. It can be readily recognized by its light yellow colour and extreme activity on the birds. It has been recorded in America also from the pigeon and is said by some to attack horses if such are in close proximity to lousy birds. The writer has never seen horses so attacked.

Menopon biseriatum Piaget.

This species is about .08 to .09 inches in length. The female has the body elongate and loosely jointed, the head short and the legs long. The abdomen tapers abruptly but slightly at the posterior end, and the posterior margin of the last segment bears a close series of fine hairs. The general body colour is yellowish brown. The male is shorter and stouter than the female and lacks the series of hairs on the posterior margin of the last segment. This species occurs commonly and often abundantly in company with *M. pallidum*. It can readily be distinguished from the latter by its larger size and less compact form. It has been recorded in America also from the turkey and pigeon, and is said to attack the pea fowl.

The Variable Chicken Louse (*Lipeurus variabilis* N.).

The length of this species is about .09 to .095 inches. The body of the female is elongate and slender. The head is broadly rounded in front and the antennæ are slender with the first joint short. The legs are long and the abdomen tapers weakly from the sixth segment. The colour is whitish, the margins of the body and front margins of the legs being pitchy black. The abdominal segments each bear a large squarish median brown patch. The male is more slender than the female and the first joint of the antenna is very large, and bears a peg-like appendage as does also the third segment.

This species is quite common and can usually be found on any heavily infested flock.

The Lesser Chicken Louse (*Goniocotes hologaster* N.).

The length of this species is about .035 to .06 inches. The body of the female is very broad. The head is squared behind, the legs short and the abdomen regularly rounded behind. The colour is light yellowish brown. The abdomen of the male is much shorter and broader and squared behind.

This species is not common in Canada, though I have specimens taken at Guelph at various times. It has been recorded in the United States and I have received specimens from Prof. Haseman taken at Columbia, Mo.

EXPLANATION OF PLATE VIII.

1. *Goniocotes hologaster* N. ♂.
2. *Goniocotes hologaster* N. ♀.
3. *Menopon biserialum* Piaget.
4. Egg of a Bird Louse.
5. *Menopon pallidum* N.
6. *Lipeurus variabilis* N. ♀.
7. *Lipeurus variabilis* N. ♂.

A NEW HOPLANDROTHRIPS (THYSANOPTERA) FROM BRITISH GUIANA.

BY J. DOUGLAS HOOD, U. S. BIOLOGICAL SURVEY.

The new species described below was received for determination from Mr. G. E. Bodkin, Government Economic Biologist of British Guiana.

Hoplandrothrips affinis, sp. nov.

Female (macropterous).—Length about 1.8 mm. Colour dark blackish brown with bright crimson hypodermal pigmentation; tarsi, fore tibiæ, and bases of antennal segments 3-6 lemon yellow; distal ends of mid and hind tibiæ and of tube paler; wings slightly

August, 1915

yellowish, with scale of fore wings and a short subbasal streak in hind wings, brown.

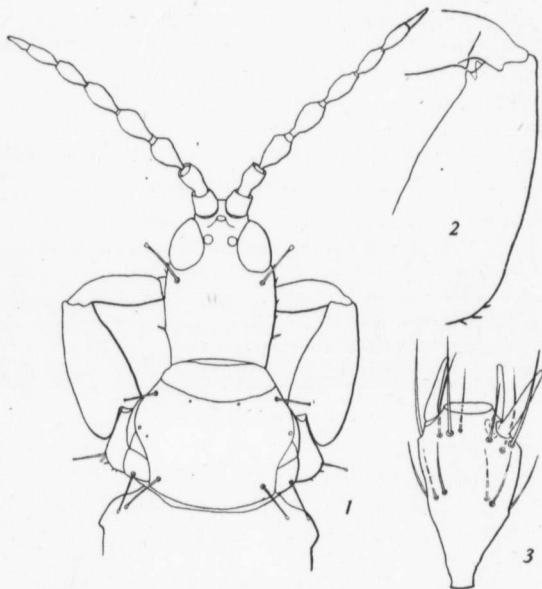


Fig. 26.—*Hoplandothrips affinis* Hood—1. Head and prothorax of female; holotype. 2. Right fore leg of male; Allotyp. 3. Third segment of right antenna of female; holotype.

Head a little less than one and one-half times as long as wide and 1.5 times as long as prothorax, broadest at middle; cheeks rounded gently to eyes and to near base, thence nearly parallel, forming a neck which is narrower than greatest distance across eyes or about 0.86 the greatest width of head, set with a few small spines arising from slight tubercles, a pair at posterior sixth stronger; dorsal surface smooth and shining except at extreme base, which with the lateral surfaces is weakly subreticulate; vertex slightly and narrowly subconically produced, the anterior ocellus only

slightly overhanging; postocular bristles alone prominent, equal in length to eyes expanded at apex. Eyes $\frac{1}{3}$ as long as head, equal in width to their interval. Ocelli of posterior pair opposite middle of eyes and equal in size to anterior ocellus, which is slightly more distant. Antennae about 1.6 times as long as head, moderately slender; segment 1 as broad as long; 2 about 1.7 times as long as wide, inner side straight, pedicel not curved outward; 4 very slightly longer and narrower than 3, clavate, pedicellate, narrowed at apex, broadest in advance of middle, about 1.8 times as long as wide; 5 almost similar in form to, but distinctly narrower and slightly shorter than, 4; about 2.1 times as long as wide; 6 clavate, more briefly pedicellate than 4 and 5, nearly 2.4 times as long as wide; 7 oblong, briefly pedicellate, truncate at apex and nearly 2.5 times as long as wide; 8 about three-fourths as long as 7, conical, more than three times as long as greatest width; segments 1 and 2 concolorous with head, 2 paler at middle of apex; 3 yellow, lightly infusate in apical half; 4 yellow in basal two-fifths, brown beyond, slightly paler at apex; 5 yellow in basal third, brown beyond, slightly paler at apex; 6 yellow in basal fourth, beyond blackish brown, darker than 5; 7 and 8 blackish brown, pedicel of former paler; sense cones: 3, 1-2; 4, 2-2; 5, 1-1⁺; 6, 1-1⁺; 7 with one on dorsum near apex. Mouth cone short, broadly rounded, reaching only about half way across prosternum, labrum scarcely surpassing labium.

Prothorax about two-thirds as long as head and (inclusive of coxae) about twice as wide as long; pronotum smooth; all usual bristles present, expanded apically, a little shorter than the postoculars. Wings slightly narrowed at middle; fore pair with scale brown, light yellowish beyond, six accessory hairs on posterior margin. Legs moderately slender; fore tarsus with a strong, slightly curved tooth.

Abdomen very slightly broader than pterothorax. Tube 0.6 as long as head, only about twice as long as greatest subbasal width, which is about 2.1 times the apical, sides straight. Lateral bristles expanded at apex, almost colourless; segment 9 with the

three long, pointed pairs; terminal bristles brown, about one and one-half times as long as tube.

Measurements of holotype: Length 1.76 mm.; head, length 0.274 mm., width 0.192 mm.; prothorax, length 0.180 mm., width (inclusive of coxæ) 0.366 mm.; pterothorax, width 0.372 mm.; abdomen, width 0.378 mm.; tube, length 0.168 mm.; width at base 0.081 mm., at apex, 0.038 mm.

Antennal segments.....	1	2	3	4	5	6	7	8
Length (μ).....	42	35	66	69	64	59	54	42
Width (μ).....	42	33	39	38	30	25	22	13
Total length of antenna, 0.431 mm.								

Male (macropterous).—Length about 1.6 mm. Colour and structure essentially as in female. Genal spines a little stouter than in female. Antennæ 1.7 times as long as head, more slender. Tarsal tooth large, stout, curved. Abdomen slightly narrower than pterothorax. Tube about 0.54 as long as head, about twice as long as greatest subbasal width, which is about twice the apical, sides slightly concave. Segment 9 of abdomen with the lower lateral and the dorsal bristles longer than tube and pointed, the upper laterals very short (three-fifths as long as basal width of tube) stout, pointed, and dark in colour.

Measurements of allotype: Length 1.56 mm.; head, length 0.246 mm., width 0.168 mm.; prothorax, length 0.157 mm., width (inclusive of coxæ) 0.318 mm.; pterothorax, width 0.322 mm.; abdomen, width 0.284 mm.; tube, length 0.132 mm., width at base 0.068 mm., at apex 0.033 mm.

Antennal segments.....	1	2	3	4	5	6	7	8
Length (μ).....	38	51	63	65	62	54	47	38
Width (μ).....	38	30	36	34	27	23	20	11
Total length of antenna, 0.418 mm.								

Described from one female and one male taken between leaf sheaths of sugar cane, at Rose Hall, Berbice, British Guiana, March 2, 1915, by G. E. Bodkin.

The only species of the genus recorded from South America.

MAYFLIES OF THE SIPHLONURUS GROUP.

BY WILBERT A. CLEMENS, ITHACA, N. Y.*

The nymphs of two interesting species of mayflies, *Siphonurus* (*Siphurus*) *mirus* Eaton and *Siphonisca aërostromia* 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.

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 *Siphonisca*.
- 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 *Siphonisca*.
- 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. femoratus*.

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.

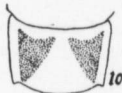
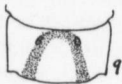
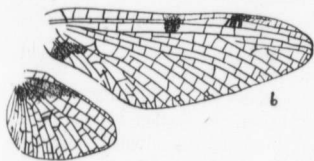
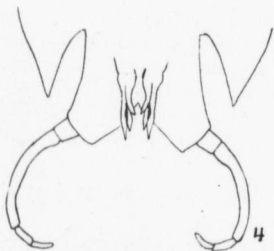
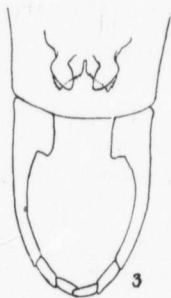
For description of adult see Eaton's Revisional Monograph, p 219, and of nymph, Bull. 47, N. Y. State Mus., 1901.

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.



MAYFLIES OF THE SIPHLONURUS GROUP.

Structurally the nymph is very similar to that of *S. alternatus* except that the lateral abdominal spines are shorter. The setae 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.

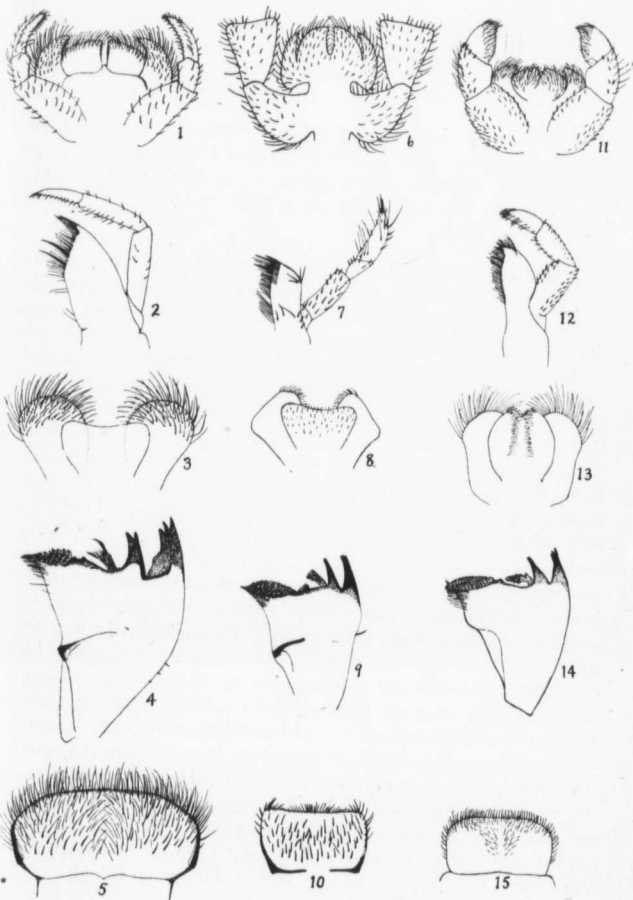
Siphonurus triangularis sp. nov.

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 coxae 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 setae 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; setae 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.; setae 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



MAYFLIES OF THE SIPHLONURUS GROUP.

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. Setae 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 setae 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

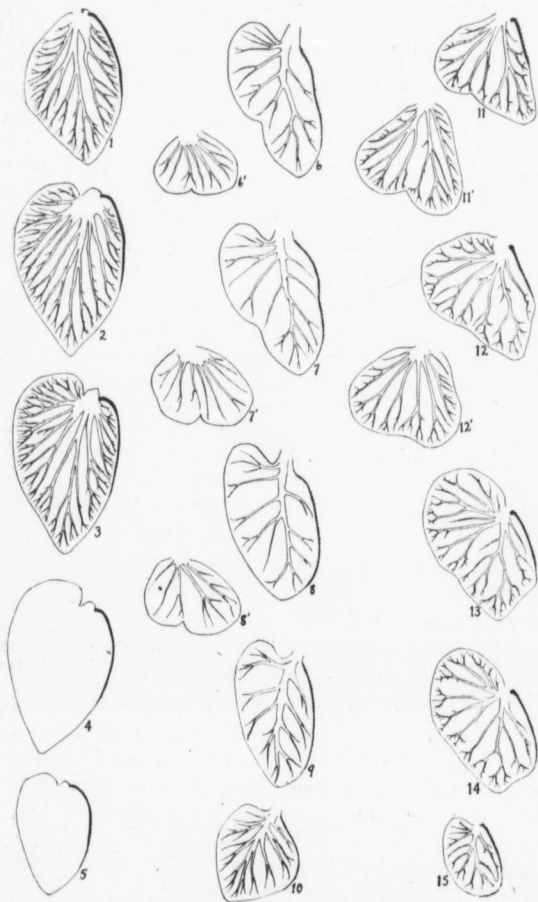
of that season's brood and the main emergence of the year took place in late May. This probably shows that the males die first, the females surviving longer in order to complete oviposition."

"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."



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 two, 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 culitus 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—*Siphylurus 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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- 1911—Morgan, Anna H.: Mayflies of Fall Creek. Ann. Ent. Soc. Amer. IV, p. 116.
- 1913—Morgan, Anna H.: A Contribution to the Biology of Mayflies. Ann. Ent. Soc. Amer. VI, p. 371.
- 1913—Clemens, W. A.: New Species and life histories of Mayflies. Canad. Entomol. XLV, p. 338.

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*.

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*.

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*.

A CONTRIBUTION TOWARDS THE TAXONOMY OF THE
DELPHACIDÆ.

BY F. MUIR,

Hawaiian Sugar Planters' Experiment Station, Honolulu, T. H.

(Continued from Page 212.)

LIST OF GENERA.

1. *Achorotile* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *albosignata* (Dahlbom), Pl. VIII, f. 16.
2. *Aloha* Kirkaldy, 1904, Entom., XXXVII, 177; type *ipomoeæ* Kirk.; 1908, P. Haw. Ent. Soc., I, Pl. IV, f. 9.
3. *Amblycotis* Stal, 1853, Ofv. Vet. Ak. Forh., 265; type *laticeps* Stal.
4. *Anectopia* Kirkaldy, 1907, H. S. P. A. Ent. Bull., 11, 143; type *mandane* Kirk., Pl. XI, f. 11-13, Pl. XIV, 4-6.
Araopus Spinola, 1839, Rev. Zool.; type *crassicornis* (Fabricius) Syn. *Delphax*.
5. *Arcofacies* Muir, gen. nov.
6. *Asiraca* Latreille, 1801, Hist. Nat. Crust. Ins., 111, 259; type *clavicornis* (Fabricius).
Atropis Kirschbaum, 1868, Cicad. Wies. u. Frank., 10; type *latifrons* Kirsch—*lævifrons* Shlb. Syn. *Metropis* Fieb.
7. *Bakerella* Crawford, 1914, Pro. U. S. Nat. Mus., XLVI, 601; Pl. XLVII, f. D.
Bambusaria Melichar, 1914, Phil. J. Sci., IX, 3, D. 274; Pl. I, f. 6, a-b.; type *picta* Mel.—Syn. *Sogatopsis pratti* Muir.
8. *Bambusibatus* Muir, gen. nov.
9. *Belocera* Muir, 1913, Pro. Haw. Ent. Soc., II, 5, 239; type *sinensis* Muir., Pl. VI, f. 4, a.
Bergia Scott, 1881, E. M. M., XVIII, 155; type *nimbata* (Berg.) n. preoc. Syn. *Bergias*.
10. *Bergias* Kirkaldy, 1904, Entom., XXXVII, 279; nom. nov. for *Bergia*.
Bidis Walker, 1856, J. Lin. Soc. Lond., Zool., I, 88; type *notivena* Walker, Pl. IV, f. 2. Syn. *Ugyops*.
11. *Bostæra* Ball, 1902, Can. Ent., XXXIV, 266; type *nasuta* Ball. Syn. *Cochise*.
12. *Calligypona* J. Sahlberg, 1871, Not. Sallsk. Faun. Fenn., XII, 408; type *albicollis* Sahlb.

13. *Canyra* Stal, 1862, Svensk. Vet. Ak. Hand., 3, No. 6, p. 7; type *placida* (Stal).
14. *Chloriona* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *unicolor* (H-S); Pl. VIII, f. 5.
15. *Chlorionidea* Low, 1885, Verh. Zool. Bot. Ges. Wien, XXXV, 356; type *flava* Low; Melichar, 1896, Cic. Mitt. Eur., Pl. IV, f. 23-25.
Cochise Kirkaldy, 1907, H. S. P. A. Ent. Bull. IV, 63; type *apacheanus* Kirk; Muir, 1913, P. Haw. Ent. Soc., II, 5; Pl. VI, f. 3, a. Syn. *Bostera* Ball.
Cona White, 1879, E. M. M., XV, 218; type *celata* White, n. pr. Syn. *Micromasoria*
Conicoda Matsumura, 1900, Ent. Nachr., XXVI, 258; type *graminae* Mats.—*brunnipennis* Sign. Syn. *Tropidocephala* (or a subgenus).
16. *Conomelus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *limbata* (Fabricius), Pl. VIII, f. 10.
17. *Copicerus* Swartz, 1802, Kon. Vet. Nya. Hand, XXIII, 181; type *irroratus* Swartz; Pl. VI, f. 2, a-f; also Fowler, B. C. Amer., Hem.-Hom., I, Pl. XIII, f. I, a, 2, a, Syn. *Holotus* Guerin.; *Jerala* Walker.
18. *Criomorpus* Curtis, 1833, Ent. Mag., I, 195; type *albomarginatus*. Curtis; Syn. *Ditropis* Kirsch; *Stiroma* Fieb.
19. *Delphacinus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *nesomelas* (Boheman), Pl. VIII, f. 12.
Delphacissa (Subg. *Delphacodes* Fieb.), Kirkaldy, 1906, Can. Ent., XXXVIII, 155; type *uncinata* (Fieber).
Delphacodes (Subg. *Delphax-Liburnia*) Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 524; type *mulsanti* Fieber, Pl. VIII, f. 32.
Delphacodes Melicher, 1901, Wien. ent. Zeit., 55; type *lethierryi* (Rey); n. pre. Syn. *Psendaraeopus*.
20. *Delphax* Fabricius, 1798, Ent. Syst. Suppl., 511; type *crassicornis* Fab. Syn. *Aræopus* Spin.
21. *Dichoneura* Lethierry, 1890, A. Soc. Ent. Fr. (6) X 151; type *simoni* Lethierry.
22. *Dicranotropis* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *hamata* (Boh), Pl. VIII, f. 17 Syn. *Phacalastor* Kirk.

23. *Dictyophorodelphax* Swezey, 1907, Pro. Haw. Ent. Soc., I, 104; type *mirabilis* Swezey. Fig. op. c. II, p. 2.
Dictropis Kirschbaum, 1868, Cicad. Wies. Frank. (nec. Fieber) part. Syn. *Jassidæus crimorphus* and *Stiroma* Fieber. (Fieber used *Stiroma* in text and *Ditropis* on his plate and Kirschbaum followed the name on plate.)
Ectopiopterygodelphax Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 412; type *eximius* Kirk. Syn. *Tropidocephala*.
24. *Embolophora* Stal., 1853, Ofv. Vet. Ak. Forh., X, 265; type *monoceros* Stal.
25. *Eodelphax* Kirkaldy, 1901, Entom., XXXIV, 39; type *serendiba* Kirk. Syn. *Eudelphax setulosus* Mel.
26. *Eoeurysa* Muir, 1913. Pro. Haw. Ent. Soc., II, 249; type *flavocapitata*, Muir.
27. *Epeurysa* Matsumura, 1900, Ent. Nachr., 261; type *nawaii* Mats.
28. *Epibidis* Fowler, 1905, B. C. Amer., Hem.-Hom., I, 131; type *goodmani* Fowler, Pl. XIII, f. 3, a, b, 4-5.
29. *Eucanyra* Crawford, 1914, Pro. U. S. Nat. Mus., XLVI, 568; type *stigmata* Crawford, Pl. XLIV, f. G. N. R. S.
Eudelphax Melichar, 1903, Hom. Cey., 32 (Cixiidae); type *setulosus* Mel., Pl. I, f. 6; Syn. *Eodelphax serendiba* Kirk.
30. *Euidella* Puton, 1886, Cat. Hem. Pal., 72; type *basilinea* (Germ.) n.n. for *Euides*.
Euides Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *basilinea* (Germ). Fig of *speciosa* (Boh), Pl. VIII, f. 7. Syn. *Euidella*, n. pr.
Eueides Dallas, 1867, Zool. Rec., III, 560, Syn. *Euidella*.
31. *Eumetopina* Breddin, 1896, Deut. Ent. Zeit., 109; type *kruegeri* Bred.
32. *Eurybregma* Scott, 1875, E. M. M., XII, 92; type *nigrolineata* Scott (considered by some a syn. of *Criomorphus*).
33. *Eurysa* Fieber, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *lineata* (Perr), figure Melichar Cic. Mitt. Eur., Pl. IV, f. 31-35.
Gadora Walker, 1858, Cat. Hom. Suppl. 84; type *capensis* Walker. Syn. *Hapalomelus flavipes* Stal.
34. *Gelastodelphax* Kirkaldy, 1906, H. S. P. A. Ent. Bull. I, 411; type *histrionicus* Kirk.; 1907, op. c., III, Pl. XVII, f. 1-3, Pl. XVIII, f. 16.

- Geoneossus* Muir, 1913, P. Haw. Ent. Soc., II, 238; type *sacchari* Muir., Pl. VI, f. 5-6. Syn. *Pseudaræopus* Kirk.
- Goniolcium* Foller, 1905, B. C. Amer. Het.-Hom., I, 132; type *granulosum* Fowler, Pl. XIII, f. 7-8. Syn. *Stobara* Stal.
- Hadeodelphax* Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 410; type *pluto* Kirk.; 1907, op. c., III, Pl. XVII, F. 12. Syn. *Sardia* Mel.
35. *Hapalomelus* Stal, 1853, Of. Vet. Ak. Forh., 265; type *flavipes* Stal. Syn. *Gadora* Walker.
36. *Haplodelphax* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 145; type *iuncicola* Kirkaldy, 1907, XII, f. 8-9.
- Holotus* (-*Holatus*) Guerin, 1856, de la Sagras Kist. Cuba, VII, and 1857, op. c., An. Artic., 429; type *thoracicus* Guerin. Syn. *Copicerus* Swartz.
37. *Idiosemus* Berg, 1883, Ann. Soc. Argentine, XVI, 233; type *xiphias* (Berg).
38. *Idiosystatus* Berg, 1883, Ann. Soc. Argen., XVI, 231; type *acutiuscula* (Spin.).
- Ilburnia* White, 1878, Pro. Zoo. Soc. Lond., 471; type *ignobilis* White (—*Ilburnia* Scudder. Nom. Zool., II, 160). Subgenus of *Liburnia*.
39. *Jassidæus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *moris* Fieber. Pl. VIII, f. 13. Syn. *Ditropis* Kbm. prt. *lugubris* (Sign).
- Jerala* Walker, 1858, List. Hom. Suppl., 85; type *singula* Walker (—*Jeralia* Scudder Nom. Zool. II, 163) Syn. *Copicerus* Swartz.
40. *Kalpa* Distant, 1906, F. B. I. Rhyn., III, 474; type *aculeata* Dist. Fig. 261.
41. *Kelisa* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *guttula* (Germar); Pl. VIII, f. 4.
42. *Kormus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *artemisia*; Fieber, Pl. VIII, f. 8.
43. *Laccocera* Van Duzee, 1897, Bull. Buff. Soc. Nat. Sci., V, 229 and 241; type *vittipennis* Van Duzee.
44. *Lanaphora* Muir, gen. nov.
45. *Leialoha* Kirkaldy, 1910, Faun. Haw. II (6), p. 579; type *naniicola* (Subgenus now erected to genus).

46. *Leimonodite* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 133 (foot note); type *beckeri* (Fieber), Fig. Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, f. 17.
Lepticus Crawford, 1914, Pro. U. S. N. Mus., XLVI, 567. Erected on nymph.
47. *Liburnia* Stal, 1866, Hem. Afr., IV, 179; type *pellucida* (Fab.) Syn. *Delphax* Auct. nec Fabricius; *Delphacodes* s. g. Fieber. *Delphacissa* s. g. Kirkaldy.
48. *Liburniella* Crawford, 1914, Pro. U. S. Nat. Mus., XLVI, 585. Pls. XLV, f. T. XLVII, f. E.; XLIX f. N.
49. *Livatis* Stal, 1859, Eugen. Resa. Ins. 274; type *annulipes* (Stal), Pl. IV, f. 3.
50. *Macrotomella* Van Duzee, 1907, Bul. Buff. Soc. Nat. Sci., VIII, 44; type *caranata* Van Duzee
51. *Malaxa* Melichar, 1914, Phil. Jour. Sci., IX, 3, D 275; Pl. III, f. 7.
52. *Megamelanus* Ball, 1902, Can. Ent., XXXIV, 265; type *bicolor* Ball.
53. *Megamelus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, 519; type *notulus* (Germar). Pl. VIII f. 2.
54. *Melanesia* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 128; type *pacifica* Kirkaldy. Pl. XVII f. 13-14.
55. *Mestus* Motschulsky, 1863, Bull. Soc. Nat. Mosc., XXXVI (3) III; type *morio* Motsch.
56. *Metropis* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *mayri* Fieber, Pl. VIII, f. 14. Syn. *Atropis*. Kirsch.
57. *Micromasoria* Kirkaldy, 1904, Entom., XXXVII, 279; n.n. for *Cona*; type *celata* (White).
Nephropsia Costa, 1862, Ann. Mus. Zool. Nap., I, 76; type *elegans* (Costa). Syn. *Tropidocephala*.
58. *Nesodryas* Kirkaldy, 1908, P. Haw. Ent. Soc., I, 203; type *freycinetiæ* Kirkaldy.
59. *Nesopleias* Kirkaldy, 1910, Faun. Haw., II (6), 582; type *nimbata* Kirkaldy. Syn. *Aloha* in part, *Nesorestias* in part.
60. *Nesorestias* Kirkaldy, 1908, P. Haw. Ent. Soc., I, 205; *filicicola* Kirkaldy.
61. *Nesosydne* Kirkaldy, 1907, P. Haw. Ent. Soc., I, 161; type *koæ* Kirkaldy; fig. op. c. 1908, Pl. IV., f. 2.

62. *Nesothoe* Kirkaldy, 1908, P. Haw. Ent. Soc., I, 203; type *fletus* Kirkaldy.
63. *Nilaparvata* Distant, 1906, F. B. I. Rhyn., III, 473; type *greeni* Dist., f. 260.
Orchesma Melichar, 1903, Hom. Cey., 94; type *marginepunctata* Mll., Pl. III, f. 3, a-c. Syn. *Tropidocephala* (or Sub. gen.).
64. *Ostama* Walker, 1857, J. Lin. Sc. Lond., Zool., I, 151; type *juncta* Walker, Pl. 7, f. 4 a.
65. *Paranda* Melichar, 1903, Hom. Cey., 92; type *globiceps* Melichar, Pl. III, f. 10.
67. *Pentagramma* Van Duzee, 1898, Bull. Buff. Soc. Nat. Sci., V, 260; type *vittatifrons* (Uhl).
68. *Perigrinus* Kirkaldy, 1904, Entom. XXXVII, 175; type *maidis* (Ashmead); figure, Psyche, V, 1890, 323.
69. *Perimececera* Muir, 1913, P. Haw. Ent. Soc., II, 250; type *giffardi* Muir, Pl. VI, f. 13.
70. *Perkinsiella* Kirkaldy, 1903, Entom., XXXVI, 179; type *saccharicida* Kirkaldy. Figure H. S. P. A. Ent. Bull., I, Pl. XXVI, f. 1-8, Pl. XXVII, f. 1-4; op. c., III, Pl. XI, f. 5-8
Phacalastor Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 408; type *Pseudomaidis* Kirk. Syn. *Dicronotropis* Fieber.
71. *Phyllodinus* Van Duzee, 1898, Bull. Buf. Soc. Nat. Sci., V, 240; type *nervatus* Van Duzee.
72. *Pissonotus* Van Duzee, 1898, Bul. Buff. Soc. Nat. Sci., V, 236; type *marginatus* Van Duzee.
73. *Platybrachys* Bierman, 1910, Notes Leyden Mus., XXXIII, 41; type *platypoda* Dammerman.
74. *Prokelisia* Osborn, 1905, Ohio. Nat., 373; type *setigera* Osborn, f. I a-f.
75. *Proterosydne* Kirkaldy, 1907, H. S. P. A. Ent., Bull. III, 130; type *arborea* Kirkaldy, Pl. XVIII, f. 11-12.
76. *Pseudaraeopus* Kirkaldy, 1904, Entom., XXXVII, 177 (foot note); type *lethierryi* (Rey) n. n. *Delphacodes*. Melichar (nec Fieber) n. pr. Figure Melichar, 1896, Cic. Mitt. Eur., Pl. III, f. 46; Syn. *Geonessus* Muir.
77. *Punana* Muir, 1913, Pro. Haw. Ent. Soc., II, 249; type *brunnea* Muir.

78. *Pundaluoya* Kirkaldy, 1902, J. Bomb. Nat. Hist. Soc., XIV, 52; type *ernesti* (Kirby), figure Kirby, 1891, J. Linn. Soc. Lond. Zool., XXIV, Pl. V, f. 14; Melichar, 1903, Hom. Cey., Pl. II, f. 12 a-c.
79. *Purohita* Distant, 1906, F. B. I. Rhyn., III, 470; type *cervina* Distant, F. 257.
80. *Rhinotettix* Stal, 1853, Ofv. Vet. Ak. Forh., 1853, 265; type *fuscipennis* Stal.
81. *Saccharosydne* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 139; type *saccharivora* (Westw), f. Westwood, 1833, A. M. N. H., 413, f. 54 a-c.
82. *Sardia* Melichar, 1903, Hom. Cey., 96; type *rostrata* Melichar, Pl. II, f. 4 a-b. Syn. *Hadeodelphax* Kirk. *Smara* Distant, 1906, F. B. I. Rhyn., III, 478; type *festiva* Distant, F. 264, Syn. *Tropidocephala* Stal.
83. *Smicrotodelphax* Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 411, type *perkinsi* Kirkaldy; figure Kirkaldy, op. c., III, Pl. XVI, f. 14-16; Pl. XVIII, f. 14.
84. *Sogota* Distant, 1906, F. B. I. Rhyn., III, 471; type *dohertyi* Distant, f. 258.
85. *Sogatopsis* Muir, 1913, P. Haw. Ent. Soc. II, 247; type *pratti* Muir; Syn. *Bambusaria picta* Mel.
86. *Sparnia* Stal, 1862, Sve. Vet. Sk. Hand, III, p. 6.
87. *Stenocranus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *minutus* (Fab.), Pl. VIII, f. 3. *Stiroma* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *mæsta* (Bohman). Syn. *Criomorphus* (Fieber's figure 18 is marked *Ditropis*).
88. *Stobæra* Stal, 1859, Berl. Ent. Zeit., III, 327; type *concinna* (Stal); Syn. *Goniolcium* Fowler.
89. *Toya* Distant, 1906, F. B. I. Rhyn., III, 472; type *attenuata* Distant, F. 259.
90. *Tropidocephala* Stal, 1853, Ofv. Vet. Ak. Forh., 266; type *flaviceps* Stal. Syns. *Conicoda* Mats.; *Ectopiopterygodelphax* Kirk.; *Nephropsis* Costa; *Orchesma* Mel.
91. *Ugyops* Guerin, 1834, Voy. Belanger, Zool., 477; type *percheronii* Guerin, Syn. *Hygyops*, *Hygiops*; *Bidis* Walker.
92. *Upachara* Distant, 1906, F. B. I. Rhyn., III, 469; type *stigma* Distant, f. 256.

- 20 (21) Clypeus with median carina *Bergias*.
 21 (20) Clypeus without median carina *Idiosystatus*.
 22 (13) Face with one medio-longitudinal carina, furcate or simple.
 23 (24) First joint of antennæ less than half the length of second
 (second joint slightly flattened) *Melanesia*.
 24 (23) Joints of antennæ subequal or first, but slightly shorter
 than second.
 25 (26) Medio-longitudinal carina of face simple *Eucanyra*.
 26 (25) Medio-longitudinal carina of face furcate.
 27 (28) First joint of antennæ considerably shorter than
 second *Ugyops*.
 28 (27) First joint of antennæ but slightly shorter than
 second *Epibidis*.

DELPHACINÆ.

- Post-tibial spur cultrate, solid, both surfaces convex, dis-
 tinct teeth along the hind edge *Alohini*
 Post-tibial spur cultrate, solid but with inner surface con-
 cave; no teeth along hind edge *Tropidocephalini*
 Post-tibial spur laminate or foliaceous, sometimes tecti-
 form, with or without teeth along hind
 edge *Delphacini*

ALOHINI.

- 1 (4) First joint of antennæ very short, broader than long;
 second joint short and thick, often ovaliform or sub-
 ovaliform (all macropterous).
 2 (3) Two median frontal carinæ, approximating at base or
 apex, or both, or even meeting together, but not forming
 a stalk *Leialoha*.
 3 (2) A single median frontal carina, forked at extreme base, if
 at all *Nesodryas*.
 a Slender, elongate forms Subgenus *Nesodryas*
 b Broader, more robust forms Subgenus *Nesothoe*
 4 (1) First joint of antennæ distinctly longer than broad,
 second joint cylindrical or only slightly enlarged at
 middle (few macropterous, most brachypterous).
 5 (8) Two median frontal carinæ.

- 6 (7) Tegmina reaching well beyond middle of abdomen.....*Aloha*.
 7 (6) Tegmina very short, not reaching to middle of
 abdomen *Nesorestias*.
 8 (5) One median frontal carina, forked or simple.
 9 (10) Head enormously elongate, longer than thorax and abdo-
 men combined*Dictyophorodelphax*
 10 (9) Head not elongate.
 11 (12) Mesonotum with rounded disk, a depression dividing the
 disk from the posterior angle.....*Proterosydne*.
 12 (11) Mesonotum with flattened disk, no distinct depression
 dividing the disk from posterior angle.....*Nesosydne*

TROPIDOCEPHALINI.

- 1 (8) Lateral carinae of vertex and face only moderately de-
 veloped.
 2 (7) First joint of antennae terete, or if at all flattened than
 longer than wide with lateral edges sub-parallel.
 3 (4) Vertex turbinate (triangular with curved sides), sometimes
 considerably elongate; lateral edges of face arcuate;
 antennae very much shorter than face, first joint annular,
 second about twice the length of first.....*Tropidocephala*.
 4 (3) Vertex quadrate.
 5 (6) Antennae slightly longer than face, joints subequal in length,
 first slightly flattened; lateral edges of face straight,
 subparallel; length of vertex equal to width at base; in
 profile clypeus not bent at right angle to
 face *Sogatopsis*.
 6 (5) Antennae about length of face, first joint terete, about
 2-3 length of second; lateral carinae of face arcuate; in
 profile clypeus bent at right angle to face.....*Arcofacies*.
 7 (2) First joint of antennae subsagittate, broader at apex than
 base, only a little longer than wide.....*Bambusibatus*.
 8 (11) Lateral carinae of vertex and face forming deep keels.
 9 (10) First joint of antennae about equal to second, not
 foliaceous *Lanaphora*
 10 (9) First joint of antennae much longer than second, flattened,
 foliaceous *Purohita*.

(To be continued.)

ON THE EARLY STAGES OF TWO MOTHS.

BY WM. BARNES AND J. MCDUNNOUGH, DECATUR, ILL.

Apantesis michabo Grt.

Eggs of this species were received early in the spring from Southern Pines, N. C. They were laid in small patches of from 30-40 ova in one patch and were similar to those of *A. arge*. The larvæ fed up quickly on lettuce and dandelion. It was noticeable that the larvæ producing the male moths underwent one less moult than those producing the female; on account of this extra moult the female larvæ were considerably smaller than the male ones in the fourth and fifth stages, but when full grown were much larger.

Stage I.—Head black. Body pale greyish with large black tubercles similar in arrangement to those of our sketch (Can. Ent., 44, p. 133, 1912). Prothoracic plate brownish, rounded posteriorly, with four long black equidistant setæ on anterior margin and two similar setæ on posterior margin situated one on each side of the centro-dorsal line; laterad to each of these is a minute white seta. Posterior to the outer corner of the prothoracic plate is a minute white seta situated on a small chitinous patch; laterad to this plate, on the anterior margin of the segment, is a larger chitinous patch with two black setæ, below which again are two small white setæ on a small chitinous area. On the meso- and metathorax the two setæ of tubercles I. and the single seta of III are black, all the others white and shorter than the black ones; tubercle IV situated laterad and posterior to III, small; on the first eight abdominal segments the seta of tubercle II and the upper one of III are black, the setæ of the other tubercles and the lower one of III being white; tubercle I minute. On the 9th abdominal segment two large dorsal tubercles contain each 4 setæ and the anal plate is shield-shaped with four short setæ on each side of the centro-dorsal line.

Stage II.—Head black with the sutures of the clypeus strongly marked in white. Body black-brown dorsally, shading into light brown laterally; a broad dorsal whitish stripe, a narrower sub-dorsal one above tubercle III and a slightly waved subspiracular one between tubercles IV and V. The tubercles are black and

show a considerable augmentation of setæ, of which a single black central one from each dorsal tubercle is very long, the individual setæ thus forming a double dorsal row, the hairs increasing in length towards the anal segments where they are pointed rearwards and tend to become white in the upper half; the central seta of tubercle III is almost as long and these form a similar lateral row pointing sideways. Besides these long black setæ on the meso- and metathorax tubercle I has 3 shorter black setæ and several minute white ones; tubercle III has three white setæ; tubercle IV of the previous stage is only represented by a faint chitinous patch, but immediately below it and posterior to V is a minute white seta; tubercles V and VII have each about 5 white setæ. On the prothorax the prothoracic plate has the setæ on the anterior margin arranged in two groups, each containing four black setæ, pointing forwards, and several shorter white ones; the setæ of the posterior margin are as in the preceding stage with the addition of two minute white ones behind the two central black setæ. Behind the corner of the plate are two small white setæ; the lateral tubercle on the anterior margin is large with two long black setæ and 4 or 5 short white ones, laterad to this is a tubercle with one central black and 4 white setæ.

On the abdominal segments tubercle I has a single short white seta, tubercle II 5 black setæ grouped around the long central one, with occasional white setæ intermingled; tubercle III with a longer black seta and 5 short white ones which tend to become blackish on the rear segments; the other lateral tubercles with about 4 or 5 white setæ each.

Stage III.—Head as before. Body with dorsal area black, shading into paler laterally, with velvety black patches on anterior dorsal portion of each segment and along edge of centro-dorsal stripe which is broad and whitish-yellow; subdorsal stripe as before, but tending to break up into spots; lateral area browner than the dorsal area, mottled with ochreous around base of tubercle III and with pale subspiracular band as before.

Prothoracic plate with two well marked anterior warts each containing numerous long black and shorter white setæ pointed forwards; the posterior row of setæ consists of 4 black ones with

the central two accompanied each by two short white setæ and the outer two each by a single one. Warts large, black, with numerous setæ, of which the double dorsal row and the lateral row of long black ones is still present, these hairs tending to become white towards their apices; besides these tubercle III has a single very long white hair pointing sideways. The dorsal setæ are mostly black and tubercle II contains about 12, arranged in two concentric rows around the long central seta; tubercle I is small with three short whitish setæ; the lateral tubercles contain each 10-12 white setæ. On the meso- and metathorax tubercle IV is again represented by a single short seta, whilst below it the secondary tubercle now contains two white setæ.

Stage IV.—Head as before. Body dull black blotched dorsally with velvety black; warts black; a broad pale yellow dorsal stripe often considerably tinged with orange; subdorsal stripe reduced to round white spots on anterior portion of each segment, occasionally lengthened posteriorly; a subspiracular waved white stripe; legs and prolegs pale orange; spiracle ochreous ringed with black; setæ much as before, but greatly increased in number, the long dorsal setæ are now whitish in colour and besides these there are several rather long black ones from tubercle II, the remainder being considerably shorter; tubercle III with the very long white seta pointing outwards and the shorter black one pointing upwards as in preceding stage; all lateral setæ white.

Stage V.—Much as in the preceding stage; the dorsal stripe often assumes a more orange hue whilst the subdorsal row of dots remains white and is occasionally almost wanting; the subspiracular stripe is overlaid with smoky and not so sharply defined as in previous stages; apart from the subspiracular ones the setæ are mostly dull black and only very slightly barbed, any white ones occurring on the dorsal and supraspiracular tubercles being very short. The orange central portion of the spiracle often tends to become obscure. This is the final stage for the male larva.

Stage VI (♀)—Practically as in the preceding stage with a considerable increase in size. The full grown larva may be at once distinguished from that of *arge* by its blacker body colour and the lack of the continuous subdorsal stripe which in *michabo* is reduced to small spots. Dr. Dyar (Jour. N. Y. Ent. Soc. VIII,

36) has recorded 7 stages for the ♀ larva of *arge*, spring brood; we are practically certain that we have missed no stage in our brood of *michabo*, so if the number of moults is constant, it would form a further means of differentiation between the two species. Of the two *michabo* would seem to be the newer species, being a further development of the *arge* type, as the subdorsal line is present in the earlier stages only, being obsolescent or wanting in the mature larva.

Acronycta impressa Wlk.

We use this name in the ordinarily accepted sense, i.e. for the species as figured by Smith in his Monograph of the genus *Acronycta*, Pl. XIII, figs. 4 and 5, and of which *verrilli* G. & R. is regarded as a synonym. The type of *impressa* Walker in the British Museum is in such poor condition that on a recent examination we were unable to tell definitely to just what form the name should be applied; until material from the type locality is available, more or less doubt will surround the application of the name. We received ova of the species late in the fall of 1914 from New Washington, Pa.; the larvæ fed up readily on poplar and pupated within a month from the time of emergence from the egg. Two ♀'s emerged the same fall, the remainder of the pupæ hibernated and produced imagines early the following spring.

Ovum.—Rather flat, base of egg broad, irregularly circular, about 1 mm. in diameter, with a slight rim around the periphery; from this rib arise 50-60 ribs, arranged more or less in pairs, which ascend the sides of the egg about half way to the micropylar area where the two component parts of each pair join and are either continued to the micropylar area by a single rib or else end blindly; occasionally the upper ends of two pairs are joined by the single rib. Colour when first laid yellow, becoming later purple with numerous white blotches and finally almost black.

Stage I.—Head shiny black; body white with abdominal segments I, IV, V and VIII deep black-brown to below the spiracles; traces of a dark dorsal stripe especially on segments preceding and following the dark ones; on the white segments traces of a lateral brown band situated above tubercle VI on a level with the lower edge of the dark colour of the four above mentioned abdo-

minal segments. Prothoracic plate black with about eight long setae projecting forward; tubercles large, shiny black, the dorsal thoracic tubercles with about 3 long setae and the abdominal ones with about six; all the lateral tubercles bear single black setae, tubercle IV being small with very minute seta. Length 2 mm.

Stage II.—Head shiny black. Body white with abdominal segments I, IV, V and VIII deep black brown as before, at times shaded dorsally with yellowish; a lateral brown band with the upper edge situated on a level with tubercle III, slightly mottled with white, and with the tubercles contained in this band ringed with white basally; this white area around tubercle V tends to spread laterally forming a more or less consecutive white subspiracular line. On the flange in some cases is a brown dorsal band with central white line, in other cases this band is lacking and the general colour appears in consequence lighter. Tubercles shiny black, large, except IV, situated immediately posterior to the spiracle, which is minute with a single seta; the number of setae have greatly increased, tubercle I bearing about 12 stiff black bristles and the other tubercles 6-8 similar ones. Length 4 mm.

Stage III.—Head black. Body largely deep black-brown, abdominal segments I, IV, V and VIII entirely so, the other segments with an orange-yellow subdorsal stripe occupying the area between the lower portion of tubercle I and the upper portion of tubercle III; some specimens show a slight white marbling both laterally and dorsally on the dark ground colour. Lateral tubercles strongly ringed with white, forming, as in previous stage, a broken subspiracular line on a level with tubercle V; on the dark segments tubercle II is also white ringed and at times tubercle I shows traces of white at the base; tubercles as before, the dorsal ones with numerous black stiff bristles and a few slight white ones around the bases, the lateral ones with several central black setae and numerous white ones; from the prothoracic shield numerous white hairs overhang the head. The segmental incisions are well marked, abdominal segments I and VIII being noticeably humped. Length 9 mm.

Stage IV.—A considerable change in the general appearance. Head black. Body black with orange subdorsal line on the seg-

ments corresponding to the pale segments of the previous stages and a whitish subspiracular line as before; tubercles large, black, prominently white-ringed; spiracle ringed with white. On the first four segments the dorsal hairs are red-brown paling to white laterally, the red-brown colour occasionally extending over to abdominal segments II and III, on the other segments all the hairs are white with the exception of a few black hairs on the 8th abdominal segment which is markedly humped; several long white hairs arise from the lateral tubercles, these being pointed forwards on the anterior segments and backwards on the anal segments. Length 12 mm.

Stage V.—Head black. Body velvety black; all trace of the orange subdorsal stripe is lost and the white subspiracular line and rings round the tubercles greatly reduced, when present the former being orange-tinged. Hairs whitish-yellow except on the meso- and metathoracic and 1st abdominal segments where the whole area above the spiracle shows red-brown hairs which often extend dorsally on to the 2nd and 3rd abdominal segments; occasionally similar hairs are found dorsally on the 8th abdominal segment which scarcely ever shows any black setae as in previous stage; the tubercles from which these reddish hairs arise are slightly tinged with red-brown and the other tubercles are mostly black occasionally tinged with whitish. Spiracle white.

Width of head 1.8 mm. Length 18 mm.

Stage VI (full grown).—Very much as in preceding stage, quite variable in coloration. Head black. Body velvety black with white spiracles and with reddish subspiracular line either slightly present or entirely lacking or confined to the base of tubercle V. Hairs ranging in colour from pure white to yellowish, the dorsal hairs being usually rather stunted and crinkly; red-brown hairing as in preceding stage on the anterior segments except prothorax and extending dorsally to 2nd and 3rd abdominal segments and frequently with similar hairs dorsally on 8th and 9th abdominal segments; the tubercles bearing the red-brown hairs are usually themselves similarly coloured, whilst the others may be black shaded with white or entirely white and frequently the lateral abdominal ones are entirely black. Length 25-30 mm.

Mailed August 14, 1915.