

THE
HYMENOPTEROUS PARASITES
OF
NORTH AMERICAN BUTTERFLIES.

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Why, here you have the awfulest of crimes
For nothing! Hell broke loose on a butterfly!
BROWNING.—*The Ring and the Book.*

It was in March, 1887, when Mr. Scudder first wrote asking me to revise and extend the chapter on butterfly parasites written by Dr. A. S. Packard for his (Scudder's) book on New England Butterflies, but published under the title "Some Ichneumon Parasites of our New England Butterflies," in the Proceedings of the Boston Society of Natural History, Vol. XXI. I at once replied that I should be glad to attempt the task, and some little time was spent during the summer of 1887 examining Dr. Packard's types and other material sent me by Mr. Scudder. Learning, during a visit to Cambridge in the fall of 1887, that there was no immediate hurry for my manuscript, I postponed the work until the summer of 1888, and meantime corresponded with several gentlemen interested in butterflies, and brought together some additional material, which I have studied with that already at hand, and present the results herewith.

The larger part of the material which I have seen was sent me by Mr. Scudder. Some of it had already been studied by Dr. Packard, while the remainder had been subsequently reared by Mr. Scudder or his correspondents. Considerable material, both in the way of specimens and notes, was also placed at my disposal by Dr. C. V. Riley, from his old collection and from the collections of the National Museum and of the Department of Agriculture. Mr. W. H. Edwards has sent me a number of specimens with notes, and Judge W. B. Thomas of Athens, Ga., Mr. A. H. Mundt of Fairbury, Ill., and Mr. H. H. Lyman of Montreal, have all sent specimens and short notes. Professor Riley has kindly written for me the portion of the chapter relating to the important parasites of the Braconid subfamily Microgasterinae, as I felt that from his familiarity with these difficult forms he would do them infinitely better justice than I could my-

self. Mr. E. T. Cresson has also, with his customary kindness, made certain determinations for me in the Ichneumonidæ, and has sent me copies of several of Holmgren's generic descriptions which were not accessible to me at Washington.

The chapter may be appropriately begun with a tabulated arrangement of the hosts from which parasites have been bred, placing opposite to each species of butterfly the parasites which have been reared from it, and the reverse. The main object of the chapter is, of course, to enable the observer to identify any parasites which he may have reared from butterfly larvae or pupae, supposing them to have been reared before, and I would advise him first, by examining this list, to ascertain what parasites have been reared from the insect in question, and then to compare the figures and descriptions of these particular species with the specimens he has reared. If he does not in this way satisfy himself, then let him run through the synoptical table of genera and the descriptions of species which follow, and it will not be difficult to ascertain whether his observation is a new one.

LIST OF HOSTS AND PARASITES.

Butterflies.	Parasites.	Butterflies.	Parasites.
Oeneis semidea.....	Ichneumon instabilis. ? Encyrtus montinus. Pteromalus chthonobæ. Tetrastichus semideæ.	Polygonia faunus.....	Ichneumon versabilis.
Oeneis macounii.....	Trichogramma intermedium.	Polygonia progne.....	Telenomus graptæ. An undetermined Pteromalid.
Chlorippe clyton.....	Limneria fugitiva. Pimpla annulipes? Chalcis flavipes. Telenomus rileyi.	Euvaessa antiopa....	Hoplismenus morulus. Pteromalus vanessæ. Pteromalus puparum. Derostenus antiopæ. Telenomus graptæ.
Chlorippe celtis.....	Limneria fugitiva.	Aglais milberti.....	Ichneumon rufiventris. Apanteles atalantæ. Trichogramma intermedium.
Basilarchia archippus.	Ichneumon caliginosus. Limneria limenitidis. Apanteles limenitidis. Pteromalus puparum. Trichogramma minutum. Trichogramma minutissimum.	Vanessa atalanta.....	Microgaster carinata. Apanteles atalantæ. Apanteles edwardsii. (A Braconid; note by Scudder; no specimen.) Pteromalus puparum. Eulophus sp.; known from its pupa only. Cirrospilus niger. Tetrastichus modestus. Trichogramma minutissimum.
Basilarchia astyanax..	An undetermined chalcid (Shurtleff).	Vanessa huntara.....	Ichneumon rufiventris. Apanteles carduicola. Microgaster; note by Riley; no specimen.
Polygonia interrogattonis	Hoplismenus morulus. Apanteles sp. (cocoon only). Pteromalus vanessæ. Tetrastichus modestus. Trichogramma intermedium. Telenomus graptæ.	Vanessa cardui.....	Ichneumon rufiventris. Trogus exesorius. Exochilum mundum.
Polygonia comma.....	Glypta erratica. Pteromalus vanessæ.		
Polygonia satyrus....	Pteromalus puparum.		

Butterflies.	Parasites.	Butterflies.	Parasites.
<i>Vanessa cardui</i> (cont.)	<i>Apanteles carduicola</i> . <i>Pteromalus puparum</i> . (An egg-parasite; note by Riley; no specimen.)	<i>Pieris rapae</i> (cont.)	<i>Pteromalus puparum</i> . <i>Tetrastichus</i> sp.
<i>Junonia coenia</i>	<i>Apanteles junoniae</i> . (An egg-parasite; note by Murtfeldt; no specimen.)	<i>Ascia monuste</i>	<i>Pteromalus vauessae</i> .
<i>Argynnis cybele</i>	<i>Apanteles argynnidis</i> .	<i>Iphiclides ajax</i>	<i>Trogus exesorius</i> . <i>Plinpla annulipes</i> . <i>Exochilum mundum</i> .
<i>Phyciodes tharos</i>	<i>Ichneumon instabilis</i> .	<i>Jasoniades glaucus</i>	<i>Trogus exesorius</i> . <i>Copidosoma turni</i> . <i>Trichogramma minutissimum</i> .
<i>Lemonias anicia</i>	<i>Apanteles koebeli</i> .	<i>Euphœades trollus</i>	<i>Trogus exesorius</i> . <i>Cryptus</i> sp. <i>Apanteles emarginatus</i> .
<i>Euphydryas phaeton</i>	<i>Pteromalid</i> ; species unknown.	<i>Euphœades palamedes</i>	<i>Pteromalus vauessae</i> .
<i>Auosia plexippus</i>	<i>Pteromalus archippi</i> . <i>Trichogramma intermedium</i> .	<i>Heracides cressphontes</i>	<i>Hemiteles utilis</i> . <i>Chalcis robusta</i> . <i>Pteromalus vanessae</i> .
<i>Agraulis vanillae</i>	<i>Chalcis flavipes</i> . <i>Pteromalus puparum</i> .	<i>Papilio polyxenes</i>	<i>Trogus exesorius</i> . <i>Trogus obsidianator</i> . <i>Apanteles lunatus</i> .
<i>Uranotes melinus</i>	<i>Anomalopseudargiole</i> .	<i>Epargyreus tityrus</i>	<i>Ophiou bilineatus</i> . <i>Limneria</i> sp. <i>Pteromalus puparum</i> .
<i>Thecla</i> sp.	<i>Apanteles theclae</i> .	<i>Thorybes pylades</i>	Egg-parasite; note by Scudder; no specimens. <i>Apanteles</i> sp.
<i>Thecla calandrus</i>	<i>Tetrastichus theclae</i> .	<i>Thanaos lucilius</i>	<i>Trichogramma intermedium</i> .
<i>Thecla edwardsii</i>	<i>Tetrastobus saundersii</i> .	<i>Thanaos juvenalis</i>	<i>Microdus sauctus</i> . <i>Apanteles flavicornis</i> .
<i>Cyaniris pseudargiolus</i>	<i>Anomalopseudargiole</i> . <i>Apanteles cyaniridis</i> . <i>Hemiteles lycænae</i> .	<i>Pholisora catullus</i>	<i>Limneria fugitiva</i> . <i>Microdus sanctus</i> . <i>Apanteles pholisora</i> .
<i>Heodes hypophlaeas</i>	<i>Ichneumon versabilis</i> . <i>Teleonemus graptæ</i> .	<i>Limochores tauros</i>	<i>Teleonemus graptæ</i> .
<i>Xanthidia nicippe</i>	<i>Apanteles caasianus</i> .	<i>Megathymus yuccae</i>	<i>Apanteles megathymi</i> . (Egg-parasite; eggs found punctured with exit-holes.)
<i>Eurema lisa</i>	<i>Pteromalus puparum</i> .		
<i>Eorymus philodice</i>	<i>Mesochorus scitulus</i> . <i>Apanteles</i> sp. <i>Pteromalus puparum</i> .		
<i>Pontia protodice</i>	(Said by Edwards to be parasitized by a small <i>Ichneumon</i> ; Butt. N. A., 1, 86). <i>Pteromalus puparum</i> .		
<i>Pieris oleracea</i>	<i>Apanteles glomeratus</i> .		
<i>Pieris rapae</i>	<i>Mesochorus pieridicola</i> . <i>Apanteles glomeratus</i> .		

LIST OF PARASITES AND HOSTS.

Parasites.	Butterflies.	Parasites.	Butterflies.
<i>Ichneumon rufiventris</i>	<i>Aglais milberti</i> . <i>Vanessa huutera</i> . <i>Vanessa cardui</i> .	<i>Hoplismenus morulus</i>	<i>Polygonia interrogatilis</i> . <i>Eurvanessa antiopa</i> .
<i>Ichneumon caliginosus</i>	<i>Basilarchia archippus</i> .	<i>Trogus exesorius</i>	<i>Vanessa cardui</i> . <i>Iphiclides ajax</i> . <i>Jasoniades glaucus</i> . <i>Euphœades trollus</i> . <i>Papilio polyxenes</i> .
<i>Ichneumon instabilis</i>	<i>Oenets semidea</i> . <i>Phyciodes tharos</i> .	<i>Trogus obsidianator</i>	<i>Papilio polyxenes</i> .
<i>Ichneumon versabilis</i>	<i>Polygonia faunus</i> . <i>Heodes hypophlaeas</i> .	<i>Hemiteles utilis</i>	<i>Heracides cressphontes</i> .

Parasites.	Butterflies.	Parasites.	Butterflies.
Hemiteles lycaenae...	Cyaniris pseudargiolus.	Pteromalus vanessae..	Polygonia interroga- tionis.
Cryptus sp.....	Euphœades troilus.		Polygonia comma.
Ophion bilineatus....	Epargyreus tityrus.		Eu Vanessa antiopa.
Exochlum mundum..	Vanessa cardui.		Ascia monuste.
	Iphiclides ajax.		Euphœades palamedes.
Anomalon pseudar- gioll.....	Uranotes melinus.	Pteromalus sp.....	Heracles crespontes.
	Cyaniris pseudargiolus.		Polygonia progne.
Mesochorus pieridico- la	Pieris rapae.		Euphydryas phaeton.
Mesochorus scitulus....	Eurymus philodice.	Pteromalus archippi..	Anosia plexippus.
Limneria fugitiva.....	Chlorippe clyton.	Pteromalus puparum.	Basilarchia archippus.
	Chlorippe celtis.		Polygonia satyrus.
	Pholisora catullus.		Eu Vanessa antiopa.
Limneria limenitidis..	Basilarchia archippus.		Vanessa atalanta.
Limneria sp.....	Epargyreus tityrus.		Vanessa cardui.
Pimpla annulipes....	Chlorippe clyton?		Agraulis vanillae.
	Iphiclides ajax.		Eurema lisa.
Glypta erratica.....	Polygonia comma.		Eurymus philodice.
Microdus sanctus....	Thanaos juvenalis.		Pontia protodice.
	Pholisora catullus.		Pieris rapae.
Apanteles glomeratus.	Pieris oleracea.	Eulophus sp.....	Epargyreus tityrus.
	Pieris rapae.	Cirrospilus niger....	Vanessa atalanta.
Apanteles edwardsii..	Vanessa atalanta.	Derostenus antiopae..	Eu Vanessa antiopa.
Apanteles megathymi.	Megathymus yuccae.	Tetrastichus semideae.	Oenais semidea.
Apanteles limenitidis.	Basilarchia archippus.	Tetrastichus sp.....	Pieris rapae.
Apanteles lunatus....	Papilio polyxenes.	Tetrastichus saunders- ii.....	Thecla edwardsii.
Apanteles cyaniridis..	Cyaniris pseudargiolus.	Tetrastichus theclae..	Thecla calanus.
Apanteles argynnidis..	Argynnis cybele.	Tetrastichus modes- tus.....	Polygonia interroga- tionis.
Apanteles koebeleii...	Lemonias anicia.		Vanessa atalanta.
Apanteles flavicornis..	Thanaos juvenalis.	Trichogramma minu- tum.....	Basilarchia archippus.
Apanteles emargina- tus.....	Euphœades troilus.	Trichogramma minu- tissimum.....	Basilarchia archippus.
Apanteles theclae....	Thecla sp		Vanessa atalanta.
Apanteles junoniae....	Junonia coenia.		Jasoniades glaucus.
Apanteles cardulcola..	Vanessa huntera.	Trichogramma inter- medium.....	Oenais macounii.
	Vanessa cardui.		Polygonia interroga- tionis.
Apanteles atalantae...	Aglais milberti.		Aglais milberti.
	Vanessa atalanta.		Anosia plexippus.
Apanteles pholisora..	Pholisora catullus.		Thanaos lucillus.
Apanteles cassianus..	Xanthidia nicippe.	Telenomus graptae....	Polygonia interroga- tionis.
Apanteles spp.....	Polygonia interroga- tionis.		Polygonia progne.
	Eurymus philodice.		Eu Vanessa antiopa.
	Thorybes pylades.		Heodes hypophlaeas.
Microgaster carinata.	Vanessa atalanta.		Limochores taumas.
Microgaster ?sp.....	Vanessa huntera.	Telenomus rileyi....	Chlorippe clyton.
Chalcis flavipes.....	Chlorippe clyton.		
	Agraulis vanillae.		
Chalcis robusta.....	Heracles crespontes.		
Encyrtus montinus....	Oenais semidea.		
Copidosoma turni....	Jasoniades glaucus.		
Pteromalus chionobae.	Oenais semidea.		

In comparison I introduce here a list of the European parasites of the four butterflies which are common to Europe and North America.

EUROPEAN HYMENOPTEROUS PARASITES OF BUTTERFLIES COMMON TO EUROPE AND NORTH AMERICA.

- Eu Vanessa antiopa.* Ichneumon fossorius Ratz.: Ratzburg, Ichn. d. Forstius.
Hoplismenus terrificus Wesm.: Giraud et Laboulbène, Liste d'éclousions d'insectes; Ann. Soc. Ent. France, 1877.
Pteromalus puparum L.: Kirchner, Cat. Hym. Eur.
- Vanessa atalanta.* Hoplismenus plica Wesm.: Giraud et Laboulbène, loc. cit.
Amblyteles armatorius Först.: Bignell, in Buckler's Larvae of British Butterflies, Ray Society, 1886.
* Hemiteles fulvipes Gr.: Fitch, Entomologist, xiv: 139.
* Limneria cursitans Holmgr.: Fitch, Entomologist, xvi: 66.
* Mesochorus sylvarum Hal.: Fitch, loc. cit., 141.
Pimpla flavicans Fabr.: Rondani, Bull. soc. ent. Ital., x: 31.
Microgaster spurius Wesm.: Giraud et Laboulbène, loc. cit.
Microgaster subcompletus Nees: Fitch, Entomologist, xiv: 142.
Microgaster deprimator Spln.: raised by Scudder, determined by Drewsen.
- Vanessa cardui.* Apanteles sp.: Fitch, Entomologist, xlii.
Pteromalus puparum (L.): Fitch, Naturalist, 1886: 213.
Ichneumon castigator Fabr.: Rondani, loc. cit.
Limneria exareolata Ratz.: Bignell, loc. cit.
Pimpla diluta Ratz. Ratzburg, loc. cit.
Bracon variator Nees: Bignell, loc. cit.
Microgaster subcompletus Nees: Scudder.
Apanteles emarginatus Nees: Bignell, loc. cit.
- Pieris rapae.* Campoplex conicus Ratz.: Rosehaur det. specimen in Mus. Comp. Zool., Cambridge.
* Hemiteles fulvipes Gr.: Bignell loc. cit.
* Mesochorus aciculatus: Bignell, loc. cit.
* Mesochorus splendidulus Grav.: reared by Scudder, determined by Drewsen.
Microgaster glomeratus L.: Scudder, Kaltenbach.
Apanteles rubecula Marsh.: Bignell, loc. cit.
Apanteles glomeratus (L.): many authors.
* Diplolepis microgastri Boh. Kaltenbach.
Monodontomerus aerus Walk.: Mayr, Europ. Torymiden
Monodontomerus dentipes Boh.: ibid.
Pteromalus puparum (L.): many authors.

* All probably hyperparasitic.

Analytical Table of Families.

- Anterior wings with several closed cells.
Anterior wings with two recurrent nervures.....**ICHNEUMONIDAE.**
Anterior wings with but one recurrent nervure.....**BRACONIDAE.**
- Anterior wings almost veinless.
Pronotum not reaching to tegulae.....**CHALCIDIDAE.**
Pronotum reaching to tegulae.....**PROCTOTRUPIDAE.**

Analytical Tables of Genera.

ICHNEUMONIDAE.

- First segment of the depressed, pedunculate abdomen bent towards apex.
 Ovipositor hidden or only slightly exerted.
 Abdomen ♀ acute at tip, last ventral segment retracted.
 Scutellum flat or convex, gradually sloping to apex..... **Ichneumon.**
 Scutellum gibbous, abruptly declivous behind..... **Hoplismenus.**
 Abdomen ♀ obtuse at tip, last ventral segment not retracted..... **Trogus.**
 Ovipositor distinctly exerted.
 Areolet incomplete..... **Hemiteles.**
 Areolet complete..... **Cryptus.**
- First segment of abdomen straight.
 Abdomen petiolate, compressed for at least posterior half.
 Cubito-discal cell receiving both recurrent nervures..... **Ophion.**
 Cubito-discal cell receiving but one recurrent nervure.
 Spiracles of metathorax oval or elongate.
 Apical margin of clypeus truncate..... **Exochilum.**
 Apical margin of clypeus acutely angled or pointed..... **Anomalon.**
 Spiracles of metathorax round.
 Areolet large, rhomboidal..... **Mesochorus.**
 Areolet small..... **Limneria.**
- Abdomen sessile.
 Ovipositor arising from a ventral cleft..... **Pimpla.**
 Ovipositor arising from apex of abdomen..... **Glypta.**

BRACONIDAE.

- Mesothoracic sutures distinct; marginal cell minute, remote from the apex of the wing.....
Microdus.
- Mesothoracic sutures invisible; marginal cell large, reaching apex of wing.
 Wings with two submarginal cells, the second confused with the third..... **Apanteles.**
 Wings with three submarginal cells, the second more or less complete..... **Microgaster.**

CHALCIDIDAE.

- Tarsi 5-jointed.
 Hind femora much swollen..... **Chalcis.**
 Hind femora not much swollen.
 Middle tibiae with a strong apical spur.
 Club of antennae rounded..... **Encyrtus.**
 Club of antennae obliquely truncate..... **Copidosoma.**
 Middle tibiae with only a slight apical spur..... **Pteromalus.**
- Tarsi 4-jointed.
 Submarginal vein not broken..... **Citrosopilus.**
 Submarginal vein broken.
 Scutellum with two bristles near the middle..... **Derostenus.**
 Scutellum with four bristles, all behind middle..... **Tetrastichus.**
- Tarsi 3-jointed..... **Trichogramma.**

PROCTOTRUPIDAE.

But one genus—**Telenomus**—is considered.

FAMILY ICHNEUMONIDAE LEACH.

GENUS ICHNEUMON Linn.

Ovipositor hidden, or only slightly exerted; basal half or two-thirds of first abdominal segment slender, expanded at apex, its spiracles closer to apex of segment than to each other; areolet pentangular; mesonotum without parapsides; metathoracic spiracles linear or narrowly oval; petiole of abdomen not depressed; ♀ abdomen acute at tip, last ventral segment retracted; ♂ ventral segments 2-4 with a longitudinal fold; scutellum more or less flat, or simply convex, and then gradually sloping to apex; metathorax rarely bispinose.

Table of Species.

Abdomen uniformly dull red.....	<i>rufiventris</i> .
Abdomen entirely black.....	<i>caliginosus</i> .
Abdomen not unicolorous.	
Antennae fulvous at middle, with black tips.....	<i>instabilis</i> .
Antennae black above, lighter below.....	<i>versabilis</i> .

Ichneumon rufiventris* Brullé. Pl. 88, fig. 1.Ichneumon hunterae* Pack.*Ichneumon* sp. Pack.

Head, thorax and petiole of abdomen black, rest of abdomen dull, brick red, sometimes reddish brown. Head black, with the orbits part way up broadly marked with yellow, forming lanceolate, triangular spots, with the slender apex opposite the antennae. Base and sides of labrum yellow. Head wholly black in ♀. Palpi brown. Antennae in ♂ black; in ♀ black, with a white ring in the middle, about four joints usually being white. Wings smoky-violaceous. Fore legs brown, pale brown in ♂. Basal three-fourths of femora blackish, legs dark brown in ♀. Hind legs black, hind tibiae paler at base; hind femora reddish at base. Thorax black, sometimes yellow spots on scutum. Length (average), ♂, 12 mm., exp., 20 mm.; ♀, 15 mm., exp., 28 mm. (Adapted from Packard.)

[The following description of the colors was taken during life: Antennae blackish fuscous; the middle joints pale, but infuscated. Body piceous; abdomen very deep reddish orange, the belly tinged with yellow, the ovipositor infuscated; extreme base of the femora inconspicuously sanguineous. s. n. s.]

This species seems to be a quite common parasite of *Vanessa huntera* and *V. cardui*. I have seen two specimens, one male and one female, from Mr. Scudder, one female from Mr. Lyman, of Montreal, and Dr. Packard records a female from Virginia, all reared from this species. Mr. Cresson (Trans. Amer. Ent. Soc., vi: 173) also states that this species has been reared from *huntera*. Professor Riley has reared it from *cardui*, and Mr. Scudder has so recorded it in his article entitled "A Cosmopolitan Butterfly." Miss Caroline E. Huestis records it from *cardui* in the Canadian Entomologist for July, 1881. Mr. Scudder has also sent a single male, reared by Dr. Dimmock, from *Aglais milberti*.

This specimen mentioned by Dr. Packard as "*Ichneumon* sp.," is, as Dr. Riley states, *I. rufiventris*. The difficulty into which Dr. Packard fell concerning the white banded antennae and the black face, I have solved by

an examination of the specimen to which Dr. Packard referred, and which proves to be a female, and not a male as he supposed.

Mr. Cresson (Proc. Ent. Soc. Phil., iii: 179, 180) describes three varieties of this species, viz.: *incertus*, *semicoccineus* and *californicus*, differing chiefly in the coloration of the legs.

***Ichneumon caliginosus* Cresson.**

Female.—Black, subopaque, densely and finely punctured; clypeus shining with a few large punctures; antennae half the length of the body, black, the 10th to 15th joints white above. Thorax densely and confluent punctured, with an abbreviated impressed line on each side of the mesothorax in front; scutellum rather flat, smooth and shining, with a large white spot occupying nearly its whole surface and slightly indented posteriorly; metathorax scabrous, the elevated lines well defined, the central area large and transversely quadrate. Wings fuscous, nervure black, stigma piceous, areolet 5-angular. Legs shining black, inner side of the anterior tibiae and tarsi whitish. Abdomen entirely black; the first segment broad and finely aciculate, the peduncle slender; basal foveae of the second segment deep and oblique; apical segments rather smooth and shining; ovipositor subexserted, yellowish. Length, 12.5 mm.; expanse of wings, 23 mm. (Adapted from Cresson.)

Mr. Scudder has sent me one female of this species reared from *Basilarchia archippus* September 5. The species has been captured in Canada, Colorado and Illinois.

***Ichneumon instabilis* Cresson.**

Ichneumon tharotis Packard.

Female.—Black or ferruginous, rather robust; head slightly narrowed beneath, the anterior orbits more or less red or yellowish; sometimes the head is entirely red, or the face and clypeus are varied with brown and yellowish or reddish; antennae moderately long, not robust, generally fulvous at base, yellow in middle and black at tips, sometimes only fulvous with tips black, or black at base, then fulvous, yellow and black; third joint elongate, longer than the fourth, which is subequal with the fifth; thorax often entirely ferruginous or more or less varied with ferruginous, sometimes black immaculate, except the scutellum, which is always yellow and polished; tegulae ferruginous, often with a reddish spot in front and another beneath; post-scutellum sometimes reddish; metathorax rugulose, the central area large and subquadrate; wings subhyaline, more or less stained with yellow, nervures brown, stigma pale honey-yellow; legs honey-yellow or ferruginous; the coxae, tips of posterior femora, of their tibiae and most of their tarsi black, sometimes the most part of the posterior legs is black; abdomen oblong-ovate, subconvex, slender at base, generally entirely ferruginous, sometimes the fourth and fifth segments above are black or fuscous, sometimes the second and third segments only are ferruginous, and sometimes the incisures of the segments are more or less blackish; beneath ferruginous or yellowish ferruginous, dusky or black at tip. Length, 10-12 mm.

Male.—This sex is exceedingly variable in color, some examples being almost entirely yellowish ferruginous, and others almost entirely black. Head black, with the anterior orbits and all beneath the antennae yellow; antennae long, slender, black above and brownish or fulvous beneath, the basal joint yellow beneath; thorax generally black, sometimes more or less varied with ferruginous, and in one specimen the mesothorax has four abbreviated, pale vittae; sometimes the thorax is black, immac-

ulate, except the scutellum, which is always yellow; generally, there is a spot or a sutural line before the wings, and a spot or line beneath; the post-scutellum is often reddish; legs honey-yellow; the fore anterior coxae often more or less yellow or honey-yellow, sometimes black spotted with yellowish beneath; the posterior coxae are generally black, sometimes more or less ferruginous, their trochanters generally half black and half honey-yellow; sometimes their femora are entirely black, or half black, generally only tipped with black, rarely entirely honey-yellow, their tibiae tipped with black; the general color of the legs varies from lemon-yellow to ferruginous; abdomen depressed, opaque, sometimes entirely yellowish ferruginous, but generally black, with the second and third, and sometimes part of the fourth segments ferruginous or yellowish ferruginous; the first segment is either entirely ferruginous, or black tipped with ferruginous, or with two apical yellow spots; the second and third segments are entirely ferruginous, or yellow stained with ferruginous; the fourth is either entirely black, or black spotted with ferruginous, or entirely ferruginous; the remaining segments are generally black or brown, often more or less varied with ferruginous; several specimens have the second and third segments bright yellow and the rest black. Length, 10.5 to 14.7 mm. (After Cresson.)

This is a very variable species. The specimen described by Dr. Packard as *Ichneumon tharotis* was an extreme variety of the female. It was reared by Mr. Scudder, June 2, from *Phyciodes tharos*. Mr. Cresson records it from Canada, Maine, Massachusetts, Connecticut, New York, New Jersey, Virginia, Georgia and Colorado, but does not know its host. During July, 1887, a single specimen of a variety of the male was received from Mr. Scudder, with the statement that he had reared it from the chrysalis of *Oeneis semidea*.

***Ichneumon versabilis* Cresson. Pl. 88, fig. 2.**

Male.—Dull black; line on anterior orbits, face, clypeus, mandibles, labrum, palpi, scape beneath, anterior margin of tegulae, line before, another beneath, scutellum, sometimes a spot or line behind, dot on four anterior coxae and trochanters beneath, their knees, tibiae and tarsi, anterior femora in front, posterior tibiae and tarsi except tips, sometimes two dots or a line at tip of first abdominal segment, and the second and third more or less, all bright yellow; occasionally the base of second and third segments is margined with dull ferruginous, and the apical middle more or less varied with black, sometimes interrupting the yellow on third segment into two spots, and in one specimen these are reduced to mere dots, and the yellow on second segment interrupted medially by a black line; wings subhyaline; postpetiole aciculated; gastrocoeli large and deep; antennae more or less pale beneath; posterior femora sometimes pale at base. Length, 12 to 13 mm. (From Cresson.)

Of this species I have seen two specimens of a variety of the male. Both were sent by Mr. Scudder. One specimen was obtained in Vermont from *Heodes hypophaeas*, and the other by Dr. G. Dimmock from *Polygona faunus*. It is recorded by Mr. Cresson from Canada and the United States. Both specimens were accompanied by the chrysalids from which they had emerged, and in each case the chrysalis was decapitated.

GENUS HOPLISMENUS Gravenhorst.

Parapsidal furrows of mesoscutum indicated anteriorly; mesoscutellum strongly elevated, abruptly declivous behind; metanotum always bispinose, metanotal spiracles

long, oval. Areolet of fore wings pentangular. More than half of first abdominal segment slender, its spiracles much nearer to apex than to each other; gastrocoell large but shallow. Abdomen of ♀ acute at tip, the last ventral segment retracted; ♂ ventral segments two to four with a longitudinal fold.

Hoplismenus morulus (Say). Pl. 88, fig. 9.

Ichneumon morulus Say.

Ichneumon calcaratus Provancher.

Black; face, clypeus, scape beneath, and sometimes spot on scutellum, ♂, and annulus on flagellum, ♀, white or pale yellowish; tibiae and tarsi bright yellow; wings uniformly fuliginous. Length, ♂ ♀, 15 to 16.25 mm. (After Cresson.)

I have seen two specimens of this insect, one male and one female. One was sent me by Mr. Scudder and was reared by Miss Pierce from the chrysalis of *Polygonia interrogationis* at Cambridge. The other was sent me by Mr. H. H. Lyman of Montreal who reared it in August, 1875, from a chrysalis of *Euvanessa antiopa*, at Portland, Me. The parasite in issuing decapitates the chrysalis (88:16). Mr. Cresson records the species from Canada, Connecticut, New York, New Jersey and Virginia.

GENUS TROGUS Gravenhorst.

Mesonotum without parapsidal grooves; mesoscutellum strongly elevated, generally subpyramidal; metathoracic spiracles oval. Areolet of fore wings pentangular. First segment of abdomen bent at apex, basal half slender, apex much expanded, spiracles closer to apex than to each other; base of second segment with lateral pits (gastrocoeli); ♀ abdomen obtuse at tip, ovipositor hidden; the last ventral segment but slightly retracted, ventral segments four to eight smooth, flat, without longitudinal fold.

Table of Species.

Uniformly brown.....*exesorius*.
Uniformly black.....*obsidianator*.

Trogus exesorius Brullé. Pl. 88, fig. 3.

Entirely fulvo-ferruginous, legs paler, tibiae and tarsi golden yellow; antennae sometimes dusky or black above; wings uniformly fuliginous, with a strong aeneous or violaceous reflection. Length, ♂ ♀, 17 to 20 mm. (After Cresson.)

This is the most abundant of the butterfly parasites which have been sent me. It seems to be almost exclusively a parasite of the different species of swallow-tails. Dr. Packard says concerning its hosts and localities: "Bred from pupa of *Papilio asterias* [polyxenes] by Dr. Harris, E. Norton, E. T. Cresson, etc., appearing at Cambridge, June 20th; also from *P. troilus* [Euph. troilus] (Mark) and *P. turnus* [Jas. glaucus] (P. S. Sprague); also from *P. ajax* and *P. marcellus* [Iphiclides ajax] West Virginia (Norton)." Professor Riley reared it in Missouri from *Iphiclides ajax*, *Papilio polyxenes*, *Euphœades troilus* and *Jasoniades glaucus*. Mr. Mundt has reared it in Illinois from the first and last of these. Mr. Lyman has reared it at Portland, Me., from polyxenes, Professor Cook in Michigan from troilus, and Mr. W. H. Edwards in West Virginia from ajax. The

only exception to its parasitism upon swallow-tails is sent me by Mr. Mundt who reared it from *Vanessa cardui*. Mr. Cresson records the species as captured in Canada, New York, Pennsylvania, Delaware, Georgia and Illinois, and hazards the opinion that it will probably prove to be a synonym of *Ichneumon pennator* Fabricius.

Trogus obsidianator Brulle.

Deep black, immaculate; antennae orange-yellow; wings uniformly blackish fuliginous, with a strong aeneous reflection; first abdominal segment bicarinate, the carinae becoming obsolete before reaching the tip. Length, ♂ ♀, 20 to 22.5 mm. (After Cresson.)

This insect has been reared from the chrysalis of *Papilio polyxenes* by Professor Riley. Mr. Cresson records the species from Pennsylvania, Illinois, Georgia and Texas.

Genus HEMITELES Gravenhorst.

Metathorax with parapsidal grooves. Areolet of the fore wings pentangular in position, but incomplete, the outer nervure hyaline or wanting. Legs and antennae generally slender. Spiracles of first abdominal segment more approximate to each other than to the apex of the segment; gastrocoel at base of second abdominal segment wanting; ovipositor distinctly exerted, short.

The species of this genus are as a rule parasites of parasites or, as they are called, "hyperparasites" or "secondary parasites." There is no well-proven exception to this rule on record so far as I know.

Table of Species.

Thorax marked with red; wings banded with brown.....*utilis*.
 Thorax black, immaculate; wings hyaline.....*lycaenae*.

Hemiteles utilis Norton. Pl. 88, fig. 4.

Female.—Black; antennae, anterior portion of prothorax, shoulders and a spot at sides of mesothorax, the legs, including coxae and trochanters, red; middle of posterior femora and extremity of tibiae brownish. Wings hyaline, nervures brown, white at base; tegulae white; stigma brown, without a white spot at base; a large brown band extends from the base of the stigma across the wing; areolet surrounded with white nervures, the exterior nervure wanting. Abdomen oval from the second segment, black, polished, shining; joints 1 and 2 reddish at base and tip, the others margined with reddish posteriorly. Ovipositor a little longer than half the body, almost entirely reddish. Length, 3.75 mm.

This species is introduced into this paper for the reason that I find in the notes sent me by Mr. A. H. Mundt the statement that from an over-wintered pupa of *Heracleides crespontes* he bred a parasite which was determined for him by Mr. Cresson as *H. utilis*.

It seems likely that there remains some yet undiscovered primary parasite of *crespontes* from which this secondary parasite came.

Hemiteles lycaenae sp. nov.

Female.—Shining black. Mandibles and palpi bright lemon-yellow; antennae dull-piceous, honey-yellow at base; all legs, including coxae, honey-yellow; tegulae yellow and venter of second abdominal segment honey-yellow. Wings hyaline, with no infuscated band; nervures brown except at base, cubital nervure whitish, beyond incomplete; areolet, and subdiscoidal nervure also white beyond juncture with second recurrent nervure. Head, thorax and abdomen very delicately shagreened; surface of mesonotum with reticulate carinae; anterior and posterior border of dorsum of each abdominal segment perfectly smooth. Ovipositor sheaths one-fourth as long as abdomen. Length, 4.5 mm.; expanse, 7 mm.

Described from one female specimen received from Mr. W. H. Edwards who reared it from the larva of *Cyaniris pseudargiolus*. In this case also there is probably a primary parasite of which we have no knowledge.

Genus **CRYPTUS** Fabricius.

Female with joints of antennae thickened in a nodose manner at their tip; antennae elongate, filiform, third joint usually three or more times longer than thick (if shorter than the metathorax is not areolated), never thickened or expanded towards the middle. Areolet of fore wings completely enclosed, pentangular. Legs generally slender. Apex of first abdominal segment not much broader than the petiole, and but slightly bent; ovipositor distinctly exerted.

I have not been able to determine the butterfly parasite of this genus specifically as I know of it only through a note of Professor Riley's to the effect that he has bred a species of *Cryptus* from *Euphœades troilus*. The specimen cannot be found.

Genus **OPHION** Fabricius.

Face pubescent; clypeus truncate at apex; ocelli large, prominent. Thorax and legs glabrous; metathorax rounded behind, not rugose; intermediate tibiae with two apical spurs; wings hyaline, stigma distinct, well developed, areolet wanting, cubito-discoidal cell receiving both recurrent nervures. Abdomen petiolate, compressed; ovipositor short.

Ophion bilineatus Say. Pl. 88, fig. 8.*Ophion tityri* Pack.

Honey-yellow; head yellow; antennae honey-yellow; mandibles blackish at tip; thorax with two somewhat reddish brown, longitudinal lines, almost obsolete; wings with fuscous nervures; costal nervure and stigma honey-yellow; tegulae paler than thorax; second segment of abdomen hardly as long as first, and longer than second. Length, 8.75 mm. (After Say.)

Packard's type of *O. tityri* was a male specimen reared from *Epargyreus tityrus* June 26, 1848, and is from the old Harris collection. As soon as it came into my possession I forwarded it to Mr. Cresson who informed me that he saw no reason for considering it as more than a variety of *O. bilineatus* of Say. The brownish stripes on the thorax seem, however, to be entirely lacking and the mandibles are lighter in color.

Genus *EXOCHILUM* Wesmael.

Apical margin of clypeus truncate. Spiracles of metathorax oval. Cubito-discoidal cell receiving but one recurrent nervure; marginal cell lanceolate; median and submedian cells not confluent, third discoidal present, not narrowed at base; cubito-discoidal cell receiving recurrent nervure in middle. Posterior femora unarmed; tarsal claws not pectinate; posterior tarsi with first joint about twice as long as second. Abdomen petiolate.

Exochilum mundum (Say).

Male.—Body black; head with the front, nasus and anterior orbits greenish-yellow; antennae fulvous yellow; three or four basal joints above black; the first joint beneath greenish yellow; trunk with rather dense, short hairs; wings purple black; abdomen much compressed; basal joint cylindrical; second segment as long as the first or a little longer, compressed towards the tip; anterior pair of feet yellowish before; intermediate pair with a line before and base of tibiae yellowish; posterior pair with the tibiae, excepting the tip, and the tarsi, excepting the terminal joint, fulvous-yellow. Length, 20-25 mm. (After Say.)

Mr. Mundt has bred this species from *Vanessa cardui* and *Iphiclides ajax*. The single specimen which he sent on and from which the species has been determined agrees with this description except that the posterior tibiae are black and the tarsi are dark gray.

Genus *ANOMALON* Gravenhorst.

Head buccate, or subbuccate; front with the median projection near the base of the antennae present or wanting, face more or less narrow. Clypeus indistinctly distinguishable, apex acutely angulate or apiculate. Antennae longer than the body, equal to it in length, or shorter. Metathorax punctate, often longitudinally sulcate (broadly, but not deeply). Abdomen compressed, joint 1 sublinear; terebra shortly exerted, valves towards apex usually dilated; legs slender, or the posterior are rather strong; posterior tarsi either incrassate or simple, linear, first joint about twice as long as second. (After Holmgren.)

The cubito-discoidal cell receives but one recurrent nervure, and this before the middle; the marginal cell is lanceolate; the third discoidal cell is present and is narrowed at base.

Anomalon pseudargioli sp. nov.

Female.—General color black and rufous. Face yellow, cheeks behind eyes rufous, vertex and occiput black with the usual yellow spots each side of ocelli; antennal scape yellow below, black above, pedicel and joint 1 of funicle black, rest of funicle rufous. Thorax black above and below, the outlines of the mesoscutum defined by an irregular, rufous band, which fails before and behind; mesoscutellum with its anterior half rufous; metanotum with a rufous band each side; front and middle legs yellow, hind coxae, femora and tibiae black with a rufous spot on coxae, and the femora with a varying amount of same color; wings perfectly hyaline, veins dark brown. First and second abdominal joints black, slightly rufous below; remaining joints rufous, with a dark shade along dorsal line, extending down more on the sides of joints 5 and 6, than on 3 and 4. Length, 13 mm.; expanse, 18 mm.

Described from four female specimens. Three were sent me by Mr. W. H. Edwards, who reared them in July from pupae of *Cyaniris pseudar-*

giolus, and one was sent by Mr. Scudder, who reared it from the chrysalis of *Uranotes melinus*.

Genus **MESOCHORUS** Gravenhorst.

Head transverse, short, not buccate. Clypeus not distinguishable. Eyes oblong-ovate. Antennae about as long as body, setose. Metathorax with a straight, superior area. Abdomen oblong-fusiform; first segment slightly curved, spiracles almost in the middle; last ventral segment with the female rather large; anal stylets of the male rather long, filiform; terebra of the female exerted for a short distance. Wings with a rather large rhomboidal, areolet. Legs moderate or slender. (After Holmgren.)

The species of *Mesochorus* are without doubt often hyperparasites; whether always so we cannot say with certainty.

Table of Species.

Thorax entirely black.....**pleridicolus**.
 Thorax entirely yellow, or marked with yellow-brown.....**scitulus**.

Mesochorus pleridicolus (Packard).

Campoplex pleridicola Packard.

Female.—Black; head black on the vertex and occiput; orbits and front below the antennae bright yellow; a slight reddish tinge in the middle. Palpi pale honey-yellow. Antennae brown, pale yellowish at base, second joint pale brown above, third yellow, fourth and fifth pale yellowish brown, and thorax shining black, with fine, white, appressed hairs. Metanotum full, rounded, smooth, and polished, with a narrow mesial ridge. Tegulae and base of wings pale greenish-yellow. Wings clear; stigma pale brown; veins concolorous; areolet rather large, rhomboidal. Legs, including the coxae, honey-yellow; tarsi of fore and middle legs dusky towards the claws, those of the hind legs a little dusky, except on basal two-thirds of first joint, and growing darker toward the claws. Abdomen long and narrow, compressed towards the end, with a minute, slender ovipositor, not quite so long as the abdomen is wide, shining black with a yellowish band in the middle, the posterior edge of the second and anterior two-thirds of the third segment being yellow. There is a yellow dot at the end of the pedicel, being an extension of the pale yellow under surface of the three basal segments; end of abdomen obliquely truncated. Length, 4 mm. (After Packard.)

Dr. Packard described this species from a single specimen, and I have seen only his type. The specimen is labelled: "From *Pieris rapae*," and this is all the information which we have concerning it. It may or may not be a secondary parasite.

Mesochorus scitulus Cresson.

Male, Female.—Pale honey-yellow or luteous; head broad; spot covering ocelli, and tips of mandibles black; occiput of ♀ more or less fuscous; antennae long and slender, pale testaceous, sometimes slightly dusky, scape paler; mesothorax fuscous in ♀, honey-yellow with dusky sides in ♂; scutellum and region honey-yellow; disk of metathorax more or less blackish or fuscous; tegulae pale luteous; wings hyaline, iridescent, nervures and stigma luteous; legs pale luteous, apex of posterior tibiae and tips of tarsal joints dusky; abdomen fusiform, very slender at base, black above, with a large, discal, pale luteous spot covering apical half or two-thirds of second

and basal half, or two-thirds of third segments; venter pale luteous; ovipositor of ♀ longer than basal segment. Length, 1.5 mm. (After Cresson.)

This species was bred by Mr. Cresson (twenty-four specimens, together with four specimens of a *Pezomachus*) from a bunch of bright yellow cocoons (probably those of a *Microgaster*) found attached to a blade of grass in Pennsylvania.

I have seen three specimens of what seems to me to be this species in the National Museum collection at Washington which were received from Miss M. E. Murtfeldt of Kirkwood, Mo., Oct. 18, 1881 and by her said to be parasitic on some "large parasite" of *Eurymus philodice*.

Genus LIMNERIA Holmgren.

Head moderately large, transverse, not inflated; eyes naked, not emarginate; clypeus normal, not carinate or denticulate. Thorax longer than high; metathorax distinctly areolated, not produced at apex. Stigma of fore wings of moderate size; areolet small, usually triangular, often petiolate, sometimes absent. Abdomen moderately broad and moderately or slightly compressed towards apex, the incisures between segments very distinct; petiole slender, longer than the transverse post-petiole.

Table of Species.

Abdomen black.....*fugitiva*.
Abdomen almost entirely rufous.....*limenitidis*.

Limneria fugitiva Say.

Body black; antennae in both sexes black; mandibles and palpi white; tegulae white; wings hyaline, nervures black, whitish at base, areolet very small, petiolated from the radial cellule; metanotum not excavated behind, but with "somewhat raised lines"; abdomen arcuated, towards tip rather abruptly clavate; punctures very small; ovipositor as long as tip of abdomen; feet honey-yellow with a white reflection; posterior tibiae white with a black tip and base; posterior tarsi black, base of first joint white; in the male the white of the posterior tibiae is less obvious. Length, from 6 to 7.5 mm. (After Say.)

Say reared this species in Indiana from a "pretty white cylindrical cocoon with maculated black bands."

As a butterfly parasite this species has been reared from *Pholisora catullus* by Professor Riley in Missouri, from *Chlorippe celtis* by Mr. W. H. Edwards in West Virginia, and from *Chlorippe clyton* by Mr. A. H. Mundt in Illinois.

Limneria limenitidis sp. nov. Pl. 88, fig. 5.

Male.—General color black. Palpi whitish; lower face with dense white pile; scape of antennae reddish below, blackish above, flagellum black; top of head and dorsum of thorax with sparse, fine white pile; tegulae dirty white, wings hyaline, nervures brown, costa black; all coxae black; front legs entirely light honey-yellow; trochanters, femora and tibiae of middle legs dark reddish yellow, tarsi much lighter and with each joint slightly dusky towards tip; first joint of hind trochanters black, second joint yellow; hind femora very dark rufous, lighter on the inner side; hind tibiae nearly black, spurs yellowish white; hind tarsi uniform in color with their tibiae, a very narrow band of white at base of first joint only. Abdomen rufous, except

joint 1, first four-fifths of joint 2, and first one-fourth of joint 3. Its entire surface covered with very short pile. Punctuation of head and mesonotum identical, fine and close; metanotum with a more rugose punctuation, and with a faint median, longitudinal channel; two diverging carinae arise each side of this median channel, at front of metanotum, and meet two converging carinae at half the length of this sclerite. Length, 8 mm.; expanse, 12 mm.

Described from two male specimens, both reared from *Basilarchia archippus*, by Mr. W. H. Edwards, at Coalburgh, W. Va. One is labelled July 15, 1886; and of the other Mr. Edwards writes that it left the archippus larva at the latter's second moult. The cocoons of both individuals were also sent by Mr. Edwards. They are 6 mm. long and 2.5 mm. broad, of a regular oval shape and spun of grayish white silk; near either end is an irregular, interrupted black band, and upon each end are three or more black spots.

Genus PIMPLA Fabricius.

Head transverse, short, cheeks not swollen; clypeus distinct, depressed or subexcavated at apex; antennae porrect, filiform, scape excised at apex; eyes oblong, emarginate near base of antennae. Thorax robust, moderately elevated; scutellum with an obtusely rounded apex; metanotum low, spiracles oval or circular; tarsal claws simple, sometimes lobed at base with female; areolet of fore wings always complete, triangular. Abdomen sessile; in females of most species oblong or oblong-ovate, in males narrower, subcylindrical or sublinear; narrower than the thorax or very slightly broader, strongly, or faintly and thickly punctate; joints 2 to 7 usually transverse, sometimes subquadrate with the males, the ventral border of the two last with the females longitudinally fissured; joint 1 subquadrate, or scarcely longer than broad, rarely slightly shorter, usually with a longitudinal carina. Terebra usually shorter than abdomen, but may equal it in length or exceed it.

Pimpla annulipes Brullé. Pl. 88, fig. 6.

Male, female.—The head is sparsely and finely punctate, especially on the face, which is sometimes so pubescent as to appear opaque, and sometimes has the pubescence mostly removed so as to appear subpolished. A minute, glabrous tubercle on the disk of the face. The palpi are generally dull, dark rufous in ♀, sometimes pale rufous, sometimes almost whitish, but in the ♂ they are always whitish; the antennae are about four-fifths as long as the body; the 1st joint of flagellum in ♂, 3-3½ times, in ♀, 4-5 times as long as wide, the entire flagellum, ♂ ♀, tinged with rufous beneath. The thorax is finely and sparsely punctate above and below, and the metathorax is confluent and rather coarsely punctate, and usually more or less covered with fine, whitish pubescence so as to be opaque; the posterior declivity and a small area behind the scutel glabrous and polished, the two glabrous areas never quite confluent. Carinae all obsolete, except a small basal portion of the two central ones. The abdomen is confluent punctate and opaque; the usual tubercles are subobsolete, and the sides and extreme tips of the intermediate joints are often more or less tinged with sanguineous in ♀, sometimes conspicuously so, but never in ♂. In joint 1 the usual carinae scarcely extend halfway to the tip, and enclose between them a glabrous, circular, subbasal excavation. The ovipositor is half as long as body; the sheaths pubescent, scarcely tapered, and basally rather narrower than the last tarsal joint of the hind legs. Venter dull rufous, blackish at tip, sometimes all blackish, except extreme base. The legs are pale bright rufous, but in the front legs of more than one-fourth of the ♂♂ the trochanters are whitish; in the middle legs ♂♀, the second fourth of the tibiae is whitish, and very rarely the first fourth and the terminal half blackish exteriorly; and

in the hind legs the ♂ ♀ extreme tips of the femora and the whole tibia except the second fourth are black, and the tarsi are pale dusky, often with the base of each joint gradually a little paler. The areolet of the fore wings is mostly rhomboidal, very rarely subtruncate anteriorly, but never peduncled. Length, ♂, 3.5-11 mm; ♀, 5-12 mm. (After Walsh.)

This is a well-known parasite of many lepidopterous larvae. It has been reared from *Carpocapsa pomonella*, *Acrobasis juglandis*, *Aletia xyliana*, *Grapholitha olivaceana*, *Coleophora cinerella*, *Orgyia leucostigma*, and other unreared larvae. As a butterfly parasite it has been reared but once, viz.: by Mr. J. B. Smith, from a chrysalis of *Iphiclides ajax* at New York. It is also probably a parasite of *Chlorippe clyton*. Professor Riley has a pupa of this butterfly which has been broken open, revealing a large ichneumonid pupa which seems to be that of a female *Pimpla annulipes*.

Genus GLYPTA Gravenhorst.

Head transverse, short, cheeks not swollen, entire; clypeus slightly convex, apex round or subtruncate; antennae filiform; eyes nearly entire. Thorax robust; scutellum rounded at tip; metathoracic spiracles minute, subcircular; legs usually slender, tarsal claws with distinct pectinations, rarely simple or setose internally; wings generally with no areolet, rarely with a complete one. Abdomen sublanceolate or linear, rarely ovate-elongate; joint 1 with a delicate, distinct carina; joints 2 to 4 with two oblique linear depressions; terebra of female at least as long as abdomen and issuing from apex; genital valvules of male usually incrassate, with obtuse apex, rarely narrower with acuminate apex.

Glypta erratica Cresson. Pl. 88, fig. 7.

Female.—Black, shining; clypeus, mandibles, except tips, palpi, tegulae and line before, whitish; antennae brown-black, darker at base, apex and above; wings hyaline; legs, including coxae, yellowish-red; trochanters whitish beneath, posterior pair blackish above; intermediate tarsi fuscous, pale at base of joints; base and apex of posterior femora blackish; their tibiae black, with a white stripe above not reaching the apex and interrupted by a black spot near base, the tarsi black, more or less white at base of joints; face with a median rounded swelling. Thorax minutely and closely punctured; metathorax rounded, smooth, shining, obsoletely punctured, apex enclosed by a well-defined arcuate carina; abdomen finely and densely punctured, the oblique lines deeply impressed, first segment with two sharply defined, longitudinal carinae at base, becoming obsolete on middle; venter piceous, ovipositor as long as abdomen. Length, 9 mm.

Male.—More slender than ♀; the metathorax above has two, more or less distinct, oblique carinae, and the anterior coxae are whitish. Length, 8 mm. (After Cresson.)

This parasite, which is said by Cresson to be a common species in New York, Delaware, Pennsylvania and West Virginia, was reared by Professor Riley in Missouri from a chrysalis of *Polygonia comma*.

FAMILY BRACONIDAE HALIDAY.

Genus MICRODUS Nees.

Maxillary palpi 5-jointed, labial 3- or 4-jointed. Face not produced or rostriform. Mesothorax distinctly trilobate. Mesopleura with a rugulose furrow. Three cubital areolets, the first confused with the praediscoidal (after Marshall).

Microdus sanctus (Say). Pl. 88, fig. 10.*Bassus sanctus* Say.

Body black; palpi tinged with piceous; thorax, pleura, pectus and the two anterior pairs of feet immaculate; wings blackish violaceous, with a hyaline literation in the middle; nervures black; separating nervure between the first cubital and the first discoidal cellules widely interrupted; second cellule triangular; cubital cellule rather large; metathorax and abdomen bright sanguineous, posterior coxae and thighs bright sanguineous, the intervening trochanter black; posterior tibiae dull sanguineous, their tips dusky, their tarsi blackish; ovipositor nearly as long as body, ferruginous with black valvules. Length, 7.5 mm. (After Say.)

Of this species I have seen two female specimens, one from *Pholisora catullus*, reared by Miss Murtfeldt at Kirkwood, Mo., (no date), and the other from *Thanaos juvenalis*, reared by Mr. Scudder, October, 1887, at Cambridge.

NOTE.—The remaining Braconidae, parasitic upon butterflies, belong to the subfamily Microgasterinae and have been treated at my request by Dr. Riley, and from this fact have been removed from this, their natural place, to the end of the chapter.

FAMILY CHALCIDIDAE WALKER.Genus *CHALCIS* Fabricius.

Antennae 13-jointed, short and stout, pubescent, inserted in the middle of the face, scape moderate, third joint minute; scutellum slightly bidentate; abdomen subpetiolated, pointed in the female, but not much produced, first segment about half its entire length; hind femora armed with large teeth. (After W. F. Kirby.)

Table of Species.

Hind femora black on the outer side.....**flavipes.**
Hind femora yellow on the outer side, with black marking.....**robusta.**

Chalcis flavipes* Fabricius. Pl. 88, figs. 14, 15.Chalcis ovata* Say.

Head black, with golden sericeous hair which is indistinct on the vertex; antennae testaceous beneath towards tip; thorax with dilated dense punctures, a little sericeous with golden hair; tegulae yellow; wings hyaline; nervures fuscous, at base yellowish; feet bright yellow; basal half of anterior pairs of thighs black; posterior thighs black with a yellow spot on the tip above, dentate along posterior edge; posterior tibiae piceous on basal incisure; terminal spine robust, shorter than the first tarsal joint; abdomen subovate, polished; first segment nearly glabrous, second segment hairy on each side; remaining segments hairy near their tips. Length, 5 mm. (After Say.)

I have previously recorded this parasite from *Chlorippe clyton* (See Bull. 5, Div. Ent., U. S. Dept. Agr., p. 8). It was reared by Professor Riley from pupae of *Agraulis vanillae* in Missouri, and it has also been sent me by Judge W. B. Thomas who reared it at Athens, Ga., from the same species. It was also reared from *Chlorippe clyton* by Professor Riley in Missouri.

Chalcis robusta Cresson.

Black, clothed with a short, golden-yellow pubescence; head broader than the prothorax, the face, cheeks and occiput densely clothed with golden pubescence. Thorax closely and rather deeply punctured, opaque; scutellum somewhat produced behind, carinate at tip which is densely clothed with golden pubescence, as well as the extreme sides near the base; metathorax roughly rugose; tegulae bright yellow. Wings faintly tinged with pale fuscous. Legs, excepting the coxae, bright yellow; posterior coxae robust, polished; their femora much swollen, black within except near the tip, above and on the outside a large, oblique, black spot not reaching the upper margin, but confluent beneath with the black of the inside; in one specimen this spot is entire and not confluent beneath with the black of the inside, and the apical third within is yellow; lower margin armed with a row of nine or ten small, obtuse black teeth and a large obtuse one near the base; their tibiae curved, acute at tips; tarsi black at tips. Abdomen subsessile, robust, convex, ovate, sometimes faintly compressed and pointed at tip, smooth and polished, and the posterior margins of the apical segments more or less fringed with yellowish pubescence. Length, 6 mm. to 8 mm.; expanse of wings, 10-12 mm. (After Cresson.)

This large and handsome chalcid has been reared by Mr. H. G. Hubbard at Crescent City, Fla., from the chrysalis of *Heraclides crespontes*, from which it issued through a large hole in the thorax. It was originally described by Mr. Cresson from Cuba.

Genus ENCYRTUS Dalman.

Female.—Antennae 11-jointed, inserted not far from the border of the mouth, moderately thick, and, with the exception of the scape, very seldom compressed; the scape is often strongly broadened; the club is rounded, or with a slight oblique truncation at tip. The facial impression is rather large and often quite deep. The mesonotum is transversely arched, shagreened, and more or less lustrous; the scutellum shows a different sculpture. The wings are always developed and ciliated; the marginal vein is present, seldom very short; the stigmal is moderately long. The ovipositor is not so long as half the abdomen.

Male.—The flagellar joints are slightly or not at all compressed, and covered equally (not in half whorls) with hairs.

Encyrtus montinus Packard. Pl. 89, fig. 4.

Female.—Scape of antennae somewhat broadened below near tip; pedicel cylindrical, twice as long as broad; first funicle joint longer than broad; succeeding joints increasing very slightly in width but not increasing in length; club nearly as long as preceding three funicle joints together, ovate, but little broader than sixth funicle joint. Fore wings cloudy, with a single, broad, clear band extending across the wing from just beyond the stigma to posterior border, curving slightly outwards; an oblique, hairless line also extends from the stigma across towards base of wing, and the course of one of the spurious veins is seen extending from the hairless line to the hyaline band. The mesonotum is very finely shagreened and is also covered with sparse, large punctures. The general color above is light metallic green; the head, pronotum, tegulae and tip of abdomen dull yellow; the whole body below and at sides dull yellow or testaceous; legs yellow, the hind thighs somewhat dusky above; antennal scape testaceous, pedicel and first four funicle joints yellowish brown with dark hairs, funicle joints five and six white with white hairs, club black with black hairs. Length, 2 mm.; expanse, 4 mm.

This description is drawn up from Mr. Sanborn's original specimen, which is a female, however, and not a male as Dr. Packard supposed, and from a captured female received from Mr. Scudder.

This species is a true Encyrtus and belongs to the chalcostomus group, approaching very closely to *E. lunatus* Dalm. It has no connection with *E. swederi* with which Dr. Packard compares it and which belongs to Comys Foerster. All of the chalcostomus group, including *lunatus*, are parasites of Coccidae, the only possible exceptions being *barbarus* and *rogenhoferi*, the habits of which are not known. Moreover, all are parasites of the genus *Lecanium*. All that we know of *E. montinus* is that it was "found alive in an old chrysalis case" of *Oeneis semidea* by Mr. Sanborn in the White Mountains, and there is nothing in this information to contradict the hypothesis that this specimen came from a *Lecanium*, perhaps on the same plant, and that its presence in the old chrysalis was purely accidental. It may be stated in further support of this view that no true Encyrtus is known in Europe to have been bred from a lepidopteron, and no species of the whole subfamily Encyrtinae from any Diurnal. Encyrtus *bucculatricis* Howard is the only American exception to the former rule. It is very probable, therefore, that *E. montinus* is not a butterfly parasite and I introduce the redescription for the reason only that it has been so considered by others. There is, however, still a bare possibility that it may yet turn out to be a parasite of the White Mountain species.

Genus COPIDOSOMA Ratzeburg.

Female.—The antennae arise near the border of the mouth; the scape is long and slender; the six-jointed funicle long and slender, or short and comparatively thicker; the club is either long, delicately bent and somewhat rounded at tip, or it is thicker and markedly obliquely truncate. This truncation is produced by the drying of a strip of more delicate membrane upon one side of the club. Front and vertex closely punctured, without larger deep punctures. The mesoscutum and often the scutellum have with most species a sculpture which was called by Ratzeburg "schuppig" (scaly), and also a thicker punctuation with round or aciculate punctures. The marginal vein is either lacking, or it is a little shorter than the stigmal. The wings are hyaline. The ovipositor is very long, but may also be entirely hidden.

Male.—The male resembles the female in the form of the body, in the punctuation, and also in the relative proportion of the wing veins, differing to a marked degree only in the antennae. These are given off near the border of the mouth as with the female; the scape is long and slender, the pedicel shorter than the first funicle joint; the funicle is rather thickly covered with short hairs (the hairs shorter than the joints), with the joints separated above more than below; the club is about as thick as the funicle. The base of the scutellum has a more or less delicate longitudinal carina, but no furrow.

Copidosoma turni (Packard). Pl. 89, fig. 5.

Encyrtus turni Packard.

Female.—Antennae short and curved; club large and strongly truncate obliquely from tip nearly to base; first funicle joint much shorter than pedicel and as thick as long; succeeding funicle joints widen to joint 6, which is considerably wider than long. Punctuation of face very delicate; mesoscutum delicately shagreened; mesoscutellum with a delicate scaly sculpture. Marginal vein of fore wings slightly shorter than the stigmal. Color: Head and mesoscutum bright metallic green or blue, sometimes head appearing blue and scutum green; pronotum and mesoscutellum copper-bronze; ab-

domen shining black with metallic green and blue reflections; antennae dark brown; all coxae dark with metallic reflections; all femora dark brown, the hind pair slightly metallic; all tibiae brownish for a little more than basal half, tip honey-yellow; all tarsi and tibial claws yellow. Length, 2 mm.; expanse, 3.9 mm.

Male.—Agrees with female in all characters mentioned except antennae. These arise in a deep groove half way between eyes and border of mouth. The scape is short, reaching only to middle of eyes; pedicel slightly shorter than first funicle joint; remaining funicle joints all subequal in length and width, with short hairs, and well separated from above; club consists of two joints, similar to funicle joints, easily distinguished, the last one rounded at tip. Color of the antennae, honey-yellow throughout.

The series of specimens of this species studied consists of seven females and one male, all obtained by E. Norton from *Jasoniades glaucus*. Most of the species of *Copidosoma* which I have studied infest small lepidopterous larvae, which they inflate upon pupating, giving to the caterpillar skin a swollen appearance, frequently stretching it until the cells of the little parasite can plainly be seen. In the absence of any notes concerning Mr. Norton's experience, I imagine that his specimens were reared from a *glaucus* larva which was not more than half grown.

GENUS PTEROMALUS Swederus.

Mandibles 4-dentate, the left rarely 3-dentate; cheeks often compressed; clypeus emarginate in middle; eyes sometimes hairy; antennae usually inserted slightly below middle of face upon a convex, slightly protruding portion; scape not short, ring-joints distinct, club not stylate. Thorax compact, not elongate; metanotum usually punctulate, spiracles rarely large. Wings with the stigmal vein usually shorter than the postmarginal, or equal to it in length; marginal not thickened; usually (always in male) immaculate. Abdomen often rotund; venter in male rarely with a straight fold. Posterior coxae broadly ovate, not pubescent at posterior base. (After Thomson.)

Table of Species.

Clypeus 2-dentate in middle.....	chionobae.
Clypeus not 2-dentate.	
Femora of female honey-yellow.....	archippi.
Femora of female brown, somewhat metallic.....	puparum.

Pteromalus chionobae sp. nov.

Female.—Clypeus 2-dentate in middle at apex; antennae inserted somewhat below middle of face, scape reaches to anterior ocellus; flagellum well clothed with short white pile; facial impression well-marked; eyes smooth; metanotum with a strong and complete median carina, spiracles small, spiracular sulcus plain, but not reaching to acetabulum, neck punctate, border of acetabulum smooth, with a row of deep shallow punctures just above it. Postmarginal vein equal to stigmal in length, speculum small. Head and thorax densely punctulate; abdomen smooth, ovate, concave above. Color bronzy green; scape honey-yellow; pedicel below honey-yellow; femora brown, tibiae and tarsi lighter towards tip. Length, 3 mm.; expanse, 5.5 mm.

Two female specimens of this species were reared by Mr. Scudder in August, 1887, from a chrysalis of *Oeneis semidea*. The chrysalis was carefully dissected, but no more parasites could be found.

Pteromalus puparum Linnaeus. Pl. 89, figs. 1, 2.

Female.—Head a little broader than the abdomen, subtransverse, greenish bronze, closely punctate, slightly narrowing behind the eyes, vertex emarginate in middle; ocelli quite large, placed in a triangle; face quite flat, antennal grooves scarcely showing, cheeks quite long, convex, slightly compressed; eyes subovate, subconvex; clypeus emarginate at apex in the middle; mandibles armed with four acute teeth, apical one externally sinuate; antennae long, filiform, inserted in the middle of the face, bases close together, brown or fuscous, scape linear, yellow, joint 2 oblong, 3 small but distinct, 4 a little larger than 3, 5-10 equal in width but growing slightly shorter, club conico-elongate. Thorax moderately robust, above slightly convex, almost smooth, very closely squamoso-punctate; metanotum quite long, very punctate, nucha almost globose, no median carina, but strong, arcuate, lateral folds, spiracles not small, suboval, situate in the spiracular sulcus just behind the suture. Wings hyaline, subcostal cell broad, marginal vein delicate, longer than stigmal and a little shorter than postmarginal. Abdomen ovate, flat above, below slightly convex, sides rounded, a little shorter than thorax, considerably broader, joint 1 dark blue, not transverse but hidden in nucha. Coxae green, femora fuscous bronze, tibiae occasionally concolorous. Mesopleura delicately punctate.

Male.—Differs from female in its thinner, more strongly pilose antennae, oblong abdomen, aureus above, head broader than thorax, green, femora and tibiae always yellow. Length, 3 to 4 mm. (After Thomson.)

This insect is common to Europe and North America, and is the commonest parasite of *Pieris rapae*. It has also been reared from *Eurymus philodice* by Mr. Lyman, from *Eurema lisa* by Mr. Mundt, from *Agraulis vanillae* by Professor Riley, from *Polygonia satyrus* by Mr. W. H. Edwards, from *Euvanessa antiopa* by Mr. Ashmead, from *Vanessa atalanta* by Mr. Lyman, from *V. cardui* by Mr. Scudder, from *Basilarchia archippus* by Mr. Scudder, and has been caught ovipositing upon an *Epargyreus tityrus* larva by Professor Riley.

Pteromalus vanessae Harris. Pl. 89, fig. 3.

Dr. Harris' types of this species, I am informed by Mr. Henshaw, are not contained in the Harris collections at the Boston Society of Natural History, and as I know of no authentic description of the species, I am obliged to take it for granted, as Dr. Packard evidently did, that the *Pteromalus* commonly reared from *Euvanessa antiopa* and *Polygonia interrogationis* at the north is the one to which Harris gave this name.

I am unable, after close examination of the specimens reared from these butterflies, to satisfactorily distinguish them structurally from *puparum*, and am reluctantly compelled to consider for the present that *vanessae* is but a variety of *puparum*. The specimens in my possession reared from *antiopa* and *interrogationis* are at least a fourth larger than the largest females reared from *Pieris rapae*, and will average darker in color. I have no males reared from either of these butterflies, but males of the large form reared from *Heraclides crespontes* resemble in all respects males reared from *rapae*.

Specimens of this form have been reared as follows: from *Heraclides crespontes* by W. H. Edwards, A. H. Mundt and Professor Riley; from *Euphoeades palamedes* by Professor Riley; from *Ascia monuste* by Professor Riley; from *Polygonia comma* by myself; from *Evanessa antiopa* by many observers; from *Polygonia interrogationis* by many observers.

***Pteromalus archippi* sp. nov. Pl. 89, fig 3.**

Female.—Resembles in size and coloration *P. puparum* var. *vanessae*, except that all femora are honey-yellow, instead of dark brown or metallic. The punctation of the notum is deeper and closer and is identical on all segments. The nucha of the metanotum is scarcely elevated and is not at all globose; the median carina is faintly indicated, and the spiracular sulci are very deep, much curved and reach about half way to the acetabulum.

Described from three female specimens sent by Prof. A. J. Cook to Professor Riley, and reared September 13, 1887, from a chrysalis of *Anosia plexippus*. A note concerning the rearing has been published by Mr. C. P. Gillette in the *Canadian Entomologist* for July, 1888 (p. 133), in which he states that over fifty specimens of the parasite issued on the above date from a single chrysalis of *plexippus*.

GENUS DEROSTENUS Westwood.

Face usually sunken after death; vertex rarely acute, smooth; eyes large, usually hairy, usually emarginate anteriorly; antennal grooves often furcate, sending a branch to the inner side of each orbit. Antennae inserted below middle of face; scape wholly or partly pale; ring joint usually distinct; funicle 3-jointed; club rarely two-jointed with both sexes. Pronotum plain, anterior margin acute; parapsidal sutures indistinct; sculpture faint, rarely subsquamous; metanotum often carinate. Wings ample, subcuneiform; costa longer than marginal; stigmal short, postmarginal usually longer, but rarely absent.

***Derostenus antiopae* (Packard). Pl. 89, fig. 7.**

Entedon antiopae Packard.

Male.—Postmarginal vein distinct. Scutellum with no median groove. Abdomen rotund, with a very short petiole. Scape of antennae long, cylindrical; flagellum with short hairs. Eyes slightly emarginate, not hairy. General color shining black; antennae with brown club and funicle, scape, pedicel and ring-joint yellow; all legs yellow (coxae cannot be seen); metanotum and petiole yellow-brown. Length, 1.6 mm.

The only specimen of this parasite known is a male. It is in poor condition and very dusty, and is glued firmly to a large card. It is marked "477," and is said to be from the old Harris collection. As its specific name indicates, it was reared from *Euvanessa antiopa*.

GENUS CIRROSPILUS Westwood.

Head transverse; vertex not broad; eyes sparsely pubescent; genal sulcus distinct; clypeus not denticulate at apex; antennae inserted far below middle of face, distant at base, funicle 2-jointed, club 3-jointed. Thorax subdepressed above, pronotum not

short but transverse; mesonotum densely minutely punctate, and with deep sulci, continuous with the lines of the scutellum; scutellum depressed, with dorsal lines slightly converging towards apex; postscutellum large; metanotum not short, median carina distinct; costal cell of fore wings moderately broad, submarginal vein with five to six bristles. Abdomen subsessile, ovate, depressed above, hardly convex below. Mesopleura well separated, smooth. Posterior tibiae 1-spurred, coxae granulate externally. Body usually metallic and with pale markings.

Cirrospilus niger sp. nov.

Female.—Shining black, with black bristles. Antennae yellowish below; all legs, including coxae, honey-yellow; abdomen yellowish below at base. Posterior border of pronotum perfectly smooth; anterior border of pronotum, all of mesoscutum and scutellum finely shagreened; metanotum without sculpture, with a very fine median, longitudinal suture through its anterior portion, and a corresponding carina through its posterior portion; spiracles of this segment perfectly round, prominent, lateral fringe of hairs white and strong. Abdomen lozenge-shape or nearly round, as broad as thorax, but much shorter. Length, 1.5 mm.; expanse, 3.25 mm.; greatest width of fore wing, .58 mm.

Male.—Differs from female in following respects: Abdomen long oval, considerably narrower in front, nearly as long as thorax and quite as wide, the first segment above bearing a large, light-brown, circular spot; all coxae shining black; hind femora black above, this color extending downwards at middle; front femora slightly dusky towards base above. Length, 1.6 mm.; expanse, 3.25 mm.; greatest width of fore wing, .49 mm.

A large number of both sexes of this species were reared by Mr. Scudder from the "tomb-stone" pupae of some un-reared *Eulophus*, which had previously destroyed the half grown larva of *Vanessa atalanta*. It is, therefore, a hyperparasite.

GENUS TETRASTICHUS Haliday.

Head with a distinct genal sulcus; clypeus bidentate at middle of apex; ocelli usually placed in a curved line; eyes smooth or rarely pilose, ovate or subrotund; vertex narrow; impressed line before the ocelli usually distinct; antennae usually inserted a trifle below the middle of the face; scape very rarely reaching above the ocelli; ring-joint very small but easily seen, rarely conforming with the joints of the funicle; funicle 3-jointed; club 3-jointed, the last joint smaller, often setigerous. Pronotum with the posterior border, especially on the sides, hairy. Mesoscutellum with four bristles behind the middle, usually with two parallel, longitudinal, deeply impressed lines. Metanotum usually short, rarely punctulate; apex in the middle not produced, but angularly emarginate; often carinate; fimbriate border with 1 to 4 bristles. Wings clear; costa longer than marginal; no postmarginal; stigmal quite long, club distinct, uncs conspicuous; submarginal with 1 to 5 bristles. Abdomen ovate or conico-triangular; terebra rarely much exerted. Posterior tibiae 1-spurred, tarsi shorter than tibiae with joints subequal in length. Male antennae rarely with erect hairs, usually with long appressed hairs; ring-joint always distinct, usually transverse (adapted from Thomson).

Table of Species.

Mesoscutum with an impressed, median, longitudinal line.	
Antennae inserted just above clypeus.....	semideae.
Antennae inserted considerably above clypeus.	
Wing veins pale.....	saundersii.
Wing veins dark.....	theclae.
Mesoscutum with no impressed line.....	modestus.

Tetrastichus semideae (Packard).*Eulophus semideae* Packard.

Male, female.—Antennae inserted slightly above clypeus. Mesoscutum with an impressed, median, longitudinal line. Mesocutellum with two parallel, impressed, longitudinal lines. Flagellum of male antennae with many long appressed hairs. Abdomen of female a little longer than thorax and about as broad, rounding out to joint 3 which is broadest, and thence, with straight sides, tapering to an acute point; the whole abdomen flattened and usually tilted upwards. Abdomen of male shorter and narrower than thorax, flattened and sub-oval. General color bluish green; antennae brown, darker in male than in female; all tibiae and tarsi honey-yellow; all coxae dark brown, yellowish at tips; front femora dark metallic except at tips; middle and hind femora dark brown except at tips. Length, 1.85 mm.; expanse, 3 mm.

This species has been reared in considerable number, from *Oeneis semidea* by Mr. Scudder who has sent me a goodly series.

Tetrastichus saundersii (Packard).*Eulophus saundersii* Packard.

Of this species of Dr. Packard's there remain but three greatly mutilated specimens. The antennae of all are gone and all are pinned with large pins through the thorax so as to destroy the characters. The species from the wings does not belong to the *Eulophinae* but to the *Tetrastichinae*, and may provisionally be placed in *Tetrastichus*. There is no hope of a proper placing of this species until it is reared once more. The best we can do is to reproduce Dr. Packard's original description:

Three females. A minute species compared with *semideae*, but otherwise closely allied to it in structure and color; the abdomen, however, is considerably shorter and thicker, being scarcely longer than the thorax, while in *semideae* it is as long as head and thorax together. Antennae of the same form as in *semideae* but much shorter, the joints between the second and the club being longer than broad, while in *semideae* they are twice as long as thick; they are brown and hairy. Wings much as in *semideae*, but the veins are much paler, less distinct. Legs colored much as in *semideae*. Trochanters brown, femora brown, pale at base, and whitish at tip; tibiae and tarsi white, except tarsal joints which are pale brown. Abdomen, like the rest of the body, deep blue with a greenish tinge, much shorter than in *semideae* and conical ovate, the tip not being at all produced. The body is smooth with very fine hairs. Length, 1 mm.

These specimens were reared by Mr. Saunders in Ontario from a chrysalis of a *Thecla* presumed to be *edwardsii*.

Tetrastichus theclae (Packard). Pl. 89, fig. 6.*Eulophus theclae* Packard.

Male.—Antennae inserted considerably above clypeus. Mesoscutum with median longitudinal sulcus. Mesocutellum with two distinct, parallel, longitudinal sulci. Submarginal vein with two bristles. Antennal scape not reaching to the eyes. Abdomen broadly ovate, as long as thorax but considerably broader. General color very dark metallic blue-black; antennae brown with whitish pile; legs with all femora and coxae blue-black; all tibiae and tarsi yellowish white; last tarsal joint dusky. Length, 1.28 mm.; expanse, 3 mm.

Of this species I have seen 12 males all reared from chrysalis of *Thecla calanus*, presumably by Mr. Scudder.

Tetrastichus modestus sp. nov.

Female.—Smooth, no perceptible punctation. Antennae arise slightly above clypeus; scape reaches a little more than half way to top of eyes; flagellum, usually bent upon scape, reaches slightly below mouth; flagellum and especially club quite hairy. Mesoscutum with no median longitudinal sulcus; mesoscutellum with usual sulci; submarginal vein with two strong bristles. Abdomen rather longer than thorax, but not as broad, narrowly ovate in form. General color shining black, with very slight greenish reflections; antennae brown, with whitish pile; wing veins very light brown; all coxae, femora and tibiae dark brown, the coxae and femora sometimes black and glistening; femero-tibial articulations and tips of all tibiae yellowish white; all tarsi yellowish white. Length, 1 mm.; expanse, 2.4 mm.

Male.—Differs from female only in having a slightly longer scape, and longer, more hairy flagellum.

Described from four female, six male specimens reared by Mr. W. H. Edwards at Coalburgh, W. Va., from cocoons of *Apanteles edwardsii* Riley, spun by larvae which had issued from *Vanessa atalanta*, and from *Apanteles* cocoons, the adults of which have not been bred, but which were spun by larvae which issued from the larvae of *Polygonia interrogationis*.

All of these species of *Tetrastichus* are secondary parasites. No *Tetrastichus*, so far as known, is a primary parasite. The real host of none of Dr. Packard's is known. That of *modestus* is as indicated.

GENUS *TRICHOGRAMMA* Westwood.

Tarsi 3-jointed; front wings with regular rows of hairs, submarginal vein reaches costa, and, with marginal and stigmal, forms a regular arch; antennae 8-jointed—scape, pedicel, ring-joint, funicle (2), club (3)—; ring-joint very minute; funicle joints in female small and subequal in length and width; club large, obliquely truncate at tip. In the male the funicle joints are much larger and the club is of same width, tapering gradually to rounded tip.

Four described North American species, and a number of undescribed species have been examined, but it seems impossible to find structural characters of specific value. Certain series of individuals can be distinguished by color, and by color alone, and for convenience those reared from butterfly eggs are grouped into the following species. The specimens should be mounted in balsam and should be studied with a dark background and reflected light, as the dusky tints are mainly lost with transmitted light. If mounted dry upon tags, these delicate insects shrivel to such an extent that they are useless for study.

Table of Species.

Color dark brown.....	<i>minutum</i> .
Color pale honey-yellow.....	<i>minutissimum</i> .
Face bright yellow; abdomen and legs dusky yellow.....	<i>intermedium</i> .

***Trichogramma minutum* Riley.**

I have been unable to find recognizable specimens of this species. Specimens preserved by Professor Riley, between two flakes of isinglass,

are spoiled. Structurally it is identical with the other forms. Colorationally it was described by Professor Riley in the following words: "It is inconspicuously marked, the body being dark brown, with the antennae and legs pale, and the wings iridescent.

The species was figured and described in the Third Report on the Insects of Missouri, p. 157, from specimens reared from the eggs of *Basilarchia archippus* in Missouri. From four to six parasites issued from each egg.

***Trichogramma minutissimum* Packard.**

Body uniformly pale testaceous or honey-yellow, legs and antennae scarcely paler than the body. Abdomen a little longer than the thorax, but no wider, seen from above. Antennae a little longer than in *minutum*, legs a little slenderer. Length, ♂ .25 mm. to .37 mm.; ♀, .38 mm.-.5 mm. (After Packard.)

[The following description of the colors was taken during life:—Body and head wax-yellow; face a little paler; eyes and ocelli dark orange; body with yellow-green internal blotches appearing through the skin; legs and antennae pale yellow, apical half of tarsi a little dusky. s. n. s.]

In the material sent me by Mr. Scudder I find eight slides of this species, three labelled from eggs of *Jasoniades glaucus*, three from eggs of *Basilarchia archippus*, and two from eggs of *Vanessa atalanta*.

***Trichogramma intermedium* sp. nov. Pl. 89, fig. 8.**

Male.—General color dirty yellow in effect; face bright yellow, eyes and ocelli red, antennae slightly dusky; mesonotum very light yellow-gray; metanotum yellow; abdomen above slightly darker than mesonotum; all coxae dusky, hind femora slightly dusky above, remainder of legs dull yellowish. Wings with a slight cloud below submarginal vein. The nearly straight line of hairs running downwards from tip of stigma consists of five hairs, the first one sometimes included in stigmal club, leaving only four apparent in the row. Average length, .55 mm.; average expanse, 1.0 mm.

Female.—Slightly smaller, and not quite so dark as male.

[The following description of the colors was taken during life: Honey-yellow, the abdomen pale and banded transversely with dusky; eyes and ocelli salmon-red; legs and antennae greenish olive; apical two-fifths of tarsi fuscous. s. n. s.]

Of this species Mr. Scudder has sent me six slides, four containing specimens reared from eggs of *Aglais milberti*, and two from eggs of *Thanaos lucilius*. Mr. James Fletcher has since sent me from Ottawa four specimens reared during the summer of 1888, from eggs of *Oeneis macounii*.

FAMILY PROCTOTRUPIDAE STEPHENS.

GENUS TELENOMUS Haliday.

Small, black, compact; abdomen acutely margined along the sides; antennae arising near the border of the mouth; anterior tibiae with one spur; anterior wings with a marginal and a stigmal vein; antennal club jointed; marginal vein shorter than stigmal; second abdominal segment longest; maxillary palpi 2-jointed; mandibles arcuate, slightly bidentate at apex.

Table of Species.

Male abdomen only three-fourths as long as thorax.....	<i>graptae</i> .
Male abdomen nearly or quite as long as thorax.....	<i>rileyi</i> .

***Telenomus graptae* sp. nov. Pl. 89, fig. 9.**

Male.—The nine funicle joints of the antennae are beaded and well separated, all joints subequal in width, joints 4 to 9 nearly as broad as long, joint 2 longest, joints 1 and 3 subequal, both shorter than 2, and longer than 4 to 9; club shorter than two preceding joints together, conical, sharply pointed. Thorax much arched and very finely pilose. Abdomen three-fourths as long as thorax. Color dark brown; nearly black, the abdomen darker than head or thorax; antennae uniform dark brown; all coxae and femora dark brown; front tibiae light brown, middle and hind tibiae dark brown; all tarsi dark honey-yellow; wing veins brown, well marked. Length, .875 mm.; expanse, 2.3 mm.

Female.—Differs from male only in antennae, in which the last three flagellar joints form a large club, the three joints well separated, and the last slightly obliquely truncate. From the basal joint of the club the funicle joints taper down in size for three joints.

Described from one male and one female. The male was reared by Mr. Scudder from an egg of *Polygonia progne*, and the female was captured June 15, by Mr. C. W. Woodworth on the White Mountains while in the act of ovipositing in an egg of *Euvanessa antiopa*. Both specimens are poorly mounted in balsam, and the characters are difficult to observe. Mr. Scudder has also sent a slide containing a single female *Telenomus*, which I hesitate, on account of its poor condition, to separate from this species. It was reared from an egg of *Heodes hypophlaeas*.

Since this description was written I have received another female from Mr. Scudder, which I cannot separate from this species and which was reared from the egg of *Limochares taumas* collected at Nepigon by Mr. Scudder in the summer of 1888. A single female was also reared from an egg of *Polygonia interrogationis* at Washington, August 6, 1887.

***Telenomus rileyi* sp. nov.**

Male.—Proportions of funicle joints much as in *graptae*; club more oval and less acutely pointed; joints 1 and 2 of funicle much more constricted at base than at apex. Thorax somewhat less highly arched than in *graptae*. Abdomen nearly or quite as long as thorax. Pile of thorax not distinguishable under a moderate power. Color black, abdomen highly polished; scape and pedicel of antennae bright honey-yellow; joints of funicle yellow below, dusky above, last three joints (club) dark brown; all legs, including coxae, bright yellow, verging upon orange. Wing veins faint, dusky. Length, .72 mm.; expanse, 1.8 mm.

Described from three males reared by Professor Riley from eggs of *Chlorippe clyton* in Missouri.

FAMILY BRACONIDAE.

SUBFAMILY MICROGASTERINAE.

BY C. V. RILEY.

It is difficult to properly consider the Microgasters affecting the larvae of New England Rhopalocera without a careful revision of the whole group; but, at Mr. Howard's request, I have prepared the following notes which may not be without interest.

In the "Notes on North American Microgasters" (Trans. Acad. Sc. St. Louis, Vol. iv, No. 2, April, 1881) I have shown that the species are more variable than had been up to that time supposed, and that even in the manner of forming their cocoons, as well as in the character of the cocoons, there may be considerable variation in the same species. A large amount of additional material obtained since the publication of that paper, and in most cases connected with the host, has served to complicate the whole question of species, so that their delimitation becomes at times almost impossible. In short, a careful study of this group, as of most other groups well and fully represented, confirms the idea of the non-existence of species as such in nature, and renders it almost as easy to make a continuous series as to make well marked divisions. On the present occasion, however, it is not necessary to enter into a consideration of this general subject of species, except in so far as to warn the reader that the species here treated of are characterized as such more for convenience than anything else; that if I have avoided a strong disposition to lump and combine forms hitherto considered good species, it is purely to assist in recognizing the alliances; and that the average characters of assemblages rather than individual characters have been utilized.

In the terminology of parts there is need of greater precision than American authors, including myself, have hitherto employed; but I have often used scutellum for the prominent triangular piece, strictly the meso-scutellum; and postscutellum when including the more critically differentiated mesopostscutellum, metapraescutum and metascutum, as the characteristic fovea usually extends across this last. Metascutellum is used for the larger piece, which I have heretofore called the metanotum. In the genus *Apanteles* I have begun with *glomeratus*, making the description of this species most full, for obvious reasons and for purposes of comparison.

The group is a difficult one on account of the monotony of the coloring

and slight structural variations. Ordinarily there are no striking secondary sexual characters, the male being on the average somewhat the smaller.

Where not otherwise stated, the rearing has been done by myself.

GENUS APANTELES Foerster.

Maxillary palpi 5-, labial 3-jointed. Antennae 18-jointed. Eyes villose. Mesopleurae impressed with a smooth fovea. Abdomen sessile; suturiform articulation distinct. Radius of fore wings subobsolete; 2 cubital areolets, the 2d being open on the outer side, and thus confused with the 3d. Spurs of the hind tibiae never much shorter than $\frac{1}{2}$ the metatarsus. (After Marshall.)

Table of Species.

Ovipositor long, as long as abdomen.	
First abdominal tergite, sculptured above.....	megathymi. 3.
First and second and base of third tergites sculptured.....	edwardsii. 2.
Ovipositor short, much shorter than abdomen.	
First and second and more or less of third tergites sculptured.	
Third tergite sculptured only at base.	
All coxae black (entirely).	
All femora partially black.	
Face with distinct tubercle.....	koebeleri. 8.
Face without tubercle.....	limentidis. 4.
All femora reddish, tips of hind femora blackish.	
Face with a minute tubercle.....	lunatus. 5.
Face without tubercle.....	argynnidis. 7.
All coxae more or less reddish.	
Face without tubercle.....	flavicornis. 9.
Face with a distinct median tubercle.....	emarginatus. 10.
Third tergite entirely sculptured.....	cyaniridis. 6.
First and second tergites, only, sculptured.	
Anterior and middle coxae yellow.....	glomeratus. 1.
All coxae black.	
More or less of all legs black.	
Metascutellum with a slight median longitudinal ridge.....	theclae. 11.
Metascutellum with no such ridge.	
First tergite narrow behind.....	junoniae. 12.
First tergite nearly as broad behind as base of second....	cardulcola. 13.
All legs yellow except coxae.	
Punctuation of second tergite confined to borders.....	atalantae. 14.
Second tergite closely punctate.....	pholisora. 15.
All tergites polished.....	cassianus. 16.

1. *Apanteles glomeratus* (Linn.). Pl. 88, fig. 12.

Microgaster pieridis Pack.

Apanteles pieridivora Riley.

Parasitic on *Pieris rapae* and *P. oleracea*.

Up to the publication of my paper already alluded to, it was not definitely known that this species occurred in North America, and I have already recorded (Ann. Rept. Entom., Dept. Agr., 1884, p. 323) the success of my efforts to colonize the species at Washington from cocoons received from Mr. G. C. Bignell of Plymouth, England, earlier attempts

which I made having failed. The importance of the introduction of this, one of the commonest parasites of *Pieris rapae* in Europe, and the interest attaching to it justified the trial. But for the last few years I have received many specimens, particularly from different parts of this country, of a *Microgaster* bred from *Pieris rapae* which bore a suspicious resemblance to the European *glomeratus*. The material before me includes, 1st: (from Europe) a perfect female which was received in 1879 by Mr. Howard from Dr. Gustav Mayr of Vienna; a large series in my own collection in the National Museum reared from the cocoons received from Mr. Bignell from England; other specimens descended from these last and reared in the District of Columbia, and two bunches of cocoons from Mr. Scudder collected in Europe in 1872; 2d: (reared from *Pieris rapae* in the United States) specimens from Prof. J. A. Lintner of Albany, N. Y., Mr. G. Haley of Brownfield, Me., Mr. E. W. Allis of Adrian, Mich., Prof. A. J. Cook of Lansing, Mich. and Mr. W. B. Alwood of Columbus, O., and finally four authoritative specimens of *Microgaster pieridis* (Pack.).

A careful study of all these specimens makes it impossible to separate the American bred forms from the European, from which fact it would seem evident that other importations must have taken place of late years besides that purposely made which I have already referred to. Indeed, as we shall see in considering the common and wide-spread *congregatus* (Say), one would be perfectly justified in looking upon it as an American representative of *glomeratus*, and while its different habit, and the slight differences which I point out make it possible and desirable to keep them under distinct specific names, yet the differences might with perhaps equal propriety be regarded as varietal, especially as *atalantae* is intermediate between them.

Thus it becomes in a measure a matter of mere speculation as to whether the more typical *glomeratus* in America is an entomophagic derivative of *congregatus* modified from breeding again in *Pieris rapae* or whether it represents earlier importations from Europe. We must not wonder at this difficulty in separating specifically allied European and American insects, when zoölogists are yet discussing the specific relations of many of the higher animals common to both countries, and opinions differ among the most competent to express them. In this country *glomeratus*, so far as the material indicates, is confined to *P. rapae*, while in Europe it is reared not only from the larva of this butterfly, but also from that of *Mancipium brassicae* and other species.

Length of body, ♀, 2.6—3 mm. Color black. Pilosity of head and thorax quite marked and white. *Head* with the punctation very fine, tolerably dense, but less so on the polished face and clypeus; a deep puncture or fovea each side at apex of the clypeus; *face* with two more or less well defined, slender carinae diverging from the base of the antennae forward, the space between them generally depressed, and in some cases short striae diverging from the carinae; eyes brown; mandibles either pale brownish or

honey-yellow; antennae black, the lower side of the basal joint and base of the flagellum often brownish; palpi from pale testaceous to quite yellow: *mesothorax coarsely punctate, polished and sparsely pubescent*; median carinae of metanotum complete but faint; scutellum polished, sparsely punctate; postscutellum very narrow, almost linear, with a central more or less circular, sometimes almost square fovea, having a central, longitudinal carina thickened at base; metascutellum rather coarsely and densely rugose, with a (generally) well defined, slender, median carina; tegulae brownish to black; wing venation normal; costa, stigma and radial vein quite dark brown, though occasionally lighter, the other veins paler; curve of radial vein more or less variable, sometimes quite angular; legs honey-yellow; posterior coxae black, sometimes brownish beneath, the others rarely brownish; tip of posterior tibiae either black or dusky or concolorous; hind tarsi generally dusky. *Abdomen* black, the two basal joints closely punctate, sometimes slightly rugoso-punctate; the first joint longer than broad, narrowest at base, gradually broadening posteriorly, the base deeply concave and highly polished, and the apical angles generally somewhat rounded; a more or less well defined, median carina on the second joint; lateral margin of both and generally of the third, honey-yellow to reddish, this color extending ventrally over the whole of two and sometimes of all three joints; rest of abdomen black, highly polished and with sparse and slender white hairs, arranged dorsally in one irregular row to each joint; ovipositor but slightly extending beyond tip—often entirely hidden from above according as it is extended or drawn up.

♂. Not separable except by the sexual differences common to the group.

The coloration of the legs as well as of the basal abdominal joints varies, the coxae being sometimes concolorous, i. e., all dusky and the femora exceptionally having no duskiness. The mandibles vary from yellowish-red to piceous. Described from some 150 specimens.

In the most complete European description at hand (Nees ab Esenbeck, Hym. Ichn. Aff., i, 181, 1834) the basal joint of the abdomen is made to form a rectangulum, due to the fact that the narrowing, highly polished base is generally hidden beneath the metascutellum, while the typical form accords more with our exceptional specimens having unicolorous femora. None of the specimens before me have the yellowish or reddish color on basal abdominal joints so broadened dorsally as to appear rufous with two large, black spots as described by Nees for the male.

The cocoons are formed in irregular masses of about 20-100 or more. They are ovoid and vary in color from very pale yellow to bright sulphur-yellow, the loose external and combining threads being generally the deeper in color, and the American specimens, as a rule, paler than the European. Nees describes them as pale testaceous. The color not only varies slightly but will depend upon the amount of exposure to bleaching weather.

I have pointed out (Am. Nat., 1882, p. 679) that Dr. Packard's name *peridivora* is preoccupied in the same genus and that his species was to be looked upon as a variety of *congregatus*. I therefore proposed the varietal name *peridivora* for it.

The four specimens at hand, as also his description (Proc. Bost. Soc. Nat. Hist., xxi, 1880-2, p. 26), so far as it goes, agree well with *glomer-*

atus, and should now be considered synonymous with this last rather than a variety of congregatus, as I was inclined to place it prior to the study of glomeratus.

Apanteles congregatus (Say).

Parasitic on various Sphingidae.

This species, as I have shown, (op. cit.) is extremely variable, having several entomophagic varieties which most authors would perhaps look upon as good species. It has not been reared from any of the Rhopalocera and is referred to here because of its close relationship to glomeratus; from which in its more typical form, it may be distinguished by the following characters:

More generally hairy. Face less polished, densely punctate and in place of the diverging carinae, a small, polished tubercle near and between the bases of antennae and sometimes a faint indication of a median carina. Mesoscutum less polished, rather densely punctate and more pubescent; metascutellum with the lateral and posterior carinae more sharply defined and a median carina more often indicated. Legs more often concolorous and rarely with tips of femora and of tibiae dusky and still more rarely black. Wings with a rather darker tinge.

2. Apanteles edwardsii n. sp.

Parasitic on *Vanessa atalanta*.

Average length, 2.6 mm. ♀: Color black. Legs pale yellowish-brown. Pilosity sparse and white. *Head*: face with a more or less distinct carina; antennae piceous; palpi very light yellow. *Thorax*: metascutellum without carina but with posterior angles and slight elevation at middle of hind border rather distinct and polished; scutellum sparsely punctate and not more polished than the rest of thorax; tegulae light honey-yellow; wings normal, stigma and costa piceous, veins paler; radial vein angulated a little beyond middle; legs with all coxae and all trochanters honey-yellow; front and middle femora, tibiae and tarsi honey-yellow; hind femora honey-yellow, dusky at tip; hind tibiae honey-yellow, nearly black at tip; hind tarsi brownish. *Abdomen*: joint 1 with a longitudinal oval median fovea not extending to joint 2; joint 1 narrow, emarginate behind, side pieces piceous-brown; joint 2 transverse, broader than 1 and thrice as broad as long, the hind wider than anterior border; both 1 and 2 strongly punctate, 3 but slightly so at anterior border; ovipositor exerted, very long, extending more than the whole length of the abdomen, and yellowish-brown.

Approaches closely *A. cacaoeciae* (Riley).

The cocoons are elongate, dense, pure white or varying to a dingy white, with scarcely any loose silk. The species has only been bred from young larvae.

Described from four females reared from *atalanta* by Mr. William H. Edwards.

3. *Apanteles megathymi* Riley.

Parasitic upon *Megathymus yuccae*.

I repeat here the description already published (Notes, etc., pp. 9-10).

Apanteles megathymi, n. sp. Length of body, 8 mm, ♂ ♀. Black; palpi whitish, antennae piceous; legs red, the coxae, and in the males the posterior femora and tarsi and the tips of the posterior tibiae, black or piceous, in the females the tips of posterior tibiae and the posterior tarsi dusky; wings, including the stigma, hyaline; tegulae and nervures white, the costa and the outline of the stigma testaceous. Mesonotum closely punctate, the punctures tending to unite to form striae, opaque, the scutellum polished, sparsely punctate; metathorax finely reticulate, divided into larger areas by regular ridges, two of these ridges enclosing a median ovate-lanceolate area, there being no median carina. Abdomen as long as the thorax, narrowing towards base; basal joint, excluding the less chitinized sides, longer than broad, and longer than the second and third joints taken together, delicately sculptured and with some scattered punctures of larger size; remainder of the abdomen smooth; second joint very short, separated from the third by a deep, but very narrow groove; the third joint twice as long as the second. The ovipositor is exerted and as long as the abdomen. The vein from the stigma forms with the basal vein of the areolet only a slight curve.

Described from many specimens bred from larvae of *Megathymus yuccae* received from South Carolina. The cocoons are spun in white masses, filling the silk-lined burrows of the *Yucca*-borer. The flies appear in April shortly after the time of appearance of the butterfly, and are more or less powdered with the waxy secretion of the caterpillar.

4. *Apanteles limenitidis* Riley.

Microgaster limenitidis Riley; Third *chaes* Riley; Notes on N. A. Microgasters, p. 13.
Rept. Ins. Mo., p. 158. *Apanteles limenitidis* Riley; Packard,
Apanteles limenitidis Riley, form *flavicon-* Proc. Bost. Soc. Nat. Hist.

Parasitic on *Basilarchia archippus*.

This parasite commonly infests the last brood of larvae of *Basilarchia archippus* in Missouri, and as my original description was rather general, I have drawn up a more full characterization:

Average length ♂, 2 mm.; ♀ 2.5 mm. Color piceous-black with white pubescence. *Head*: with a perceptible but very slight median facial elevation below antennae; palpi whitish or testaceous. *Thorax*: mesoscutum coarsely punctate and with a faint median carina obsolete anteriorly; scutellum more polished; fovea of metascutum broad, subtriangular and with central depression; wings normal the basal vein of areolet but slightly angulate; legs with all coxae and trochanters black; front femora with basal half black; apical half honey-yellow (sometimes nearly all honey-yellow); front tibiae and tarsi honey-yellow; middle femora dark brown above, tibiae and tarsi honey-yellow; hind femora black; hind tibiae with basal half honey-yellow, apical half brown, spur yellow; hind tarsi brown above, paler below. *Abdomen* with joints 1, 2 and 3 punctate, the rest polished; 2 with a slight median carina; 1 and 2 yellowish at sides ventrally; ovipositor hidden.

The male differs but slightly, the front and middle femora being usually darker. One female has all legs yellow except extreme tip of hind femora.

Described from numerous specimens reared from *B. archippus* and others (var. *flaviconchae*) from cocoons found in fields infested with *Leucania unipuncta*.

The cocoons from *archippus* are from young larvae of autumn brood and are dull whitish, single and with little loose silk. Those of form *flaviconchae* are pale yellow and in masses with a small amount of loose silk.

5. *Apanteles lunatus* (Pack.).

Microgaster lunatus Pack., Proc. Bost. Soc. Nat. Hist., xxi, p. 28 (1880).

Parasitic on *Papilio polyxenes*.

This species was described by Dr. Packard from a single female bred by me from *Papilio polyxenes*. Mr. Scudder is not able to find the specimen, and hence I can only adopt Dr. Packard's description:

Body dull black, not shining, stout and thick. Head and antennae covered with an unusually dense silvery pile, the antennae rather thicker than in *M. pieridis*; palpi pale testaceous; front rather broad between the eyes; thorax dull black; metanotum with no median ridge. First subcostal cell instead of being irregularly oblong, is much broader and irregularly pentagonal. Fore and middle trochanters black, legs deep honey-yellow with a slight reddish tinge, outer third of tarsi pale brownish; hind femora reddish honey-yellow tipped with black, tarsi wholly black. Abdomen entirely black, granulated as usual on two basal segments, polished beyond, a faint dull testaceous spot on under side of first segment, not appearing above. Length, .13 inch.

I have one female in poor condition reared from *polyxenes* received from W. B. Thomas, of Athens, Ga. in 1885, which is apparently this species, and which is characterized by a minute tubercle on the face, by the scutellum being densely punctate and not polished and by the basal joint of palpi being black. The metascutellum has no carina but is heavily pilose. Abdominal joint 1 narrow, the hind border almost as wide as the joint is long, without carina, but with a strongly marked median tubercle, extending to anterior border of joint 2, with both joints and basal part of 3 strongly rugose. Ovipositor but slightly exerted, the sheath extending but a short distance beyond the tip of abdomen.

The cocoons are single, dense, dull yellow and with but little loose silk.

6. *Apanteles cyaniridis* n. sp.

Parasitic on *Cyaniris pseudargiolus*.

Length, 2.8 mm. ♀: Pilosity sparse. Head: face without carina; palpi pale yellow. Thorax: mesoscutum with barely a trace of a carina; scutellum hardly more polished

and evenly and minutely punctate; the scapulae perfectly smooth and polished behind; metascutellum with the median carina divided around acetabulum; the lateral carinae starting each side of spiracle: wings normal, with stigma and costa very dark brown, the radial vein strongly angulated below its middle: legs with all coxae black; all femora and tibiae honey-yellow; trochanters dusky at base; hind femora dusky just at tip; hind tibiae with a dusky band at tip; hind tarsi dusky except at bases of joints; basal joint darker than the rest. *Abdomen* without a trace of yellow; dorsal plate of joint 1 broader posteriorly than long; of joint 2 with a well marked median carina extending slightly upon joint 3; joints 1, 2 and base of 3 well sculptured; ovipositor but very slightly protruding and not reaching beyond tip of abdomen.

Described from 3 specimens in my collection received from William H. Edwards, reared from *Cyaniris pseudargiolus*.

The cocoon is white with a tinge of lemon-yellow and surrounded with considerable loose silk.

7. *Apanteles argynnidis* n. sp.

Parasitic on *Argynnis cybele*.

Length of body, 2—2.2 mm. Color black. Pubescence white and quite dense. *Head*: profusely punctate; face without median carina or tubercle; mandibles yellowish-brown, palpi whitish; eyes black; antennae black, often brown or ferruginous beneath. *Thorax* more coarsely and densely punctate than the head, and with no median carina on mesoscutum; scutellum somewhat polished and sparsely punctate; fovea of postscutellum small, transverse, divided by a distinct median carina; metascutellum strongly rugose, with distinct median carina, the lateral ridges almost parallel, diverging somewhat anteriorly; tegulae brownish-black: wings hyaline; venation normal; costa dark brown, stigma and veins paler brown: legs reddish-yellow; all coxae black, anterior and median tarsi paler, almost whitish, brownish toward the end, their claws blackish; posterior femora and tibiae blackish toward tips; posterior tarsi dusky. *Abdomen* black; the two basal joints densely and confluent punctate, the third less so, and only at its basal half; joint 1 longer than broad, the concavity at its base deep and similarly sculptured; a faint indication of a median ridge on joint 2; flexible margins of the two basal joints scarcely apparent, somewhat yellowish or often almost black; remaining joints highly polished and sparsely hairy; venter black; ovipositor and its sheaths scarcely projecting.

The cocoon is dense, narrow, smaller than in *koebelei*; single or in small, exposed masses, dingy white, with a little loose silk surrounding.

This species also closely resembles *A. flaviconchae*, which differs, however, in being somewhat larger, in having a more densely punctate thorax and scutellum, in the entirely punctate third abdominal joint and in having the basal half of the anterior and median and the whole of posterior femora, black.

Described from 7 specimens, all females, bred from *Argynnis cybele* by William H. Edwards.

8. *Apanteles koebelei* n. sp.

Parasitic on *Lemonias anicia*.

Length of body 2.6—2.8 mm. ♀: color black. Pubescence short, dense and faintly

yellowish. *Head* finely punctate, somewhat polished; facial carina not well defined, but terminating in front of antennae in a distinct polished tubercle; mandibles reddish; palpi whitish, the basal joint of maxillary palpi black; eyes brown with paler inner border; antennae black in both sexes, scarcely as long as the body. *Thorax*: scutellum polished, sparsely punctate; fovea of post-scutellum circular, occasionally with a round, central granule; metascutum and metascutellum coarsely rugose, the median carina on latter distinct, the lateral carinae straight, diverging anteriorly; tegulae blackish; wings hyaline, venation normal; the radial vein angulated; costa, stigma and veins brownish black; legs, usually reddish with all coxae black and the extreme base of the anterior and median and apex of posterior femora more or less distinctly blackish; all tarsi more or less dusky. *Abdomen* black, laterally compressed beyond joint 3, and wedge-shaped; joint 2 and extreme base 3 rugose-punctate; joint 1 longer than broad, narrowest at base, broadening and almost as broad posteriorly as 2; concavity at base deep and not polished; median carina of joint 2 either very distinct or almost wanting; the other joints highly polished and sparsely hairy; flexible border of two basal joints rather narrow; venter black; the ovipositor short, exerted, its sheaths black.

The ♂ is distinguished by the longer antennae, by the less compressed abdomen, by the palpi being dusky, the femora darker, the sides black along the whole length, the tibiae with a dusky tinge and the tarsi blackish. There is more variation in the carina on abdominal joint 2, being but feebly indicated in one specimen and wanting in a second.

There is some variation in coloration, and one female, smaller than the average, has the coloration of the male.

The cocoons are white, less satiny than in *flavicornis*, somewhat stouter, but similarly exposed and held together by loose silk.

Described from 15 specimens (12 ♀, 3 ♂), bred by Mr. A. Koebele from *Lemonias anicia*? from California.

This species resembles *A. limenitidis*, var. *flaviconchae* which is readily distinguished, however, by the want of median carina and facial tubercle, but its coarser and more densely punctate mesoscutellum, the coarser sculpturing of the basal abdominal joints and by the normally shaped abdomen.

9. *Apanteles flavicornis* n. sp.

Parasitic on *Thanaos juvenalis*.

Average length of body 2 mm. ♀: general color black; pubescence quite dense, short white. *Head*: face without carina or tubercle; mandibles honey-yellow; palpi white with the first joint of the maxillary palpi pale yellow; antennae brown above, yellowish-brown beneath. *Thorax*: mesonotum without or rarely with an indication of a carina; scutellum polished, without punctation; fovea of postscutellum very small, divided by a minute median ridge; metascutellum rugose, its median carina distinct; tegulae yellow; wings with the costa, stigma and radial vein brown, the other veins almost colorless; legs honey-yellow, the posterior coxae black; tip of posterior femora, tibiae and tarsi often dusky. *Abdomen* black and honey-yellow; basal joint somewhat longer than broad, narrowest at base; together with second joint and more or less of the base of the third, rugose-punctate; the second with a rather prominent median carina; the other joints polished; the margins of joints 1 and 2, whole of 4 and 5 and generally the posterior margin and angles of 3 and sometimes more or less of 6 and the greater portion of the venter honey-yellow; ovipositor very short, scarcely exerted.

♂ with the antennae entirely yellow and the abdomen above generally black.

The cocoons are narrow, satiny, pure white and spun in irregular masses loosely held together by some few threads, but not embedded.

Described from 17 specimens, bred from *Thanaos juvenalis* at Kirkwood, Mo.

The species is close to *emarginatus*, which is distinguished, however, by its larger size, by the black antennae (brownish beneath only in the male), by the frontal tubercle, the punctate scutellum, the coarser punctation of abdomen, the somewhat darker venation, and the cottony nature of the cocoon mass.

10. *Apanteles emarginatus* n. sp.

Parasitic on *Euphœades troilus*.

Length of body, 2.4 mm. to 2.6 mm. ♀: general color black; hairs white, very short. *Head*: punctation moderately coarse and dense; face with a distinct median tubercle near base of antennae; mandibles reddish-yellow, their tips brown; palpi pale testaceous; antennae black, basal joint reddish-yellow beneath, with black apex. *Thorax*: with punctation on mesoscutum dense and coarse, and with an indication of a median carina at posterior half; scutellum somewhat polished and sparsely punctate; postscutellum as in *glomeratus*; metascutellum closely and quite coarsely rugose, with an indication of a median and with a distinct, angulated, lateral carina; tegulae testaceous; wings as in *glomeratus*; legs reddish-yellow; hind coxae dusky on basal half; extreme tip of femora and more or less of hind tarsi often dusky or blackish. *Abdomen* with the two basal joints opaque, and with the base of the 3d densely and quite coarsely rugose; basal joint longer than broad, narrowest at base, which is not polished and only slightly concave; rest of the abdomen above highly polished and sparsely beset with slender white hairs; lateral margins of basal joints 1 and 2, a quite distinct, roundish spot each side of the 3, and the greatest portion of venter, reddish yellow; ovipositor with the outer sheaths black and stout, and reaching about 1 mm. beyond tip of abdomen.

♂ with the antennae more or less distinctly brownish beneath.

Described from 7 specimens marked from *troilus* by Mr. A. Koebele, in breedings at the Department of Agriculture; but as I have no notes other than the label, I feel some uncertainty about the host. In general appearance the species approaches *scitulus*, which is readily distinguished, however, by the absence of facial tubercle, coarser sculpturing and more yellow abdomen and legs.

The cocoons are very delicate, white and imbedded in a dense mass of white, cottony silk, having a faint yellow tinge.

11. *Apanteles theclae* Riley.

Parasitic on *Thecla* sp.

This species, described in my "Notes on N. A. Microgasters" (loc. cit.) has several times been reared by me from the larva of a *Thecla* found in Georgia and Alabama upon the cotton plant. The butterfly has not been

reared, and as it may prove to be a species found in New England, the description of the parasite is here quoted:—

Apanteles theclae: length 2 mm. ♂. ♀ black; palpi white; labrum, mandibles, and sometimes the antennae, piceous; tibiae and tarsi testaceous, the apical half of posterior tibiae and the posterior tarsi blackish. Wings hyaline; the tegulae, stigma, costa, beyond stigma, and the radius and veins at base of areolet, piceous. Antennae of the female much shorter than the body, of the male nearly as long as the body. Mesothorax closely punctured, opaque; metathorax not truncate, finely rugose-reticulate, and with a slight median, longitudinal ridge. Two basal joints of the abdomen with numerous distinct punctures; remaining joints often sparsely punctate; basal joint with the lateral margins narrow; ovipositor not exerted. Stigma short, triangular, radius descending from its middle and uniting at a considerable angle with the basal vein of the areolet.

12. *Apanteles junoniae* n. sp.

Parasitic on *Junonia coenia*.

Length of body ♂, 2.6 mm. Color black. Punctuation of head, thorax and scutellum dense, coarsest on thorax, very dense, fine and somewhat confluent on the head. *Head* with facial ridge not very distinct, though there is a slight, smooth projection close to and in front of the antennae; (palpi wanting) eyes brown; antennae black; the first joint and flagellum brownish beneath. *Thorax* with a slight median carina on posterior third of mesoscutum; fovea of postscutellum minute; metascutellum rugose, without median carina, its lateral carinae strongly angulated; tegulae honey-yellow; wings normal; costa brown, stigma yellowish brown, veins very pale yellowish; legs brownish-yellow, with all coxae black and posterior femora dusky. *Abdomen* black, of normal shape; joint 1 slender but slightly broader posteriorly than at base, and much narrower than 2, sides broadly bordered by a flexible, honey-yellow margin; the three basal joints sculptured, 1 and 2 densely and 3 less so; no median carina on 2; the other joints polished; venter honey-yellow as far as joint 3.

The cocoon is single, dense, yellowish-white, and covered with threads of loose silk.

This species closely resembles *A. carduicola* Pack., but differs from it in several points, more particularly in the shape of the first abdominal joint, which in *carduicola* is posteriorly almost as broad as joint 2, and which has the third joint smooth, the yellow borders almost wanting and the middle and posterior legs much darker.

Described from a single specimen, bred from *Junonia coenia*.

13. *Apanteles carduicola* Pack.

Parasitic on *Vanessa cardui*.

Microgaster carduicola Pack., Proc. Bost. Soc. Nat. Hist., xxi, p. 27 (1880).

Its characters are as follows:—

Average length, 3 mm. *Head* black; palpi pale testaceous. *Thorax* moderately and uniformly punctate; the metascutum without carina; the scutellum more highly polished; fovea of postscutellum broad and with a central pit; metascutellum without carina. *Abdomen* with ovipositor just showing at tip of body; dorsal plate of

joint 1 narrowest at base, its length exceeding its width at hind border, its lateral edges slightly arcuate and rounded behind; joints 1 and 2 rugose; rest of abdomen perfectly smooth, polished and with little trace of hairs; the radius of wings normal; stigma rather broad; radial vein strongly angled; coxae and trochanters black; basal one-third to one-half of front femora blackish, rest ferruginous and concolorous with tibiae; tarsi brownish, base of first tarsal joint paler; middle and hind femora blackish; tibiae ferruginous, with a slight dusky tinge; tarsi pale at base, becoming black towards claws.

11 specimens, all ♀, are before me bred by Mr. Scudder from *Vanessa cardui*, but no cocoons accompany them.

The species closely resembles *Apanteles theclae* Riley, but may be distinguished by having no median ridge on metascutellum, by the more closely punctate basal joints of abdomen, by the slightly larger size, by the more intense angulation of the radial vein, the lack of punctation beyond the second abdominal joint, and in the almost complete absence of hairs from the abdomen.

14. *Apanteles atalanta* Packard. Pl. 88, fig. 13.

Parasitic on *Vanessa atalanta* and *Aglais milberti*.

Dr. Packard's colorational description (Proc. Bost. Soc. Nat. Hist., xxi, p. 27) which would apply to many different forms is as follows:

"Body jet black, polished; antennae blackish brown; palpi whitish; mandibles pale reddish, blackish at base. Legs with the coxae black; trochanters blackish at base, all beyond dark honey-yellow; terminal joint of tarsi a little dusky."

From limited material and the description I formerly considered this a variety of *congregatus* (Am. Nat., 1882, p. 670); but from a larger number of specimens since examined it may very well remain as a good species, intermediate in some respects between *glomeratus* and *congregatus* by comparison with which it may best be characterized.

From *glomeratus* it differs in the more convex, more densely punctate face without diverging carinae; in the lateral ridges of metathorax being more distinct. From *congregatus* it differs in being less hairy, in the less densely punctate face without distinct tubercle, and in its concolorous coxae. From both species it is distinguished by the smoother second joint of abdomen, the sculpture being confined to the lateral borders; by the stigma being shorter and darker, the angle of the radial vein more pronounced and above the middle of the vein, i. e., nearer to the stigma; and finally by the sheath of the ovipositor being broader, more strongly developed and projecting somewhat more beyond the tip of abdomen.

In some specimens, the middle portion of the first abdominal joint is also smooth and impunctate.

I have examined some 50 specimens from *atalanta* and 15 from *milberti* reared by Packard, and 2 specimens from *milberti* reared by William H. Edwards. There are no entomophagic differences whatever in the specimens.

The cocoons are arranged on end, side by side, in moderate masses, the whole covered with loose silk and the color pure white.

15. *Apanteles pholisora* n. sp.

Parasitic on *Pholisora catullus*.

Length of body, 2.4 mm.—2.7 mm. ♀: Color black with much reddish-yellow on abdomen. Pubescence rather dense and white. *Head*: punctation coarse and uniform; a deep puncture on each side of clypeus; facial carina quite distinct; mandibles yellowish-brown; palpi pale testaceous; eyes brown, antennae black, longer in the male than in the female, the basal joint often yellowish-brown, and the flagellum beneath, in both sexes frequently brownish. *Thorax*: scutellum sparsely punctate and somewhat polished; postscutellum very narrow, its median fovea small and often indistinct; metascutellum rugose, its median carina distinct, the lateral carinae straight and parallel with it; tegulae brownish: wings normal, the radial vein variable and either uniformly curved or more or less angulated; costa, stigma and radial vein light brown, the other veins paler: legs honey-yellow; anterior and median coxae brownish, the hind pair black; hind femora and tibiae blackish at tip; all tarsi slightly dusky, the posterior pair darkest; claws blackish. *Abdomen* narrow, slender, tapering gradually from joint 2 toward the end; basal joints 1 and 2 black and closely punctate; joint 1 longer than broad, narrowest at base, broadening gradually toward hind border where the angles are slightly rounded, the basal portion somewhat concave; joint 2 with a rather distinct median carina; remaining joints polished and sparsely hairy, their color variable, either entirely honey-yellow, with only the sutures blackish or with only 2 yellowish spots at the hind border of 3, with all gradations between these extremes; flexible lateral margin of 1 and 2 and often the whole venter, honey-yellow; sheath of ovipositor black and reaching somewhat beyond the tip of abdomen.

Resembles both *A. scitulus* and *A. emarginatus*. From the latter it is distinguished by the absence of the facial tubercle, by the denser and coarser sculpturing of the head and absence of median carina on posterior half of mesoscutum; by the median carina and straight lateral ridge on the metascutum and the more slender abdomen. From *scitulus* it differs in the smaller size, the more slender abdomen, with its carina and different sculpturing.

Described from 16 specimens, reared from *Pholisora catullus*, one by William H. Edwards, the rest by myself.

The cocoons are normal, perfectly white, with much loose silk adhering to them, and either single or in small masses.

16. *Apanteles cassianus* Riley.

Parasitic on *Xanthidia nicippe*.

This species was described by me (loc. cit., p. 12) from cocoons found at East St. Louis, Ill., upon *Cassia marylandica* with *Xanthidia nicippe* from which they had in all probability issued. I reproduce the description:

"Length, 1.5 to 2.2 mm. ♂ ♀. Black; palpi white; mandibles sometimes testaceous; knees, the four anterior tibiae; the basal half of posterior tibiae, and all the tarsi ex-

cepting at the apex and on the apical half of the basal joint of posterior pair, whitish; the anterior femora more or less piceous and the intermediate tibiae often tinged with testaceous. Wings hyaline, the veins white; the stigma, strongly in contrast, piceous; tegulae tipped with piceous. Antennae of the ♀ scarcely shorter than those of the ♂. Mesothorax opaque, the punctures shallow and obscure; metathorax opaque, without distinct sculpture, its upper face limited on each side by a carina exterior to the spiracles, a few slight ridges at the apex. Abdomen without punctures, lateral margins of the basal joint dark piceous, the central portion broad and with sharply defined sides; second joint with a broad, triangular central area marked off by two deep grooves which diverge from the middle of the anterior margin; ovipositor concealed. The radius forms with the basal vein of the areolet only a slight curve, but in one or two specimens there is a slight angle on the outer side at their point of union."

Since the description was published I have received two other specimens, one reared from *nicippe*, by Mr. William H. Edwards and one from *Eurymus eurytheme* by Mr. David Bruce in Colorado. The species is well marked especially by the sculpture of the second abdominal joint. The cocoons vary. Those from which my specimens were obtained are either dingy gray or pale yellowish, the former with five tolerably marked longitudinal ribs, the latter almost smooth. That from Mr. Edwards is intermediate.

GENUS MICROGASTER Latreille.

Maxillary palpi 5-, labial 3-jointed. Eyes villose. Antennae 18-jointed. Mesopleurae rarely with a rugulose fovea. Abdomen sessile; suturiform articulation distinct. Radius of the fore wing almost complete; three orbital areolets, the 2d often imperfect. Hind coxae elongate; spurs of the hind tibiae not shorter than half the metatarsus. Terebra more or less exerted. (After Marshall.)

***Microgaster carinata* Pack. Pl. 88, fig. 11.**

Parasitic on *Vanessa atalanta*.

Microgaster carinata Pack., Proc. Bost. Soc. Nat. Hist., xxi, p. 25 (1880).

This species was described by Dr. Packard from specimens bred by Mr. Scudder from *Vanessa atalanta*. Its characteristics from the material before me, rather than from the original description, are as follows:

Average length, 4 mm. ♀: Body black. Antennae brownish-black; palpi pale yellow. Wings with the stigma and veins brown. All coxae black; all trochanters black at base and yellowish at tip; front and middle femora, tibiae and tarsi honey yellow; the tarsi dusky at tip; hind femora and tibiae honey-yellow and dark at tip; hind tarsi dusky throughout. Abdomen with dorsum of joints 1 and 2 strongly rugose, the rugosity on joint 1 having a tendency to form into irregular, longitudinal lines toward the outer hind angles, the median carina being obsolete but with a decided elevation or tubercle on the hind border; anterior portion of joint 3 very slightly punctate; ovipositor quite long, reaching when extended beyond the length of the whole abdomen; the sheaths dark, quite pilose and two-thirds as long as abdomen. Venter with a large, honey-yellow spot each side at base.

Three females are before me from Mr. Scudder.

In my notes on *Microgasters* (Am. Nat., Aug. 1882, p. 679). I have

stated it to be a variety of *M. gelechiae* (Riley) having then seen but one specimen. With the material before me it may, however, stand as a species, for, in addition to the colorational differences there pointed out and to the other colorational fact that in *gelechiae* the yellow spot covers nearly or quite the whole of the dorsum of joints 5 and 6, structural differences are also noticeable in that the rugose elevations of first tergite in *gelechiae* exhibit no tendency toward forming longitudinal lines behind and that the scutellum is much more strongly punctate than in *carinata*. The sheath of ovipositor is, also, less pilose.