

NORTH AMERICAN SAWFLIES OF THE SUBFAMILY CLADIINAE.¹

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WITH

NOTES ON HABITS AND DESCRIPTIONS OF LARVAE.

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INTRODUCTION.

The adult sawflies of the subfamily Cladiinae are, with one or two striking exceptions, rather small, black, and inconspicuous insects which attract the attention of few people other than the specialist.

The larva of most of the species are also rare and seldom seen. Two of our American species, are, however, conspicuous; one (*Trichiocampus viminalis*) because of the coloring of the adult and feeding habit of the larva, the other (*Cladius isomerus*) because the larva is the commonest defoliator of roses in the eastern states. The following paper, which is a contribution from the Branch of Forest Insects, Bureau of Entomology, contains a revision of the adults and descriptive notes for the known larvae as well as some observations on the habits of certain species. The work on the adults has been done by Mr. Rohwer and the new species should be accredited to him, while the work on the larvae was done by Mr. Middleton. The biological work and rearing was done at the Eastern Field Station of the Bureau of Entomology (Forest Insects), located at East Falls Church, Virginia.

¹ Since this paper was submitted MacGillivray has published descriptions of seven new species of North American sawflies of this group. See "New Species of Cladiinae—Hymenoptera," Ent. News, vol. 32, no. 2, 1921, p. 48–50. I have studied these descriptions but have been unable to satisfy myself that any of the forms characterized are the same as the new species described in the present paper. Because of the different interpretations of generic limits it is also impossible to be certain that the generic assignment of Dr. MacGillivray is the same as that here used, and judging from the descriptions alone it would seem that certain species placed in *Trichiocampus* would, according to the characters, here used, be placed in *Priophorus*. (See p. 4.) S. A. ROHWER.

The illustrations for the adults were prepared by Miss Eleanor Armstrong from sketches made by Mr. Rohwer, by use of a Leitz projection apparatus. The illustrations for the larvae were made by Mr. Middleton.

EXPLANATORY.

In this paper the external genitalia of the female is considered as being composed of three primary parts. The outer part is called the sheath. The inner parts, or that which has heretofore usually been loosely called the saw, are grouped together under the name ovipositor and the upper (fused dorsally) pair of pieces is termed the lance and the lower pair the lancets. In preparing the ovipository for mounting, the lancets are removed, separated from each other and from the lance and are mounted as separate parts, while the two parts of the lance are mounted as one.

The terminology used for the larva is that adopted in two recent papers² by the junior author.

Subfamily CLADIINAE.

Cladiinae ASHMEAD, Can. Ent., vol. 30, 1898, p. 282 (part).

Cladiinae MACGILLIVRAY, Proc. U. S. Nat. Mus., vol. 29, 1906, p. 635 (part); Bull. 22, Conn. Geol. and Nat. Hist. Survey, 1916 (1917), p. 108 (part).

Cladiinae ROHWER, Proc. Ent. Soc. Wash., vol. 13, 1911, p. 224.

As here treated the subfamily Cladiinae deals only with the genus *Cladius* as treated by Hartig, Thomson and Cameron, and comprises these species belonging to the subfamily Nematinae as defined by Konow,³ in which the basal vein joins the subcosta close to the origin of the cubitus. Both Ashmead and MacGillivray in recognizing their subfamily Cladiinae placed more stress on the character of the anal cell and therefore included the genera *Platycampus* and *Anoplonyx*. According to the senior author's opinion the anal cell, although very useful in classification, is a character so subject to modifications due to the use of the wing, that it does not necessarily show subfamily relationships. He therefore prefers to use the position of the basal vein as compared to the origin of the cubitus. From the standpoint of the larvae the definition of the subfamily as here used is much more satisfactory than when the genera *Platycampus* and *Anoplonyx* are included, because the larvae of species that belong to these genera and which we have been able to study, have characters which place them in the subfamily Nematinae rather than the subfamily Cladiinae.

² Middleton, William.—Suggested Homologies between Larvae and Adults in Sawflies, Proc. Ent. Soc. Wash., vol. 23, no. 8, 1921, p. 173.

Middleton, William.—LeConte's Sawfly, an enemy to young pines, Journ. Agric. Research, U. S. Dept. Agr., vol. 20, no. 10, 1921, pp. 741-760, pls. 88-92.

³ Gen. Ins., fasc. 29, 1905, p. 45.

The three genera grouped together in this subfamily although closely allied to the Nematinae have certain characters which suggest a relationship to the genus *Monoctenus*. In venation, especially in the position of the basal vein, they are very like *Monoctenus*. The ovipositor of species of the genera *Cladius* and *Priophorus* is very similar to the ovipositor of species of the genus *Menoctenus*, while on the other hand the ovipositor of the species of the genus *Trichiocampus* is very similar to that of certain genera and species in the subfamily Nematinae. In the structure of the thorax, the adults are more closely allied to the Nematinae than to the genus *Menoctenus*. In the larva, affinity to the Nematinae is perhaps even more striking than in the adult, and there is no more to suggest relationship with *Monoctenus* in the Cladiinae than there is in the Nematinae.

The genus *Trichiocampus* as here defined is more different from both *Cladius* and *Priophorus* than these two are from each other and we believe that it will later be found advisable to express this by the use of subgenera. Such an arrangement would reduce *Priophorus* to a subgenus of *Cladius*.

Subfamily Characters, Adults.—Small or medium sized, usually black sawflies of a Nematine habitus; prepectus present although in some of the black species the prepectal furrow is indistinct; proepisternum short, not meeting ventrally; malar space present, inner margin of the eyes nearly parallel; clypeus somewhat emarginate; antennae nine-jointed; the flagellum variable; interradius wanting; three closed cubital cells (often the first intercubitus is obsolescent); basal vein joining the subcosta close to the origin of the cubitus; nervulus at or somewhat beyond the middle of the first discoidal cell; basal vein and first recurrent strongly divergent; second recurrent received by the third cubital cell; anal cell broadly contracted; discoidellan cell present, usually extending beyond the first cubitalellan cell; anellan cell longly petiolate; tarsal claws cleft with the inner tooth shorter.

Larvae.—All larvae studied have the following characters in common, and it is fair to assume that the characters given below are of subfamily value.

Antennae 4-jointed (chitinized, disk type, with central cone surrounded by flattened oval disks, outer disk may be broken into two floating or disconnected parts) (fig. 53); lacinial armature with a pair of blades or setae near galea and distinctly separate from the main series of blades or setae⁴; maxillary palpi 5-jointed; labial palpi

⁴ This character is found, so far as known, in only one Nematinae larva (*Pteronidea amelanchieridis* Rohwer), which clings to the surface of the leaf of *Amelanchier canadensis*, upon which it feeds, and which resembles to a considerable degree Cladiinae larvæ, although it is devoid of long, prominent hairs.

3-jointed (fig. 54); thoracic segments structurally much as Nematinae; legs 4-jointed (fig. 52); abdominal segments (uropods normal on urites 2-7, inclusive, and postpedes on urite 10 as in Nematinae) 4 annulate, A, B, C, and D (figs. 57-61), A, B, and C are large, prominent, distinct, and ornamented with spines or hairs, A to a somewhat lesser degree, while D is membranous, inconspicuous, narrow, not prominent, unornamented, and often infolded or depressed to apparent absence; spiracle in alar region below B; spiracular area not large and distinct; alar area, below C in alar region, consisting of a pair of large dorsad-ventrad elongated folds, the anterior fold more distinct.

Distribution.—This subfamily is represented in both divisions of the Holarctic Region, but most of the species occurring in the Nearctic Region are confined to the eastern part of the continent. The best-known species of the subfamily, the bristly rose slug, *Cladius isomerus* Norton, which is very abundant and injurious in the eastern part of the Nearctic Region, and has heretofore been confused with a European species.

Generic Characters.—Heretofore with the exception of the synopsis given by MacGillivray⁵ the genera assigned to this group have been separated by the modification of the flagellum, especially that of the male. MacGillivray in his recently published synopsis introduces the character of the relative length of the anterior basitarsis and separates the genus *Priophorus* from the other two genera by the absence of an appendage to the radiellian cell. Although this last-mentioned character applies for certain few species of the genus *Priophorus* some of the species described in this paper and assigned to *Priophorus* (and which agree with the definition here used) have a distinct appendage to the radiellian cell. The relative length and distinctness of this appendage is subject to individual variation and is sometimes different in the two wings of the same specimens. Because of this variability this character can not safely be used in separating genera and even for species it should be used with great care.

The secondary sexual characters, as found in the antennae and heretofore used as generic, cannot be considered of such value, since they group together species which on biology, larvae, and habitus are not closely allied. *Trichiocampus irregularis* (Dyar) has the antennae in both sexes simple, and if those antennal characters are used it would be placed in the genus *Priophorus*, but the larvae, larval-habits, ovipositor, and leg characters show that it belongs to *Trichiocampus*, where in the female it is so closely allied to *gregarius* (Dyar) as to offer difficulty in separating it, without examination of the ovipositor. *Priophorus ulmi* (Linnaeus) has therefore been placed in the genus *Trichiocampus* because of the character of

⁵ Bull. 22, Conn. Geol. and Nat. Hist. Surv., 1916 (1917), p. 108.

the male antennae, but an examination of the description of the larva, the female ovipositor, and habits as given by von Vollenhoven,⁶ shows that in those characters it agrees with *Priophorus* and not with the species here assigned to *Trichiocampus*. Adults received from Enslin also show the leg and head characters of *Priophorus*. To use the character of the antenna as of generic value makes it impossible to find characters in the larvae or biology which can be used to separate species of Cladiinae into generic units. We are, therefore, of the opinion that the larvae, biology, character of the ovipositor and legs offer a satisfactory and natural means of grouping these insects and have employed them in the following synopsis:

KEY TO THE GENERA BASED ON ADULTS.

1. Anterior basitarsus distinctly shorter than the three following joints which are sharply separated from each other; supraclypeal area triangular in outline, gently convex; lower margin of the lancets nearly straight and with 12 or more regular teeth; the posterior margin of the lancet plates at most feebly armed-----*Trichiocampus* Hartig.
- Anterior basitarsus subequal with or longer than the three following joints which are not sharply differentiated; supraclypeal area rectangular in outline, strongly convex, almost keel-like; lower margin of lancets strongly curved and with eight large teeth; posterior margin of lancet plates strongly armed----- 2
2. Female antennae short, the third joint constricted medianly so it is strongly concave beneath; dorsal side of antennal joints 3 to 6 in male armed with rami apically, the third joint with a projection at base beneath.

Cladius Rossi.

 Antennae of male and female normal, or occasionally the third joint in the male has a projection at the base beneath-----*Triophorus* Dahlbom.

KEY TO THE GENERA BASED ON LARVAE.

The following synopsis gives the most reliable and useable generic characters we have found on the larvae studied. While we have not been able to examine larvae of all of the species, it seems probable that we have had sufficient material to express confidence in the characters here used.

1. Gregarious feeders; body black spotted, sometimes subdorsally, always supra-alar and epipleural regions; head mostly black (at least frons and entire dorsum from eye to eye); figures 57-59 and 71-----*Trichiocampus* Hartig.
- Solitary feeders; body not spotted; head mostly pale (eye spots and sometimes vertex black)----- 2
2. Vertex and eye spots black; body usually grayish dorsally, especially in thorax from annulet A mesothorax to and including annulet C metathorax and abdominally on the eighth and ninth segments; figures 61 and 73.

Priophorus Dahlbom.

 Head pale excepting black eye spots, body entirely pale; figures 60 and 62.

Cladius Rossi

⁶ Tijdschr. v. Ent., vol. 4, 1860, pp. 84-87.

Genus *TRICHIOCAMPUS* Hartig.

Trichiocampus HARTIG, Fam. Blatt-und Holzwespen, 1837, p. 176. Genotype.—(*Nematus grandis* Lepeletier) = (*Tenthredo*) *Trichiocampus viminalis* (Fallén).

The genus *Trichiocampus* was first recognized by Hartig, who treated it as a subgenus of *Cladius*, and separated it from the other groups of this genus *Cladius* by characters found in the antennae. Westwood, in 1840,⁷ was the first writer to treat this group as of generic value, but he as well as his predecessors and successors defined it in much the same way as it was originally defined by Hartig.

As here defined the group is more different from the other two genera of the Cladiinae than these genera are from each other. The characters of the larvae and their gregarious habit together with the characters of the ovipositor and legs show that this group is a natural one and indicates that these characters are better than those previously used.

Generic Characters, Adults.—Clypeus emarginate; supraclypeal area gently convex, triangular in outline; lateral supraclypeal area flat; antennal foveae small for subfamily; inner margins of the eyes parallel; anterior basitarsus distinctly shorter than the three following joints (fig. 2); radiellian cell with a distinct appendage; cerci short, stout; lower margin of lancets with twelve or more regular teeth; the posterior margin of the plates of lancets not or only feebly armed; female antenna long, slender, the third joint simple in species here treated; male antenna long slender, the third joint simple or strongly produced at base beneath.

Larvae.—Characters common to the larvae studied. Head mostly black (at least frons and entire dorsum from eye to eye); frons with margin spined, median area bare; body always with black spots in supraalar and epipleural regions and sometimes spotted subdorsally. Supraalar spots extending from anterior annulet B back to about middle annulet C; epipleural spots on the posterior portion of the epipleural fold (figs. 49, 57-59). Uropods normal, on urites 2-7, urites 8 and 9 bare and urite 10 with postpedes.

Adult Specific Characters.—The color, the character of the ovipositor and the modification of the third antennal joint, in the male, offer the most valuable specific characters in this genus. The shape of the sheath and the emargination of the clypeus are also useful but more difficult to use.

KEY TO THE ADULTS.

- | | |
|--|---|
| 1. Females ----- | 2 |
| Males ----- | 4 |
| 2. Abdomen and mesepisterum reddish-yellow; clypeus deeply emarginate. | |
| <i>viminalis</i> (Fallén). | |
| Body entirely black; clypeus more shallowly emarginate----- | 3 |

⁷ Introduction to the Modern Classification of Insects, Synopsis, p. 54.

3. Apex of the first and all of the following joints of the hind tarsi black; clypeus with a shallow V-shaped emargination; sheath obtusely pointed apically from a broad base.....*irregularis* (Dyar).
Only the apical joint of the hind tarsi black (apices of some of the joints may be slightly brownish); clypeus with a shallow arcuate emargination; sheath obliquely truncate from a broad oblique base.....*gregarius* (Dyar).
4. Third antennal joint not produced at base beneath and not wider at the base than the pedicellum; body black.....5
Third antennal joint strongly produced at base beneath so it is wider than the pedicellum.....6
5. Anterior margin of clypeus with a deep V-shaped emargination; apex of hind tibia and most of hind tarsus black.....*irregularis* (Dyar).
Anterior margin of clypeus with a rather deep U-shaped emargination; hind tibia and first four tarsal joints pale.....*simplicicornis* (Norton).
6. Abdomen and mesepisternum reddish yellow.....*viminalis* (Fallén).
Body entirely black.....*gregarius* (Dyar).

KEY TO THE LARVAE.

1. Larvae with subdorsal, as well as supraalar and epipleural rows of black body spots.....*gregarius* (Dyar).
Larvae without subdorsal, but with supraalar and epipleural rows of black body spots.....2
2. Spiracular area not darkened.....*viminalis* (Fallén).
Spiracular area partially blackened by spot confluent with epipleural black spot.....*irregularis* (Dyar).

TRICHIOCAMPUS VIMINALIS (Fallén).

Figures 5, 9, 10, 23, 24, 36, 42, 57, 71.

Tenthredo viminalis FALLÉN, Svensk. Vet. Akad. Handl., vol. 29, 1808, p. 177, n. 59.

Aulacomerus lutescens LINTNER, 4th Rept. Ins. N. Y., 1888, p. 44, fig. 20, 21, 22.

Trichiocampus viminalis Fallén, DYAR, 1895, Can. Ent., vol. 27, p. 340.—COSENS, Rept. Ent. Soc. Ont. 1915 (1916), p. 15.—CAESAR, Rept. Ent. Soc. Ont. 1915 (1916), p. 33.—MACGILLIVRAY, Bul. 22, Conn. Geol. Nat. Hist. Survey, 1916 (1917), p. 110.

The location of the type of this species is unknown to us. American specimens have been carefully compared with European specimens identified by Konow and there seems to be no reason to doubt that this is the European species and that it was introduced before 1888, when first seen by Lintner. It is our most easily distinguished species in the Cladiinae, as it is the only one in North America in which the abdomen and mesepisternum is pale.

Female.—Length 8–9.5 mm.; length of the antenna about 5 mm. Clypeus shining with sparse, setigerous punctures, basally gently convex, the apical margin with a deep arcuate emargination which in outline is approximately the same as the outline for one of the lobes; supraclypeal foveae deep, punctiform; lateral spyraclypeal area broad, gradually sloping to the antennal foveae; ocellar basin defined with rounded walls, pentagonal in outline; middle fovea

elongate, confluent with the ocellar basin; antennal furrows nearly complete, only slightly interrupted opposite the lateral ocelli; postocellar line distinctly longer than the ocellocular line; ocellocular line subequal with the ocelloccipital line; postocellar furrow present, straight, not broken by the faint furrow that runs to the anterior ocellus; postocellar area sharply defined laterally, convex, without punctiform foveae; frontal crest broken medianly; antennae and wings as illustrated in the accompanying figures 5, 10, 23; sheath broad, straight above, oblique to a sharp apex; saw as illustrated in the accompanying figures 36 and 42. Reddish yellow; head, scape, pedicellum, mesosternum, proepisternum, pronotum medianly, meso and meta notum and apex of sheath, black; wings yellowish hyaline, strongly iridescent; venation reddish yellow.

Male.—Length 6.5–7 mm. Clypeus more densely punctured than in the female, strongly convex basally, deeply, arcuately emarginate anteriorly, the emargination in outline is approximately the same as the outline of the lobes; supraclypeal foveae deep, punctiform, the rest of the head agreeing well with the female except that the middle fovea is smaller, and more sharply defined and is in a broad depressed area; antenna as in figures 9 and 24; hypopygidium nearly truncate. Color as in female.

Described from specimens from Canada and New York.

Oviposition.—Eggs are deposited in cuts in the petiole of the leaves. Lintner has counted twenty-eight to thirty scars in one petiole.

Larva.—Length of full fed larva 16 mm. Head blackish and brownish excepting clypeus, antennae, and ventral mouthparts which are yellowish (figs. 49, 53, 54). Body yellow, large black spots in supraalar and smaller ones epipleurally (figs. 71 and 57). Annulet A pale, without prominent areas and with pairs of small hairs, usually two, situated subdorsally and in supraalar region. Annulets B and C larger than A and D and with more spines, spines grouped somewhat upon slightly prominent areas which arrange themselves in a transverse row across the tergum. Annulet D is quite small, indistinct, pale, and without spines. Epiproct with a single transverse black splotch.

Cocoon.—Length 14 mm., width 7 mm. Dark brown and translucent, papery, somewhat shining, outline irregular.

Host.—American Records:—Carolina Poplar and *Populus monilifera*. European Records:—*Populus pyramidalis* (according to Ratzeburg); *Populus monilifera* (according to Bouché); *Populus alba* and *Populus dilatata* (according to Ondemann); *Salix caprea* (according to Enslin).

Seasonal History.—Gregarious feeders, eating the entire leaf, exclusive of the midrib and larger veins. This species has apparently two generations, the first appearing in June and the second in Au-

gust. The latter generation overwintering in cocoons, the adults emerging in May of the next year.

Distribution.—This species is generally distributed over Northern and Central Europe. In America it was first discovered by Lintner at Albany, New York, where he found it defoliating *Populus monilifera*, and described it under the name *Aulacomerus lutescens*. In the summer of 1915 it was abundant enough on the shade trees at Toronto, Ontario, to attract the attention of park supervisors, and specimens were sent both to Doctor Cosens and Mr. Caesar. The same season it was abundant on poplars in Brooklyn, New York, and the Bureau of Entomology received a number of inquiries from this place. A female, reared July 28, 1915, from larvae collected June 30, 1915, on poplar at New Haven, Connecticut, has also been examined.

TRICHIOCAMPUS IRREGULARIS (Dyar).

Figures 13, 14, 26, 27, 38, 44, 59.

"N" DYAR, Can. Ent., vol. 27, 1896, p. 340.

Priophorus irregularis DYAR, Journ. N. Y. Ent. Soc., vol. 8, 1900, p. 28.

Trichiocampus irregularis Dyar, MacGILLIVRAY, Bull. 22, Conn. Geol. Nat. Hist. Surv., 1916 (1917), p. 110.

Type.—Cat. No. 21581 U.S.N.M.

Female.—Length 6 mm.; length of antenna 3.5 mm. Clypeus with rather close setigerous punctures, strongly convex in the basal middle, the apical margin with a broad, shallow, V-shaped emargination; supra-clypeal foveae large, circular in outline; lateral supra-clypeal area flat; ocellar basin faintly indicated ventrally and almost triangular in outline; dorsally the ocellar basin is more sharply defined and projects to the postocellar furrow; frontal crest prominent medianly and broken by the elongate middle fovea; antennal furrows wanting below lateral ocelli; postocellar furrow distinct, straight; postocellar line distinctly longer than the ocellocular line; ocellocular line slightly longer than the ocelloccipital line; postocellar area sharply defined laterally, strongly convex, without foveae; antennae as in figures 13 and 26; wings normal, stigma gradually tapering from the basal third; first intercubitus obsolescent; second cubital cell distinctly longer than the third; second recurrent received the length of the second intercubitus from the base of the second cubital; sheath straight above, obtusely pointed apically, tapering from a broad base; ovipositor as in figures 38 and 44; lancet with three broad, not emarginate, teeth at apex, then eleven prominent teeth which are pointed slightly backwards, the last two teeth are slightly larger but are not emarginate; posterior margin of transverse plates seven to ten finely serrate. Black; tibiae and the

base of the first tarsal joint white; wings fuliginous, subhyaline beyond the apex of the stigma; venation dark brown.

Male.—Length 4 mm. The description of the female applies well to the male. The hypopygidium broadly rounded apically; color same as in the female, except the antenna are pale brown beneath; antennae as in figures 14 and 27.

The above description of the female is made from specimens from East River, Connecticut. The male is redescribed from the unique type and specimens from East River, Connecticut.

Oviposition.—The eggs are deposited in a double row along the stem of a twig of the host. (Observation of Chas. R. Ely.)

Larva.—Length of full fed larva 13 mm. Head black excepting pale clypeus. Body (fig. 59) pale yellowish with large black spots in supraalar region and with black spots epipleurally which encroach, or are confluent with a spot, upon the spiracular area; spined as *Trichiocampus gregarius* and otherwise the same as that species excepting epiproct which has large, undivided, black splotch.

Cocoon.—The cocoon is translucent, pale brownish, thin walled cell, 9 mm. long by 3.5 mm. broad, irregularly oval, spun in rearing on dirt or leaves at bottom or sides of cage.

Host.—*Salix*, one, or more than one species.

Seasonal History.—Gregarious feeders. Larvae collected in late August or early September become prepupa and spin cocoons emerging as adults the following May and June, although occasionally a few come out in late September of the same year, in which they cocoon. Larvae collected in early July emerge as adults early the following September.

Distribution.—Wood's Hole, Massachusetts and Weirs, New Hampshire (Dyar); Maine, August 9, 1907; East River, Connecticut (Ely).

The type of adult came from Weirs, New Hampshire, and is Dyar's No. 9 F; the record from Wood's Hole is based on a larva which is under Dyar's No. N.

TRICHIOCAMPUS SIMPLICICORNIS (Norton).

Cladius simplicicornis NORTON, Trans. Amer. Ent. Soc., vol. 2, 1869, p. 367.

Priophorus simplicicornis (Norton) KIRBY, List Hymen. Brit. Mus., vol. 1, 1882, p. 101.—MACGILLIVRAY, Bull. 22, Conn. Geol. Nat. Hist. Surv., 1916 (1917), p. 109.

Type.—Cat. No. 10302, Acad. Nat. Sci. Philadelphia.

This species is known only from the single type male, and is closely allied to *irregularis* (Dyar) but may be distinguished by the characters given in the above key.

Male.—Length, 4.5 mm.; length of antenna, 3 mm. Anterior margin of the clypeus with a rather deep U-shaped emargination, the lobes narrow and acute; middle fovea rather large, shallow, oval

in outline, and with a tubercle in center; ocellar basin very poorly defined, especially above, hexagonal in outline; postocellar line subequal with the ocellocular line; postocellar area defined laterally by a shallow fovea, very slightly convex, with a median impressed line; antenna strongly tapering, the third joint simple and about one-fourth shorter than the fourth; stigma rather large, obliquely truncate apically, broader near base; first intercubitus wanting; second and third intercubiti subequal in length; second recurrent the length of an intercubitus beyond the second; radiellan cell completely closed, without a distinct appendage; hypopygidium rather acutely pointed. Black; knees, tibiae and tarsi yellowish, apical joint of tarsi brownish; wings smoky brown, to the end of stigma, then subhyaline; venation dark brown.

Redescribd from holotype.

Distribution.—Norway, Maine.

TRICHIOCAMPUS GREGARIUS (Dyar).

Figures 2, 11, 13, 25, 37, 43, 58.

Trichiocampus gregarius DYAR, Can. Ent., vol. 27, 1895, p. 191.—MACGILL-LIVRAY, Bull. 22, Conn. Geol. and Nat. Hist. Surv., 1916 (1917), p. 110.

Type.—Cat. No. 3481, U.S.N.M.

Female.—Length 6.5 mm.; length of antenna 4 mm. Clypeus shining with sparse, setigerous punctures, convex along the median axis, the apical margin broadly arcuately emarginate, the lobes obtuse; supraclypeal fovea punctiform; lateral supraclypeal area flat; ocellar basin practically obsolete, not extending above the anterior ocellus; frontal crest rather prominent medianly, hardly broken; middle fovea shallow, broad; postocellar line distinctly longer than the ocellocular line; ocellocular line longer than the ocelloccipital line; antennal furrows obsolete; postocellar furrow distinct, straight; postocellar area sharply defined laterally, convex and without fovea (in some specimens there is an indication of a slight median furrow); antennae as in figures 13 and 25; stigma short, two and one-third times as long as greatest width, which is at about the middle, from which it tapers sharply to the apex; first intercubitus obsolescent; second cubital cell distinctly longer than the third; second recurrent received at a distance somewhat greater than the length of the second intercubitus from the base of the second cubital; sheath straight above with a short oblique truncation apically and gradually tapering to a broad base; ovipositor as in figures 37 and 43; lancets with three broad teeth at the apex which are slightly emarginate at the middle, then ten regular teeth which are pointed backwards, then two teeth which are pointed backwards and emarginate beneath; the posterior margin of none of the transverse plates armed. Black; tibiae and tarsi

white; the apical joint of the tarsi in some specimens is brownish; wings fuliginous, subhyaline beyond the stigma; venation dark brown.

Male.—Length 5 mm. The above description of the female applies well to the male. Hypopygidium broadly rounded apically, brownish beneath; antennae as in figure 11.

Redescribed from Dyar's type and other specimens from the locations listed below.

Oviposition.—The eggs are laid in two parallel rows of slits one on each side of the petiole. They are 1.5 mm. long and placed directly opposite each other in these rows but each egg has its individual incision. The incision is deeper and the pocket fuller towards the base of the petiole and the opening only extends over the apical two-thirds of the pocket.

Larva.—Length of full fed larva 13 mm. Head above, from eye to eye, frons and apices of mandibles blackish; epicranium about frons, below antennae, epistoma, labrum, mandibles excepting apices, and ventral mouth parts, yellowish to pale brown. Body (fig. 58) pale yellow, with subdorsal, supraalar and faint epipleural black spots. Annulet A pale excepting faint subdorsal spots, without prominent areas and with only a pair of small subdorsal spines, annulets B and C large and thickly spined, the spines grouped upon slightly prominent areas arranged in a transverse row across the dorsum; annulet D bare, narrow, indistinct, pale, without spots or hairs. Epiproct with a pair of subdorsal blackish spots.

Cocoon.—The cocoon is translucent, pale brown, thin walled cell, length 10 mm., width 4 mm.: irregularly oval. Spun in rearing on dirt or leaves at bottom or sides of cage.

Pupa.—Pale, 8.5 mm. long.

Host.—*Populus deltoides* (according to material from Chas. R. Ely) and *Populus tremuloides* (according to Dyar).

Seasonal history.—Gregarious larvae feeding on more or less of the leaf tissue depending on the size of larva, the younger larvae skeletonizing while the larger leave only the principal veins. The number of generations a year has not as yet been determined; prepupae and larvae about fullgrown on July 19 became adults between August 2 and 7.

Distribution.—Keene Valley, New York (Dyar); East River, Connecticut (Ely); Northeast, Pennsylvania (Cushman).

Genus CLADIUS Rossi.

Cladius Rossi, Fauna Etrusca. ed. 2, vol. 2, 1807, p. 27. *Genotype*.—*Tenthredo difformis* Panzer.

On account of its peculiar antenna in the male and because it is represented by such common garden insects the genus *Cladius* has

long been correctly recognized and is one of the few well-known genera of the Tenthredinidae which does not have a synonym. In the larva and in the adult the genus *Cladius* is closely allied to *Priophorus*.

The genus is distributed throughout the Palearctic Region. One species has been described from the northern Oriental Region and there is one species in the Nearctic Region. The fossil *Cladius* recently described by Professor Cockerell should probably be referred to *Priophorus* (p. 36). From our present knowledge it is fair to assume that the genus *Cladius* originated in and is naturally confined to the Palearctic Region. The North American species will probably be found to be an European form and the species from northern India be found to occur only in that portion which is Palearctic.

Generic Characters, Adults.—Clypeus arcuately emarginate; antennal foveae deep, large, extending almost to the eyes; supraclypeal area strongly convex, rectangular in outline; inner margin of the eyes slightly converging below; anterior basitarsus subequal or longer than the three following joints (fig. 3); the male antenna with joints 3, 4, 5, and 6 with apical dorsal projections and with the third joint with a strong basal projection beneath; the antenna of the female short, the third joint compressed, distinctly concave beneath; radiellian cell with a distinct appendage; cerci long and slender; lower margin of lancet strongly curved and armed with eight large teeth; the posterior margin of the lancet plates strongly armed.

Larvae.—See characters in above key. Larvae of only one species available for study, and all characters for genus are taken from this species.

CLADIUS ISOMERUS Norton.

Figures 3, 7, 16, 17, 28, 29, 39, 45, 50, 60, 62-70, 72.

Tenthredo (Cladius) isomera HARRIS, Cat. Ins. Mass., 1835, p. 583, without description.

Cladius isomera NORTON, Proc. Bost. Soc. Nat. Hist., vol. 8, 1861, p. 223; Trans. Amer. Ent. Soc., vol. 1, p. 74.—MURTFELDT, U. S. D. A. Div. Ent. Bull. 22, 1890, p. 78.

Cladius pectinicornis RILEY, Ins. Life, vol. 5, 1892, pp. 6-11, figs. 1 and 2.—DYAR, Can. Ent., vol. 27, 1895, p. 340; Can. Ent., vol. 28, 1896, p. 239.—DALLA TORRE, Catalogus Hymenopterorum, pt. 1, 1894, p. 291.—MARLATT, U. S. D. A. Techn. Ser. 3, Bur. Ent., 1896, p. 19.—CHITTENDEN, U. S. D. A. Bur. Ent. Circ. 105, 1908, pp. 6-9, figs. 3 and 4.

The location of the type of *isomerus* Norton is not definitely known, but it is presumed that the female bearing number 185 in the Harris collection is one of the types; all others are probably lost.

In 1892 Riley synonymized the American bristly rose slug (*isomerus*) with the common European species (*pectinicornis*) and

since then all American authors have followed this synonymy. There seemed to be no good reason for doubting that the American species was the same as the European and the writers were much surprised, when they compared American insects with literature and European specimens, to find that *isomerus* did not agree with *pectinicornis*. *Isomerus* differs from *pectinicornis* in much the same manner as does the European *difformis*, and if the American species is the same as any European species it is synonymous with *difformis*, and not *pectinicornis*, as previously supposed. The United States National Museum contains about fifteen specimens of Cladii from the Palearctic region, and while most of these agree with various species as they are characterized, some few, especially specimens from Japan, do not agree, and it seems that the understanding of the species in Europe is not yet sufficiently stabilized to make it advisable to try to synonymize our American species with any of the European. Until it is possible to carefully compare our American form with authentic European specimens of all the species we prefer to use Norton's name for our species. We have studied very many specimens, collected throughout the range of the species in America, and have observed but little variation. The absence of variation in the number of rami on the male flagellum is especially noticeable. The extent of yellow on the legs is also remarkably constant.

Female.—Length 5 to 6 mm.; length of antenna about 3 mm. Clypeus coarsely punctured, convex, the anterior margin broadly, arcuately emarginate, the lobes narrow and triangular in outline; supraclypeal foveae deep, oval in outline; lateral supraclypeal area convex near the eye, sharply sloping into the antennal foveae; ocellar basin completely wanting; frontal crest strong, broken medianly; middle foveae small, oval in outline; postocellar line nearly twice as long as the ocellocular line; ocellocular line slightly longer than the ocellocipital line; antennal furrows wanting; postocellar furrow complete, well defined, straight, not broken by the furrow from the anterior ocellus; postocellar area sharply defined laterally, very gently convex; antenna as in figures 17 and 28; wings as in figure 7; sheath straight above, truncate apically, oblique to the broad base; ovipositor as in figures 39 and 45; cerci long, slender. Black; tibiae and tarsi white; apices of the posterior tibiae and the apical four joints of the posterior tarsi brownish; wings yellowish hyaline; venation pale brown, costa and the stigma yellowish.

Male.—Length 5 mm. The above description of the female applies very well to this sex except that the four anterior tarsi are usually brown and the costa is not so distinctly yellowish; hypopygium narrowly rounded; antenna as in figures 16 and 29.

Described from numerous specimens taken in the vicinity of Washington, District of Columbia.

Oviposition.—The egg is laid in an incision in the axis of the leaf. The incision is about 1.75 mm. long, enters the axis on the upper side in the middle of the fluting, is slightly deeper apically where it about reaches the center. In the living leaves these egg scars are quite readily observed as the edges of the puncture or rip have a yellow brown, dead, and frayed appearance.

Egg.—Length, 1.25 mm.; greatest width, 0.33-0.4 mm.; yellowish, translucent, soft, gelatine-like, oval, somewhat larger towards the cephalic end, thin skinned, the surface smooth to shiny.

Larva (fig. 72).—In the earlier stages the head and spines are blackish, but as the larva grows the head becomes tan in appearance and the spines white. The head when appearing tan is greenish with tan or pale brown spots (fig. 50); the eyes are in black spots and the frons is spined medianly as well as marginally. The body is pale green, very spiny, and with the elementary canal rather distinct and imparting a green hue to the translucent body. Annulet A smaller than B and C and with but four pairs of spines; annulets B and C largest and with numerous spines; and annulet D smallest, and spineless (fig. 60). The spines group themselves somewhat on rather prominent areas which are arranged in a transverse row across the segment. Legs semitransparent and 4-jointed. Uropods on urites 2-7, urite 8 bare, urite 9 with a pair of small adventral protuberances (doubtless uropods but not developed to the extent of those on urites 2-7) and urite 10 with the postpedes.

LARVAL INSTARS.

The following series of descriptions record the appearance and changes in the larvae of *Cladius isomerus* from stage to stage. A comparison of the mandibles of an early second stage larva and a full-grown larva reveal no fundamental differences. The mandibles of the mature larva being generally larger and their teeth more blunt and appearing worn, while those of the younger larva were long in proportion to their width, with the teeth sharp and fine.

STAGE I (both sexes).—Body length, 2-3 mm.; head, 0.5 mm. high by 0.4 mm. wide. Color: Body translucent white; alimentary canal greenish; legs white; spines long and black on head and body; head pale or faintly grayish; eyespots black.

STAGE II (both sexes).—Body length, 2.5-4 mm.; head, 0.6 mm. high by 0.5 mm. wide. Color: Body whitish green; spines of head and body not conspicuously blackish; head pale yellowish with black eyespots.

STAGE III (both sexes).—Body length, 4.5 mm.; head, 0.75-0.8 mm. high by 0.6-0.7 mm. wide. Color: Body translucent greenish white and shiny; all spines black; body spines longer than those on

vertex of head; head pale grayish yellow, darkened across face between eyes; eyespots black.

STAGE IV (both sexes).—Body length, 5.5–9 mm.; head, 1 mm. high by 0.8 mm. wide. Color: Body pale green; alimentary canal leaf green; spines blackish on head and body; head pale tan darkened across face between eyes; eye spots black.

STAGE V (ultimate male from leaves).—Body length, 7–11 mm.; head, 1.2 mm. high by 1 mm. wide. Color: Body while feeding greenish; later, when feeding is completed and alimentary canal is emptied, leaden white; spines, head, and body whitish; head with brownish freckles; frons pale brownish; mouth parts brownish; eye spots black.

(Ultimate male from cocoon).—Body length, 5.5–6.5 mm. Color: Same as larva above with emptied alimentary tract.

STAGE V (preultimate female).—Body length, 8–10.5 mm.; head, 1.3 mm. high by 1.1 mm. wide. Color: Body greenish white; head tan.

STAGE VI (ultimate female from leaves).—Body length, 11–14 mm.; head, 1.5 mm. high by 1.3 mm. wide. Color: Body greenish white while feeding; later, when finished feeding and alimentary canal is emptied, leaden white.

(Ultimate female from cocoon just spun).—Body length, 12–13 mm. Color: Same as larva above with emptied alimentary tract.

The following table (Table I) records, stage by stage, the change in size of a series of isolated larvae:

Cocoon.—The cocoon is a semitransparent, whitish to pale brown, thin walled cell; 7 mm. long by 3 mm. wide, irregularly oval. It seems to consist of several layers, one complete inner envelope and two or three partial outer envelopes that serve as further protection and at the same time attach more firmly the inner case to the leaf upon which it is spun.

Pupa.—Pale yellow white, length 6 mm. (alcoholic specimen); living specimen described as grayish green; the thorax and end of body slightly yellowish; head whitish green; ocelli brown; eyes black; antennae, wing sheaths and legs white, with a slight green tinge. Darkened pupa, 6 mm. long; head and thorax black, excepting legs and wing pad, which are yellow; abdomen dark brown.

LIFE AND SEASONAL HISTORY.

The studies which furnished information on the stages likewise afforded an opportunity for observations to be made on the length of the various stages and periods. Observations of this character could hardly be made under natural conditions because the variation in emergence of overwintering adults, coupled with the difference in length of life under varying conditions, makes it but a short while before all forms of the insect, especially all stages of the larvae, may be found in the rose garden at the same time.

The following table is summary of the notes made upon the length of the various periods and stages of eleven larvae of the second generation. These larvae were under close observation during their entire life, and since comparisons indicate that the life-cycle of the preceding and succeeding generations (excepting the resting stage of the overwintering generation, which is longer) is approximately the same, the table will serve to represent the average (in days).

TABLE II.

Subletter.	Sex.	Incubation period.	Length feeding period.	Stages.				V. Ultimate male.	V. Preultimate female.	VI. Ultimate male.	Length cocoon period.	Total length life.
				I.	II.	III.	IV.					
a.....	Female....	8	12	2	2	1	2	.....	3	2	10	30
b.....	* Female....	8	13	2	2	1	1	.....	.....	.....	.....	.....
c.....	Female....	8	13	2	2	1	1	.....	.....	.....	.....	.....
d.....	Male.....	8	11	2	2	2	2	.....	3	.....	.....	.....
e.....	*.....	8	.....	2	2	2	.....	.....	.....	.....	.....	.....
f.....	*.....	8	.....	2	2	2	3	.....	.....	.....	.....	.....
g.....	Female....	8	12	2	2	1	2	.....	.....	.....	.....	.....
h.....	*.....	8	.....	2	2	1	.....	.....	.....	.....	.....	.....
i.....	Male.....	8	11	2	2	1	.....	.....	.....	.....	.....	.....
j.....	Male.....	8	11	2	2	1	2	.....	3	.....	11	30
k.....	Male.....	8	11	2	2	1	2	.....	3	.....	11	30

* Larva died.

Upon hatching the larva does not eat the skin of the egg but leaves it in the puncture. Besides shedding and changing its dimensions as described under "Larval Instars", the larva characterizes its advance, somewhat by a difference in the extent of its feeding. The larvae during the first two stages, skeletonize small separate splotches usually from the underside of the leaflet. Late in the second stage or early in the third the larvae begin to cut holes through the leaflets. By the fourth stage the holes are cut clear through to the margin of the leaf and some of the edge is eaten, including small veins. The fifth stage larvae feed on the entire leaf, usually stopping only for the heavy midrib and bases of the larger veins.

When full grown the larva stops feeding and crawls about searching a place suitable for cocooning, in the meantime evacuating by the usual method, its alimentary tract. During this process it changes in appearance from greenish white to a yellow or a leaden white but neither sheds nor otherwise changes in character. The cocoon is spun in the leaves, usually in a curled leaflet.

In the foregoing table, as in the description of "Larval Instars", the male and female fifth stages are made separately and the sixth stage is represented only in the female. This treatment indicates an influence of sex upon the number of larval stages which is worthy of especial mention. The male larvae have one less stage than the female. In the fifth stage of the male (which is comparable with the fifth stage of the female in size, proportions, and other characters) the male larva feeds, empties his elementary tract, and without shedding spins his cocoon. The female larva, however, sheds to become larger, feeds again, and without shedding in this sixth stage, spins her cocoon. Thus the male larva has five instars while the female has six. Another interesting feature which was discovered in the study of this insect's development in the absence of a distinct prepupal stage. In this respect not only is the spinning stage identical in appearance with the feeding form but there is neither a shedding of the skin nor a loss of hairs between feeding and cocoon spinning, during the spinning nor after it until pupation occurs. This is a peculiarity of note especially in view of the striking changes usually exhibited in the sawflies previous to spinning. In the Nematinae, a subfamily close to and much like the Cladiinae, this prepupal stage is clearly defined. Of what significance this change from the usual method of development of sawflies is, the authors hesitate as yet to form an opinion.

The following information was obtained from notes made on a number of larvae of both the first and second generations during the period between the molting of the penultimate stage and the emergence of the adult. This period is divided into several portions;

first, the ultimate stage feeding period varying from 2 to 3 days in length and averaging 2.6 days for both males and females of both the first and second generations; second, the ultimate stage between feeding and spinning, a short time occasionally as long as a day; third, the period spent between the spinning of the cocoon and the appearance of the pupa, five and six days respectively in the two opportunities in which the appearance of this stage was noted; and fourth, the pupal period, 3 days in both instances noted. The total length of the cocoon period, or the time spent between spinning and adult emergence is shorter for the first generation, being 8-9 days in length and the sex of the individual does not seem to be associated with the variation in the length of the period, however, the second generation ranges from 10-11 days which variation is associated with the individual sex as follows: Ten days for the females and 11 days for the males.

BEHAVIOR.

The adults of this sawfly are restless in nature but more so in captivity, spending most of their time trying to escape. If jarred or disturbed while on a leaf or twig, both sexes fall to the ground, fold their legs, wings, and antennae, close their bodies and remain motionless, a common habit among sawflies.

For this reason, observations on the habits and functions were difficult to make, and at best somewhat superficial and wanting in detail and exactness. The following notes on mating and oviposition, however, were deemed worthy of publication.

Mating.—A female from one isolation cage where she was reared without access to a male and a male from another were placed in the same vial—at first they paid no attention to each other, but later the male became much agitated and when in close proximity to the female exerted his genitalia and endeavored to grasp the female with the harpes. In a few attempts he was unsuccessful, but after the first few trials the female became more submissive and remained quiet, not avoiding the male. A few seconds later a union was effected. It was very short, and with the exception of motion of apical part of abdomen the insects were motionless. On completion the female was the first to show desire to break away, and pushed her ovipositor down against the top of the abdomen of the male. When the male left the female, he remained quiet for a few seconds and again resumed his activity. No other attempt of mating was observed. The position normal for Nematinae was the one assumed.*

Oviposition.—The eggs of *Cladius isomerus* are laid in the midrib of the leaf from the upperside and in the middle of the fluting. Upon arriving at a favorably considered place for oviposition the

*The Mating Habits of Some Sawflies, S. A. Rohwer, Proc. Ent. Soc. Wash., vol. 17, 1915. pp. 195-8.

female bends the apex of her abdomen well under—exerts her ovipositor slightly from the sheath and endeavors by a posterior sliding motion to catch it in the stem tissue. Once caught she works her lancets until the slit is well under way, then she raises her abdomen, completing the exertion of her ovipositor and exposing both the lancets and the lance to view. The lancets are worked opposite each other up and down, by a somewhat rolling (side to side) motion of the apical tergites of the abdomen, while the lance seems to act as guide, brace, and track for the moving lancets. This part of the work is continued anteriorly until the ovipositor is buried in the tissue and the sheath once again is in contact with the stem. A short period of work follows during which the ovipositor is probably withdrawn from the slit and recased in the sheath, and the egg laid. The abdomen is then swung back, its apex in contact with the stem, until the slit is passed, then it is straightened to the normal position and the female moves to the next location to be favored with an egg.

The following table records the number of eggs laid on each of several days, and the number and sex of these insects present in the cage at the time of oviposition and the result of the day's oviposition.

TABLE III.

Cage No.	Date.	Variety of rose.	Parent adults.	Parent adults generation.	Results.		
					Eggs.	Larvæ.	Adults.
13694 b ¹ ..	1918. May 22	Conrad F. Myers.	3 females, 6 males	Second....	12	11	3 females, 3 males
13694 b ² ..	May 23	Frau Karl Druschki.	4 females, 5 males	do.....			
13694 b ³ ..	May 24	Killarney.....	3 females, 6 males	do.....	2	1	1 male.
13694 b ⁴ ..	May 25	A. R. Waddell..	2 females, 4 males	do.....			
13694 d ¹ ..	June 22	Killarney.....	3 females, 4 males	Third.....	35	28	
13694 d ² ..	June 23	General Jacqueminot.	do.....	do.....	19	19	
13694 d ³ ..	June 24	Kaiserina Augusta Victoria.	3 adults.....	do.....			

The number of eggs a female adult of the bristly rose slug can lay has not been recorded, but the abdomen of a virgin female killed four days after emergence contained 41 eggs. One of the females which died and was removed from the second cage (see Table III) was likewise dissected and 28 eggs were counted from her abdomen. It was, however, impossible to ascertain the condition of these eggs as far as the maturity was concerned owing to their poor preservation.

Egg Slit.—The eggs are laid in short slits in the fluting of the upper surface of the midrib of the leaf and early in their incubation period are concealed in the slit or pocket and covered over with a yellowish white sawdust or ovipositor-torn fiber. During the period of incubation they increase in size until the day previous to the hatch-

ing of the larvae; they are yellow green in color and so much swollen as to protrude from the slit. The puncture itself becomes more distinct, as a brownish scar, with age.

METEOROLOGICAL NOTES.

All life has its optimum conditions for growth and also its maximum and minimum requirements and limits for existence of each of the various factors that go to make up those conditions. The extreme heat and humidity of a part of the summer of 1918 gave an excellent opportunity for observing the effect of high temperatures on this species. The following account is from notes made by S. A. Rohwer.

After a maximum temperature of 105.5° and a minimum of 76° with the humidity varying from 32° to 83° and including a period of between 10 to 12 hours when the humidity was 80° or more,¹⁰ but few larvae were found in the rose garden, and these "sicklooking" and not feeding. Three days before a large number of young and partially developed larvae were observed on these plants. Further, there was no mature feeding work done at this date, proving that the larvae had not completed development. The variation of temperature and humidity between the position occupied by the larvae and that of the hygrothermograph was considerable, the latter recording air temperature as 92° and humidity as 54° while a sling psychrometer at the former location read 99.5° temperature and 73° humidity. Later records of the same day showed 104° temperature and 40° humidity by the hygrothermograph and 106° temperature and 43° humidity by the sling psychrometer with all larvae gone.

This hot spell was of slightly over a week in duration and the summary of the temperature for the first six days as recorded by the hygrothermograph is as follows:

6.25 hours above 100°		53.0 hours below 75°
12.5 hours above 95°		9.75 hours below 70°
26.5 hours above 90°		0 hours below 63°
80.5 hours below 80°		

Following this period of excessive temperature and high humidity, *Cladius* larvae were rare and remained scarce throughout the rest of the year, whereas earlier in the season they had been quite abundant.

PHENOLOGICAL NOTES.

The seasonal phenomena of development for plants are often of much importance in indicating the appearance of or the approach of a particular stage of an insect. In the bristly rose slug, however, the

¹⁰ Records from a hygrothermograph located a few feet from the rose garden and about 4 feet above the ground. The long period of high humidity was recorded the day before these observations.

irregularity of emergence and the overlapping of the generations reduces the value of such observations to the minimum of first appearance. Observations made during the years 1916 to 1919 indicate that in the vicinity of Washington, District of Columbia, the parent adults of the first generation of the bristly rose slug appear coincident with the full blooming of the Snowball (*Viburnum opulus* and *V. plicatum*) and the weigela (*Diervilla florida*).

HOSTS.

From observations by Mr. Rohwer, made during two seasons on the roses at the Eastern Field Station, from notes sent by correspondents, and from field studies by Mr. Rohwer and the author at Falls Church, Virginia, and many other places throughout the range of this species' distribution, it seems fair to conclude that *Cladius isomerus* will attack all cultivated varieties (and species) of rose. Varieties with a small midrib or forms with hairy leaves, while not immune, are not favorable food plants. The one essential is, however, a midrib of sufficient size to hold the eggs. Preliminary observations indicated that certain varieties seemed to be preferred but more extended study proved that the condition of the leaves was a more important factor. There are a few authentic records of the species living on the common eastern wild rose (*Rosa palustris* Marsh), but the evidence seems to indicate that where cultivated roses are present they are preferred.

The following list gives the varieties of cultivated roses on which larvae have most frequently been observed.

Climbers.—*Rosa multiflora*, Dorothy Perkins, Philadelphia Crimson Rambler, Climbing Baby Rambler.

Hybrid perpetuals.—Paul Neyron, Conrad F. Meyer, General Jacqueminot, Clio, Camille de Rohan.

Tea.—Radiance, La Tosca, Killarney, White Killarney, Frau Karl Druschki, Mrs. A. R. Waddell, Stanley, Hadley, Mrs. Aaron Ward, Kaiserin Augusta Victoria, Marquise de Querhoent, Gruss an Teplitz, Laurent Carl.

PARASITES.

Two parasites are recorded in literature as having been reared from *Cladius isomerus*. They are:

Frontina tenthredinidarum Townsend.¹¹

Coelopisthoidea cladiae Gahan.¹²

Neither of these parasites are, however, sufficiently abundant to be considered as a successful means of control.

¹¹ Tothill, Can. Ent., vol. 45, 1913, p. 73.

¹² Gahan, Can. Ent., vol. 45, 1913, p. 103.

Genus *PRIOPHORUS* Dahlbom.

Priophorus DAHLBOM, Conspect. Tenthredin. Scan., 1835, p. 4. Genotype.—(*Priophorus pilicornis* Dahlbom) = (*Trenthredo*) *Priophorus padi* (Linnaeus).

Stevenia (Lepelletier MSS.) BRULLÉ, Hist. Nat. Ins., Hymen, vol. 4, 1846, p. 667.

No species were included by name in Brullé's account, but it is evident that his remarks apply to the species now known as *Priophorus* (*varines* (Lepelletier)) = *padi* (Linnaeus), so *Stevenia* is isogenotypic through synonymy with *Priophorus*.

The genus *Priophorus* was first described by Dahlbom as a subgenus of *Nematus*. Later, Hartig placed it in his genus *Cladius* and made it a subgenus of *Cladius*. Until recently it has been treated as a subgenus of *Cladius*, but Konow, Enslin, and MacGillivray considered it as of generic value. All the species known to us are closely allied to the species of the genus *Cladius*, but the larva and antenna are different, so it seems advisable to consider it as a separate group. For the time being, at least, we prefer to treat it as a genus.

Generic Characters—Adults.—Clypeus slightly emarginate; supra-clypeal area strongly convex, almost keel like, rectangular in outline; lateral supra-clypeal area narrow, sloping to the large antennal foveae; the inner margins of the eyes subparallel; anterior basitarsus longer than or subequal with the three following joints, which are not sharply separated from each other (fig. 4); wings about as in figure 6; radiellian cell usually without an appendage but occasionally with a short distinct appendage; cerci medium; lower margins of the lancets curved, armed with eight teeth; posterior margins of all the lancet plates heavily armed; female antenna long, slender, the third joint simple; male antenna long, slender, the third joint usually simple but occasionally with a strong projection at the base beneath.

Larvae.—Characters common to the larvae of this genus studied; Head (figs. 51, 55, 56) mostly pale-yellow freckled; eye spots black; vertex black; frons and labrum pale brown, the former spined medianly as well as marginally. Thorax, dorsum darkened from A mesothorax to and including C metathorax (D metathorax?) and sometimes the entire dorsum from A mesothorax to and including C (D?) of urite 9 darkened (fig. 73). Annulet A smaller than annulet B and C and spined, annulet B and C large and thickly spined, and annulet D bare, narrow, indistinct, and unspined (fig. 61). Uropods normally developed on urites 2-7; urite 8 with pair of small but distinct adventral protuberances; urite 9 with similar but smaller, less distinct protuberances. (These structures on urites 8 and 9, as those on urite 9 of *Cladius*, are doubtless uropods which, since the larvae are surface feeders and do not grip the leaf by curling the apex of the abdomen, are retained, though not developed by much use.)

Distribution.—The species of this genus are distributed throughout the Palaearctic Region; one is known from the northern Oriental Region; and several occur in Nearctic Region, where they are confined almost entirely to the eastern part of the Transition and Canadian Zones.

Specific Characters.—In the adults the shape of the sheath, the exact dentation of the lancet plates, the character of the frontal crest, and the presence or absence of foveae in the postocellar area offer the best structural characters for separating the species. The color of the legs, even to the number of tarsal joints which are black or infuscated, is very useful in separating the species, and for all of the species here treated it is found to be surprisingly constant.

KEY TO THE ADULTS.

The species *petrinus* (Cockerell) and *infuscatus* (MacGillivray) are omitted from the following key (see also footnote 1):

1. Females -----2
Males -----11
2. Lower walls of ocellar basin strong, keel-like, sharply broken by the middle fovea, the lateral walls sharply defined, linelike; postocellar area separated by a median furrow; wings with a dusky band below the stigma; antennae long, sharply tapering; trochanters white-----*crataegi* Rohwer.
Lower walls of ocellar basin not especially strong, rounded, not or only feebly broken by the middle fovea; the lateral walls obsolete or poorly defined; postocellar area convex, with, at most, a fovea anteriorly-----3
3. Postocellar area without a fovea near the middle of the anterior margin----4
Postocellar area with a fovea near the middle of the anterior margin-----8
4. Distinct large, somewhat triangular-shaped depression in front of the anterior ocellus; hind tarsi and all of the trochanters black--*betulae* Rohwer.
No large or triangular-shaped depression in front of the anterior ocellus---5
5. Recurrentella distinctly postfurcal-----*rubivorus* Rohwer.
Recurrentella antefurcal-----6
6. Wings before of the anterior margin of the stigma, brownish; trochanters and hind tarsi brownish black-----*salicivorus* Rohwer.
Wings uniformly hyaline; trochanters and hind tarsi white-----7
7. Middle fovea deep, large-----*solitarius* (Dyar).
Middle fovea practically obsolete-----*montanus* Rohwer.
8. Trochanters black; ocellar basin entirely obsolete; frontal crest unbroken; sheath oblique above, obtusely rounded apically, tapering to a broad base; antennae long, slender, sharply tapering apically-----*rubi* Rohwer.
Trochanters white; at least the lower wall of the ocellar basin distinctly present-----9
9. Frontal crest not broken medianly; antennae slightly shorter and not strongly tapering; wings brownish basally-----*pruni* Rohwer.
Frontal crest broken medianly; antennae slightly longer and sharply tapering apically-----10
10. Wings strongly brownish basally-----*virginianus* Rohwer.
Wings uniformly hyaline-----*plesius* Rohwer.
11. Postocellar area with a small distinct fovea at the anterior middle; trochanters white; hind tarsi mostly white-----12
Postocellar area without a fovea at the anterior middle; trochanters and hind tarsi brownish-----13

Described from one female reared from a larva collected on *Crataegus* by Chas. R. Ely, and recorded under Bureau of Entomology Number, Hopk. U. S. 13649*.

Type.—Cat. No. 21587, U.S.N.M.

Larva.—Length 10 mm. similar to and with apparently no characters distinguishing it from that of *P. pruni* Rohwer. All the larvae examined were quite dark, blackish along the dorsum.

Host.—*Crataegus*, species.

Seasonal History.—Larvae, collected in early July, became prepupae and spun cocoons by the twenty-seventh, from which adults had emerged August third.

PRIOPHORUS BETULAE Rohwer, new species.

Figure 51.

Female.—Length 3.5 mm.; length of the antenna about 3 mm. Clypeus shining, almost without punctures, not strongly convex basally, the anterior margin rather deeply, arcuately emarginate, the lobes nearly triangular in outline; supraclypeal foveae deep, punctiform; middle fovea shallow, wedge-shaped in outline; antennal furrows poorly defined along the ocelli; ocellar basin obsolete laterally, the lower wall rounded, broken; a distinct triangular depression in front of the anterior ocellus; postocellar area sharply defined laterally, convex, without foveae; postocellar furrow wanting; postocellar line subequal with the ocellocular line; antenna rather short, not sharply tapering, the third joint distinctly shorter than the fourth, the apical joint slightly shorter than the preceding; stigma rounded below, obliquely truncate apically; first intercubitus obsolescent; the third cubital on the radius distinctly shorter than the second; radiellian cell with a very short appendage; sheath obtusely pointed apically, straight above, tapering to a broad base. Black; the four anterior tibiae and tarsi (the apical joints of the intermediate tarsi are infuscated), and the basal two-thirds of the posterior tibiae white; wings strongly brownish, subhyaline beyond the apex of the stigma.

Male.—Length 4.5 mm.; length of the antenna 3.5 mm. In structure and color the above description of the female applies well to the male, except the middle fovea is smaller with more sharply sloping walls and the radiellian cell is entirely without an appendage; hypopygidium broadly rounded apically; antenna very hairy, the third joint considerably shorter than the fourth, concave below and very faintly produced basally so it is fully as broad at the base as the pedicel, the entire joint one-fifth broader than the fourth; the apical joint distinctly shorter than the preceding.

Type locality.—East River, Connecticut.

Described from two females (one type) and two males (one allotype) reared from larvae collected on *Betula populifolia* by Chas. R. Ely, and recorded under Bureau of Entomology Number Hopk. U. S. 10754^{e2} (type and allotype) and 10757^t (paratypes).

Type.—Cat. No. 21588, U.S.N.M.

Larvae.—Similar to *P. pruni* Rohwer but in the few specimens available for study, entirely pale excepting a faint grayness laterally on the mesothorax and metathorax and ninth abdominal segment. These larvae, however, were young, the largest being only 6.5 mm. in length.

Host.—*Betula populifolia*.

Seasonal History.—Solitary feeders from the underside of the leaf similar to *P. pruni* Rohwer. Larvae collected about one-half or two-thirds grown on August 25 spun cocoons August 30 and transformed to pupae September 4. The adults emerged September 16.

PRIOPHORUS RUBIVORUS Rohwer, new species.

A small species readily distinguished by the postfurcal recurrentella. The eastern *rubi* is much larger and is very easily separated by the presence of a median fovea in the postocellar area.

Female.—Length, 4.5 mm.; length of antenna about 3 mm. Clypeus gently convex, the anterior margin not depressed, broadly and very shallowly emarginate, lateral angles (no distinct lobes) obtusely rounded; supraclypeal foveae deep but not distinctly separated from the antennal foveae; middle fovea very shallow, elongate, not sharply defined or breaking through the crest; ocellar basin very poorly defined, the walls obsolete above and broadly rounded below; antennal furrows obsolete opposite the ocellar basin; a rather distinct, small depression both immediately before and behind the anterior ocellus; postocellar line subequal with the ocellular line; postocellar furrow wanting; postocellar area without a median fovea on anterior margin, sharply defined laterally by the slightly diverging vertical furrows; antenna rather short, tapering, the third and fourth joints subequal stigma short, broad, but little more than twice as long as greatest width, rounded below; first intercubitus obsolete; three abscissae of radius subequal in length; second cubital cell on radius about two and one-third times as long as third intercubitus; radiellian cell closed and with a short appendage; recurrentella postfurcal by about half the length of intercubitella; sheath broad, pointed apically. Black; palpi dark brown, tegulae almost entirely black; hind trochanters, tibiae and tarsi, except the infusate apices of hind tibiae and apical joints of all tarsi, yellowish-ferruginous; wings hyaline; venation brown.

Type locality.—Portland, Oregon.

Described from a single female recorded under Bureau of Entomology number Quaintance 14055 collected by E. J. Newcomer, August 10, 1917 and labeled "On raspberry."

Type.—Cat. No. 23557, U.S.N.M.

PRIOPHORUS SALICIVORUS Rohwer, new species.

Figures 20, 21, 34, 35, 41, 47, 56.

Female.—Length 4.5 mm.; length of antenna 3.5 mm. Clypeus shining, strongly convex medianly, the apical margin broadly, shallowly, arcuately emarginate; supraclypeal foveae punctiform, small, not much deeper than the antennal foveae; middle fovea oval in outline; ocellar basin with the lateral walls obsolete, the lower wall poorly defined, rounded and unbroken; antennal furrows obsolete below the ocelli; postocellar area gently convex (incompletely defined laterally by a foveaeform depression); postocellar furrow obsolete; a faint depression behind the anterior ocellus; antennae as in figures 20 and 34, short, not tapering, the third joint distinctly shorter than the fourth, the apical joint subequal with the preceding; first intercubitus obsolescent; third cubital cell on the radius, slightly longer than the second; stigma short, broad at base, gradually tapering to the apex; radiellian cell with a short distinct appendage; sheath straight above, sharp apically tapering from the broad base, as seen from below the sheath is narrow, ovipositor as in figures 41 and 47. Black; four anterior tibiae and tarsi (the apical joints and all of the intermediate tarsi are brownish) and the basal two-thirds of the posterior tibiae, extreme base of the posterior basitarsus, whitish; wings strongly brownish basally, subhyaline beyond the apex of the stigma.

Male.—Length, 4 mm. The male differs from the above description of the female in having the middle fovea more elongate and deeper, breaking completely through the lower wall of the ocellar basin; hypopygidium narrowly rounded; posterior tibiae entirely brownish; antennae (see figs. 21 and 35) pale beneath, the third joint broader than the fourth but simple; radiellian cell with a very short appendage.

Type locality.—East River, Connecticut.

Described from three females (one type) and two males (one allotype) reared from larva collected on *Salix* by Chas. R. Ely, and recorded under Bureau of Entomology number Hopk. U. S. 13656^a.

Type.—Cat. No. 21589, U.S.N.M.

Larva.—Length, 11 mm. Black spot at vertex small; black spot about each eye also small and not extending more than half way to edge of cranium (fig. 56). Otherwise the larvae are similar to those previously described, with dorsum pale between the grayish thorax and the markings on eighth and ninth urites.

Host.—*Salix*, species.

Seasonal History.—Larvae collected July 27, cocooned August 5, transformed to pupae August 21, emerging as adults August 24.

PRIOPHORUS SOLITARIS (Dyar).

Cladius solitaris DYAR, Can. Ent., vol. 27, 1895, p. 192 and p. 340.

Priophorus solitaris DYAR, DYAR, Journ. N. Y. Ent. Soc., vol 8, 1900, p. 28.—
MACGILLIVRAY, Bull. 22, Conn. Geol. Nat. Hist. Survey, 1916 (1917),
p. 110.

Type.—Cat. No. 4129, U.S.N.M.

Female.—Length, 5 mm. Clypeus flat, anterior margin sub-squarely emarginate, the lobes triangular, obtusely rounded; supra-clypeal foveae deep, punctiform; middle fovea broad, shallow; ocellar basin obsolete laterally, the lower wall rounded, faintly broken; antennal furrows obsolete below the ocelli; postocellar area flat, sharply defined laterally with a faint longitudinal line medianly; postocellar furrow feebly defined; antennae broken but apparently long, slender; first intercubitus obsolete; second and third cubital cells subequal on the radius; stigma long, narrow, broader at base, gradually tapering to the apex; radiellian cell with a very short appendage; sheath straight above, gradually rounded to the broad base. Black; trochanters, four anterior tibiae and tarsi, the posterior tibiae except apices and the posterior tarsi except the apices of the joints, white; wings uniformly subhyaline, venation pale brown.

Redescribed from the unique type.

The following description is arranged from Dyar:

Larva.—Solitary feeder, eating the parenchyma of the leaf from the underside.

STAGE III.—Head round; shining black pilose, width, 0.5 mm.; thorax a little enlarged, thoracic feet faintly yellowish tinged; abdominal feet slightly spreading, segments distinct, rather faintly three annulate;¹³ annulet first small, second and third with many pale setae, so that the larva is pilose or hairy; color, translucent whitish, with no yellow tint; the food gives a dark green broad line by transparency, as far as joint twelve, in joint thirteen the fascies show black.

STAGE IV.—Head pale whitish, with a black shade at side and vertex; width .8 mm.; body whitish, with a faint greenish tinge, densely hairy; the tubercles slight; alimentary canal gives a dark shade.

STAGE V.—Head greenish, thickly dotted with brown; a confluent black patch on clypeus, over eye and above and behind it; or a patch

¹³ Doubtless 4 annulate with A, B, and C visible and haired while D is hidden—annulet first probably A, second and third probably B and C.

at vertex and another on side covering the eye and reaching to the back of head; head shining, pilose; mouth brown, width 1 mm.; dorsal region of body olivaceous blackish; joint second anteriorly¹⁴ subventral region,¹⁵ venter, feet, and joint thirteen¹⁶ posteriorly translucent whitish, not shiny; body pilose, the hairs arising from thickly placed pale tubercles on each of the three annulets; hairs rather short and pale.

Cocoon.—Double, made of white or brownish silk, large and resembling thin paper.

Host.—*Alnus*, species.

PRIOPHORUS MONTANUS Rohwer, new species.

Closely allied to *solitaris* (Dyar), but is somewhat larger and more robust and the middle fovea is practically obsolete.

Female.—Length, 5.5 mm.; length of antenna about 3.75 mm. Clypeus rather distinctly convex medianly, the apical margin broadly acutely emarginate, not depressed; supraclypeal foveae large, deep; middle fovea very shallow and indistinctly defined, practically obsolete, not breaking through the crest; ocellar basin obsolete dorsally, the lower wall very poorly defined, rounded; a very small U-shaped depression in front of the anterior ocellus; antennal furrows obsolete; postocellar area without a pit in the anterior middle, distinctly limited laterally by the nearly complete vertical furrows; postocellar furrow wanting; postocellar line distinctly longer than the ocellular line, but not quite twice as long as the ocellocipital line; antenna rather long, slender, distinctly tapering apically, the third and fourth joints subequal in length; stigma rather large, angled near base then rapidly tapering to apex, about two and one-third times as long as greatest width; first intercubitus obsolete; first abscissa of radius longer than the second and subequal in length with the third; second abscissa of radius not quite twice as long as the third intercubitus; radiellian cell closed and with a short appendage; recurrentella distinctly antefurcal; sheath broad, rounded apically. Black; tegulae brownish; apical joints of palpi, tibiae and tarsi except the infusate apical joints (posterior ones more broadly) and hind trochanters, yellowish; wings uniformly dusky hyaline; venation brown, except the costa and base of cubitus which are pale brown.

Type locality.—Belgrade, Montana.

Described from three females (one type) collected July 14, 1909, and sent in under number 228 by an unknown collector.

Type.—Cat. No. 23558, U.S.N.M.

¹⁴ Mesothorax.

¹⁵ Epipleural, pleural, and hypopleural regions.

¹⁶ Urte nine.

PRIOPHORUS RUBI Rohwer, new species.

Female.—Length 6 mm.; length of the antenna 4 mm. Clypeus flat, shining, slightly convex in the basal middle, anterior margin rather deeply arcuately emarginate; lobes triangular in outline, rather sharply pointed; supraclypeal foveae deep, punctiform; middle fovea shallow, circular in outline; ocellar basin entirely wanting; antennal furrows nearly complete; a small wedge-shaped depression in front of the anterior ocellus; postocellar line subequal with the ocellocular line, and but little shorter than the ocellocapital line; postocellar area convex, sharply defined laterally, with a small fovea in the anterior middle; postocellar furrow wanting; antenna rather short, sharply tapering; the third joint distinctly longer than the fourth; the apical joint somewhat longer than the preceding; stigma short, rounded below, its greatest width at about the middle; first intercubitus obsolescent; second cubital cell on the radius subequal with the third; radiellian cell with distinct appendage; sheath straight above, obtuse at apex, tapering from the broad base. Black; anterior tibiae and tarsi, the posterior tibiae and most of the posterior tarsi white; posterior margin of the tegulae whitish; wings hyaline, iridescent, venation dark brown.

Type locality.—Northeast, Pennsylvania.

Described from one adult which was reared from a larva collected on Blackberry. This larva formed a cocoon on June 11, was a pupa on June 16 and an adult on the 23 and emerged on the 24. Material collected and reared by R. A. Cushman.

Type.—Cat. No. 21594, U.S.N.M.

Another female of this species was collected at Hamburg, New York, June 14, 1911, by M. C. Van Duzee.

PRIOPHORUS PRUNI Rohwer, new species.

Figures 15, 22, 32, 33, 48, 55, 61, 73.

Female.—Length 5 mm.; length of the antenna 4 mm. Clypeus gently convex, shining, not prominent in the basal middle; the anterior margin broadly, shallowly, arcuately emarginate; the lobes short and obtuse, apically; supraclypeal foveae punctiform, middle fovea elongate, deep, with sloping walls, not breaking through the frontal crest; lower wall of ocellar basin defined, the lateral walls are obsolete; antennal furrows wanting below the ocelli; postocellar area flat, sharply defined laterally, with an elongate fovea in the anterior middle; postocellar furrow wanting; postocellar line slightly shorter than the ocellocular line; antenna short, the third and fourth joints subequal, the apical joint subequal with the preceding (see figs. 15 and 33); stigma short, broadest at base, gradually tapering to the apex; first intercubitus obsolescent; second cubital on

the radius distinctly shorter than the third; radiellian cell without an appendage; sheath oblique above, sharply pointed apically and tapering to a broad base; lancet as in figure 48. Black; trochanters, the four anterior tibiae and tarsi, the posterior tibiae except apices, and the first four joints of the posterior tarsi, white; wings fuliginous, subhyaline beyond the apex of the stigma.

Male.—Length 4.5 mm.; length of the antenna 3 mm. Hypopygidium broadly rounded. The above description of the female applies well to the male. The antenna (see figs. 22 and 32) are slightly brownish beneath.

Type locality.—East River, Connecticut.

Described from two females (one type) and two males (one allotype), reared from larvae collected on *Prunus serotina* by Chas. R. Ely, and recorded under Bureau of Entomology number Hopk. U. S. 13660 i.

Type.—Cat. No. 21595, U.S.N.M.

Oviposition.—The eggs are placed in punctures in the midrib of the leaf.

Larva.—(Fig. 73.) Length of full fed larva, 11 mm. Head pale, tan freckled; frons and labrum tan; clypeus, ventral mouthparts, mandibles and cranium about antennae pale; black spot about eye large, extending posteriorly almost to cranium; black spot at vertex large (fig. 55). Thorax with mesothorax and metathorax darkened dorsally from above epipleurite gray to almost black, age and size of the larva increasing the extent and depth of the color. Abdomen of young larvae almost entirely pale excepting grayish dorsum of eighth and ninth urites. In larger larvae the dorsum of the eighth and ninth urites is gray or blackish, where gray, the dorsum of the abdomen is pale, where blackish, the dorsum of the abdomen is gray. Annulet A with from 4 to 6 pairs of small spines, annulets B and C with numerous spines arranged in clusters forming transverse rows across the dorsum, and annulet D narrow, indistinct, and without spines (fig. 61).

Cocoon.—Length 8 mm.; width 3 mm. Transparent, pale brown, thin walled, irregularly oval, attached to leaves, dirt, or side of rearing cage.

Host.—*Prunus serotina*.

Parasites.—Mesoleptine pupae found in cocoons (determined by S. A. Rohwer).

Seasonal history.—Solitary feeders, the young larvae skeletonizing the leaf from the under surface while the older larvae eat holes through from the under side. Larvae collected August 16th, spun cocoons August 21, and transformed to pupae August 25th, emerging as adults August 30th. September 2d of the same year more larvae

were collected. These spun by September 12th, but did not emerge as adults until April 13th of the following year.

PRIOPHORUS AEQUALIS (Norton).

Cladius aequalis NORTON, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 78.

Priophorus aequalis (Norton), KIRBY, List Hym. Brit. Mus., vol. 1, 1882, p. 101.—MACGALLIVRAY, Bull. 22, Conn. Nat. Hist. Geol. Survey, 1916 (1917). p. 109.

A single male, with apices of antennae wanting and right fore wing on pin, without locality label but a name label in Norton's handwriting, is in the collection of the Academy of Natural Sciences of Philadelphia. This specimen agrees perfectly with the original description and is with but little doubt from the type series. It may be designated as electotype.

The species is closely allied to *pruni* but may be easily separated by the middle fovea breaking through the crest. It agrees well with the species here described as *virginianus*, and it is not unlikely that it will prove to be the male of that species.

Male.—Length, 5.5 mm. Anterior margin of the clypeus broadly, shallowly, arcuately emarginate; lobes small and obtuse; median fovea deep, well defined, elongate, breaking through the frontal crest; ocellar basin obsolete dorsally; a faint impression in front of anterior ocellus; antennal furrows present but not strong; postocellar area very narrow, distinctly limited laterally, and with a distinct median fovea anteriorly; postocellar furrow wanting; third antennal joint distinctly shorter and slightly broader than the fourth, with a faint swelling at base beneath; stigma rather broad, about three times as long as greatest width which is at base and from which it tapers to apex; first intercubitus obsolescent; first abscissa of radius shorter than the second, which is subequal with the third; second cubital on the radius about two and one half times as long as third intercubitus; second recurrent distinctly before the middle; radiellen cell closed and with a short appendage; hypopygidium broadly rounded apically. Black; palpi, four posterior trochanters, four anterior tibiae and tarsi, posterior tibiae and tarsi, except apical tarsi and apices of tibiae which are brownish, whitish; anterior femora reddish beneath; wings brownish to apex of stigma, then hyaline; venation dark brown.

Description of above-mentioned specimen.

Distribution.—Farmington, Connecticut.

PRIOPHORUS VIRGINIANUS Rohwer, new species.

It is not unlikely that more material will prove that this is the undescribed female of *aequalis* (Norton).

Female.—Length 5 mm.; length of the antenna 4.25 mm. Clypeus strongly convex medianly; anterior margin broadly, arcuately emar-

ginate; the lobes very obtuse; supraclypeal foveae deep, nearly circular in outline; middle fovea elongate, oval in outline, with sloping walls, breaking through the frontal crest; lower walls of the ocellar basin rounded; lateral walls nearly obsolete; a shallow, poorly defined depression in front of the anterior ocellus; antennal furrows poorly defined below the ocelli; postocellar area gently convex, sharply defined laterally with an elongate fovea in the anterior middle; postocellar furrow wanting; antenna rather long and sharply tapering, the third joint slightly shorter than the fourth and with a projection at the base beneath apical joint distinctly longer than the preceding; stigma rather narrow, broader at base, gradually tapering to the apex; first intercubitus obsolescent; second and third cubital cells subequal on the radius; radiellian cell with a very short appendage; sheath straight above, obtuse apically, and tapering from the broad base. Black; trochanters, four anterior tibiae and tarsi, the posterior tibiae except apical third and the four basal joints of the posterior tarsi, white; wings fuliginous basally, subhyaline beyond the apex of the stigma.

Type locality.—Great Falls, Virginia.

Described from one female reared from a larva collected on *Prunus serotina* by S. A. Rohwer, and recorded under Bureau of Entomology number Hopk. U. S. 10718. This species was also collected and reared from the same host at Newington, Fairfax County, Virginia, by S. A. Rohwer.

Type.—Cat. No. 21596, U.S.N.M.

Larva.—Length, last stage, 11 mm. Black above with lower part of latus, legs, and beneath, white; head with usual black markings.

Pupa.—The antennae of the pupa, on reaching their full length, were composed of eighteen joints, the division between the regular nine joints more strongly marked.

Host.—*Prunus serotina*.

Seasonal History.—These larvae are solitary feeders from the under surface of the leaves, the younger larvae skeletonizing, the more mature larvae eating holes. A larva collected June 27, spun cocoons June 30, pupated July 2, and emerged as an adult July 16.

PRIOPHORUS PLESIUS Rohwer, new species.

Figure 4.

Female.—Length 5 mm.; length of the antenna 3.75 mm. Clypeus strongly convex; the apical margin rather deeply, subangulately emarginate; the lobes broad, triangular in outline; the apical margin acute; supraclypeal foveae deep, circular in outline; middle fovea elongate, deep, with sloping walls, breaking through the frontal crest; lower walls of ocellar basin rounded; lateral walls

only faintly indicated; an elongate depression in front of the anterior ocellus; antennal furrows nearly obsolete below the ocelli; postocellar area strongly convex, sharply defined laterally, with a punctiform foveae in the anterior middle; postocellar furrow obsolete; antenna rather long, sharply tapering apically, the third joint distinctly shorter than the fourth; the apical joint slightly longer than the preceding; stigma narrow, broadest at base, sharply tapering to the apex; first intercubitus obsolescent; the second and third cubital cells subequal on the radius; radiellian cell with a short appendage; sheath straight above, obtuse apically tapering from the broad base. Black; trochanters, the four anterior tibiae and tarsi, posterior tibiae except their apices, the four basal joints of the posterior tarsi, white; wings hyaline; venation dark brown, stigma pale brown.

Type locality.—Profile House, New Hampshire.

Described from three females (one type) reared from larvæ collected on cherry by Dr. H. G. Dyar, and recorded under his Number 6H.

Type.—Cat. No. 21597, U.S.N.M.

This species has also been collected at East River, Connecticut, in the larval stages on *Prunus serotina*, by Chas. R. Ely.

Larva.—"Spun within a day or two, before I had a chance to describe it in detail. It was, however, strikingly colored, being reddish or brownish above and greenish below." (Ely.)

Host.—*Prunus serotina*.

Seasonal History.—A larva collected August 15, spun its cocoon August 17, emerging as an adult September 20.

PRIOPHORUS PETRINUS (Cockerell).

Cladius petrinus COCKERELL, Proc. Acad. Nat. Sci. Phila., (1914) 1915, p. 641.

A study of the original description and subsequent notes from the type kindly supplied by Professor Wickham, indicates that this species is more properly referred to the genus *Priophorus*.

This species was described from the shales of Florissant and the type is in the collection of Professor Wickham.

PRIOPHORUS INFUSCATUS (MacGillivray).

Craterocercus infuscatus MACGILLIVRAY, Bull. 22, Conn. Geol. Nat. Hist. Surv. 1916 (1917), p. 106.

Priophorus infuscatus (MacGillivray), ROHWER, Proc. Ent. Soc. Wash., vol. 20, 1918, p. 165.

Type.—Collection of A. D. MacGillivray.

Although the senior author examined the type of this species he is unable to definitely associate it with any of the species here de-

scribed. It is probably more closely allied to the species here described as *pruni*. The original description is as follows:

"Mesonotum and collar black; body black, with legs beyond femora white; third segment of antennae shorter than fourth; clypeus distinctly emarginate; median fovea large, shallow, circular; wings infuscated on basal half. Length 6 mm."

In a letter dated January 13, 1919, Doctor MacGillivray says: "The type of *Craterocercus infuscatus* was collected at Ithaca, New York, and is without date. The specimen is a female."

(PRIOPHORUS) CAULOCAMPUS ACERICAULIS (MacGillivray) Rohwer.

Figure 8.

Priophorus acericaulis MACGILLIVRAY, Can. Ent., vol. 38, 1906, p. 306.

Caulocampus acericaulis (MacGillivray) ROHWER, Proc. U. S. Nat. Mus., vol. 43, 1912, p. 240; Proc. Ent. Soc. Wash., vol. 20, no. 8, 1918, p. 165.

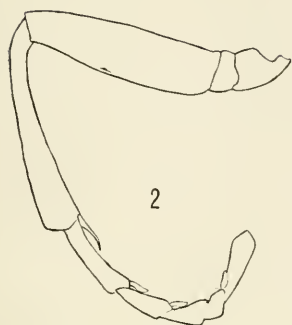
In his latest paper¹⁷ MacGillivray leaves this species in the genus *Priophorus*. According to our opinion, it does not belong to this subfamily. The basal vein, which joins the subcosta remote from the origin of the cubitus (see fig. 8), the larvae and their habits are important characters which show that the species is Nematine. This species, according to our opinion, is generically different from *Priophorus*, and the genus *Caulocampus*, of which it is the genotype, should be placed in the Nematine, tribe Hemichorini.

¹⁷ Bull. 22, Conn. Geol. and Nat. Hist. Survey, 1916 (1917), p. 109.

EXPLANATION OF PLATES.

PLATE 1.—Legs and Wings of adult Cladiine sawflies.

- FIG. 1. Claw of *Cladius isomerus*.
2. Leg of *Trichiocampus gregarius*, female.
3. Leg of *Cladius isomerus*, female.
4. Leg of *Priophorus plesius*, female.
5. Wings of *Trichiocampus viminalis*, female.
6. Wings of *Priophorus padi*, female.
7. Wings of *Cladius isomerus*, female.
8. Wings of *Caulocampus acericaulis*.



T. gregarius



C. isomerus



C. isomerus



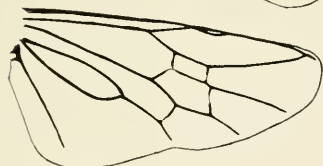
P. plesius



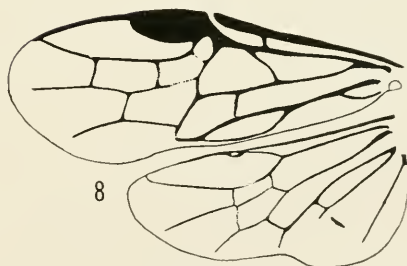
T. viminalis



P. padi



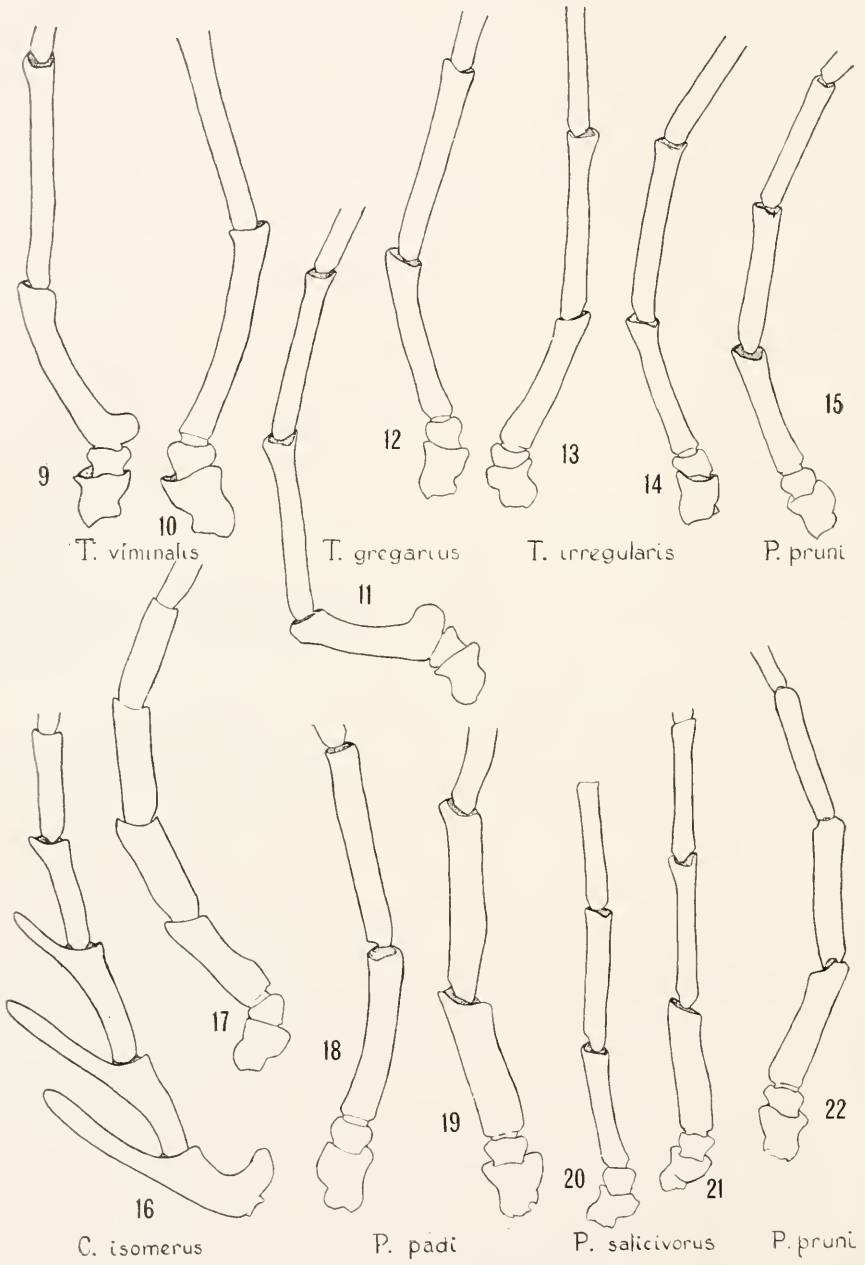
C. isomerus



Ca. acericaulis

NORTH AMERICAN CLADIINE SAWFLIES.

FOR EXPLANATION OF PLATE SEE PAGE 38.



NORTH AMERICAN CLADIINE SAWFLIES.

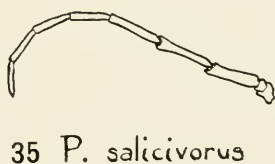
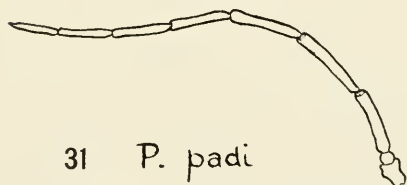
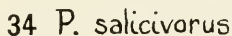
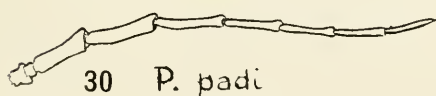
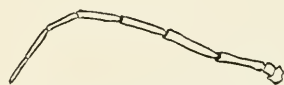
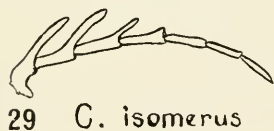
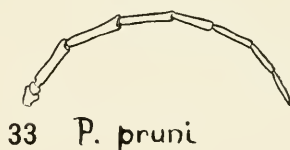
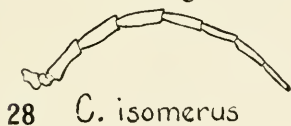
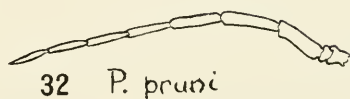
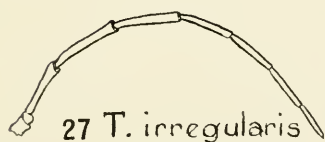
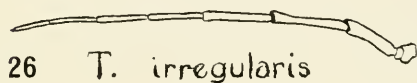
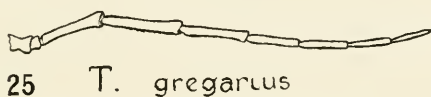
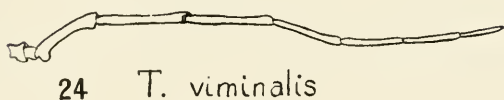
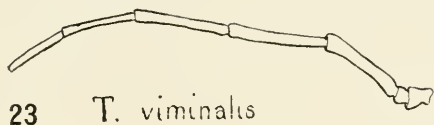
FOR EXPLANATION OF PLATE SEE PAGE 39

PLATE 2.—Antennae of adult Cladine sawflies.

- FIG. 9. Antenna of *Trichiocampus viminalis*, male.
10. Antenna of *Trichiocampus viminalis*, female.
11. Antenna of *Trichiocampus gregarius*, male.
12. Antenna of *Trichiocampus gregarius*, female.
13. Antenna of *Trichiocampus irregularis*, female.
14. Antenna of *Trichiocampus irregularis*, male.
15. Antenna of *Priophorus pruni*, female.
16. Antenna of *Cladius isomerus*, male.
17. Antenna of *Cladius isomerus*, female.
18. Antenna of *Priophorus padi*, female.
19. Antenna of *Priophorus padi*, male.
20. Antenna of *Priophorus salicivorus*, female.
21. Antenna of *Priophorus salicivorus*, male.
22. Antenna of *Priophorus pruni*, male.

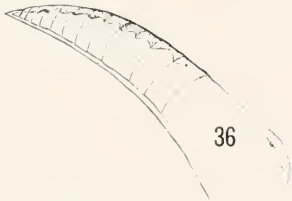
PLATE 3.—Antennae of adult Cladiine sawflies.

- FIG. 23. Antenna of *Trichiocampus viminalis*, female.
24. Antenna of *Trichiocampus viminalis*, male.
25. Antenna of *Trichiocampus gregarius*, female.
26. Antenna of *Trichiocampus irregularis*, female.
27. Antenna of *Trichiocampus irregularis*, male.
28. Antenna of *Cladius isomerus*, female.
29. Antenna of *Cladius isomerus*, male.
30. Antenna of *Priophorus padi*, male.
31. Antenna of *Priophorus padi*, female.
32. Antenna of *Priophorus pruni*, male.
33. Antenna of *Priophorus pruni*, female.
34. Antenna of *Priophorus salicivorus*, female.
35. Antenna of *Priophorus salicivorus*, male

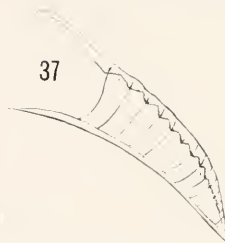


NORTH AMERICAN CLADIINE SAWFLIES.

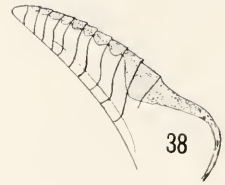
FOR EXPLANATION OF PLATE SEE PAGE 40.



T. viminalis



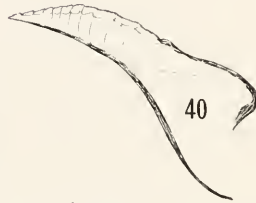
T. gregarius



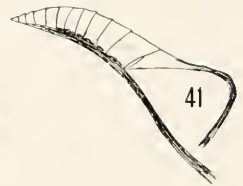
T. irregularis



C. isomerus



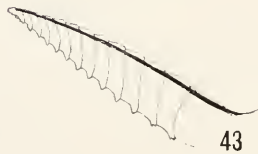
P. padi



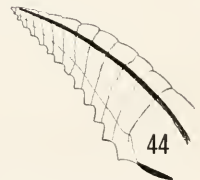
P. salicivorus



T. viminalis



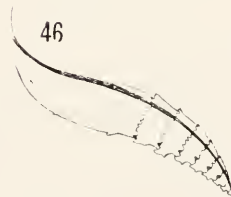
T. gregarius



T. irregularis



C. isomerus



P. padi



P. salicivorus



P. pruni

NORTH AMERICAN CLADIINE SAWFLIES.

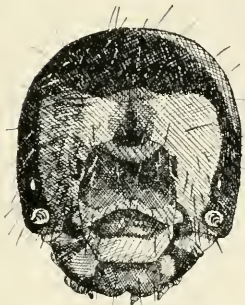
FOR EXPLANATION OF PLATE SEE PAGE 41.

PLATE 4.—Parts of the ovipositor of Cladiine sawflies.

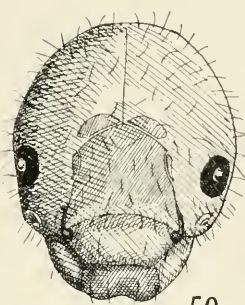
- FIG. 36. Lance of *Trichiocampus viminalis*.
37. Lance of *Trichiocampus gregarius*.
38. Lance of *Trichiocampus irregularis*.
39. Lance of *Cladius isomerus*.
40. Lance of *Priophorus padi*.
41. Lance of *Priophorus salicivorus*.
42. Lancet of *Trichiocampus viminalis*.
43. Lancet of *Trichiocampus gregarius*.
44. Lancet of *Trichiocampus irregularis*.
45. Lancet of *Cladius isomerus*.
46. Lancet of *Priophorus padi*.
47. Lancet of *Priophorus salicivorus*.
48. Lancet of *Priophorus pruni*.

PLATE 5.—Larval characters of Cladiine sawflies.

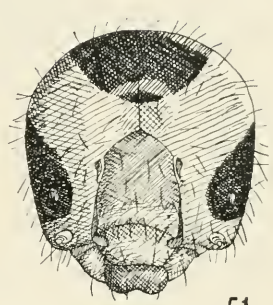
- FIG. 49. Front view of head, *Trichiocampus viminalis*.
50. Front view of head, *Cladius isomerus*.
51. Front view of head, *Priophorus betulae*.
52. Leg of larva, *Trichiocampus viminalis*.
53. Antenna of larva, *Trichiocampus viminalis*.
54. Mouth parts of larva, *Trichiocampus viminalis*.
55. Side view of head, *Priophorus pruni*.
56. Side view of head, *Priophorus salicivorus*.
57. Abdominal segment, plus annulet A of the following segment, *Trichiocampus viminalis*.
58. Abdominal segment, plus annulet A of the following segment, *Trichiocampus gregarius*.
59. Abdominal segment, plus annulet A of the following segment, *Trichiocampus irregularis*.
60. Abdominal segment, plus annulet A of the following segment, *Cladius isomerus*.
61. Abdominal segment, plus annulet A of the following segment, *Priophorus pruni*.



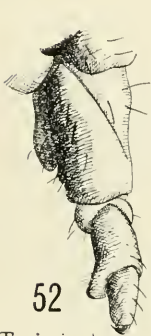
T. viminalis 49



C. isomerus 50



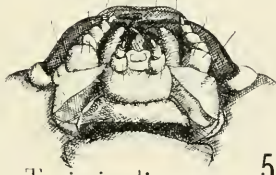
P. betulae 51



T. viminalis 52



T. viminalis 53



T. viminalis 54



P. pruni 55



P. salicivorus 56



57



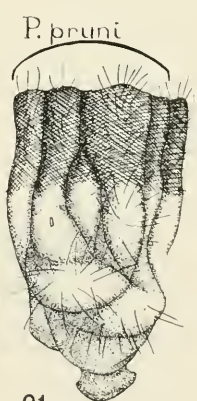
58



59



60



61

NORTH AMERICAN CLADIINE SAWFLIES.

FOR EXPLANATION OF PLATE SEE PAGE 42.



62



66



63



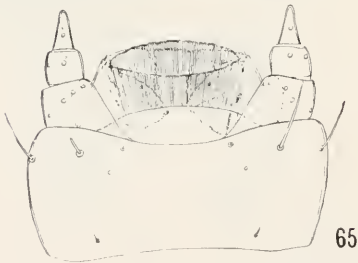
67



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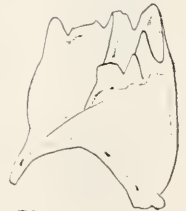
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NORTH AMERICAN CLADIINE SAWFLIES.

FOR EXPLANATION OF PLATE SEE PAGE 43

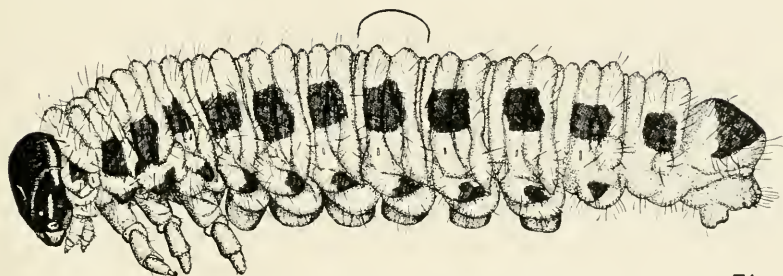
PLATE 6.—Larval details of *Cladius isomerus*.

- FIG. 62. Maxilla of larva of *Cladius isomerus*.
63. Labrum of larva of *Cladius isomerus*.
64. Epipharynx of larva of *Cladius isomerus*.
65. Labium of larva of *Cladius isomerus*.
66. Frons of larva of *Cladius isomerus*.
67. Antenna of larva of *Cladius isomerus*.
68. Leg of larva of *Cladius isomerus*.
69. Ventral interior view—Right mandible of larva of *Cladius isomerus*.
70. Ventral interior view—Left mandible of larva of *Cladius isomerus*.

PLATE 7.—Larvae of Cladiine sawflies.

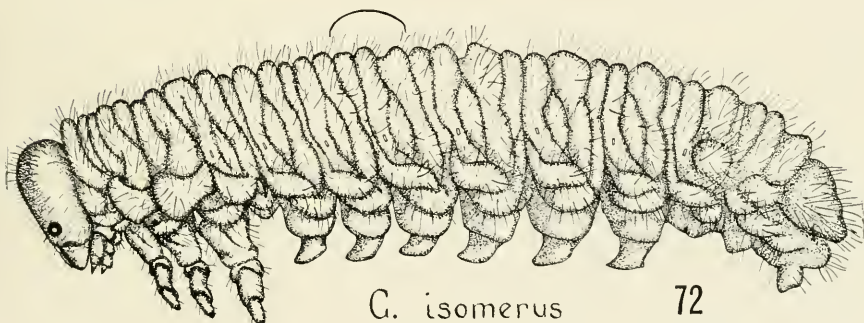
The bracket above a segment indicates the segment illustrated in detail on plate 5.

- FIG. 71. Larva of *Trichiocampus viminalis*.
72. Larva of *Cladius isomerus*.
73. Larva of *Priophorus pruni*.



T. viminalis

71



C. isomerus

72



P. pruni 73

NORTH AMERICAN CLADIINE SAWFLIES.

FOR EXPLANATION OF PLATE SEE PAGE 43

INDEX.

This index contains the names of the species discussed in this paper. Valid generic names are in bold-face type, valid specific names in roman type, and synonyms in italics.

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