

*Notes on NORTH AMERICAN MICROGASTERS, with
descriptions of New Species.*

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[Read Feb. 7, 1881.]

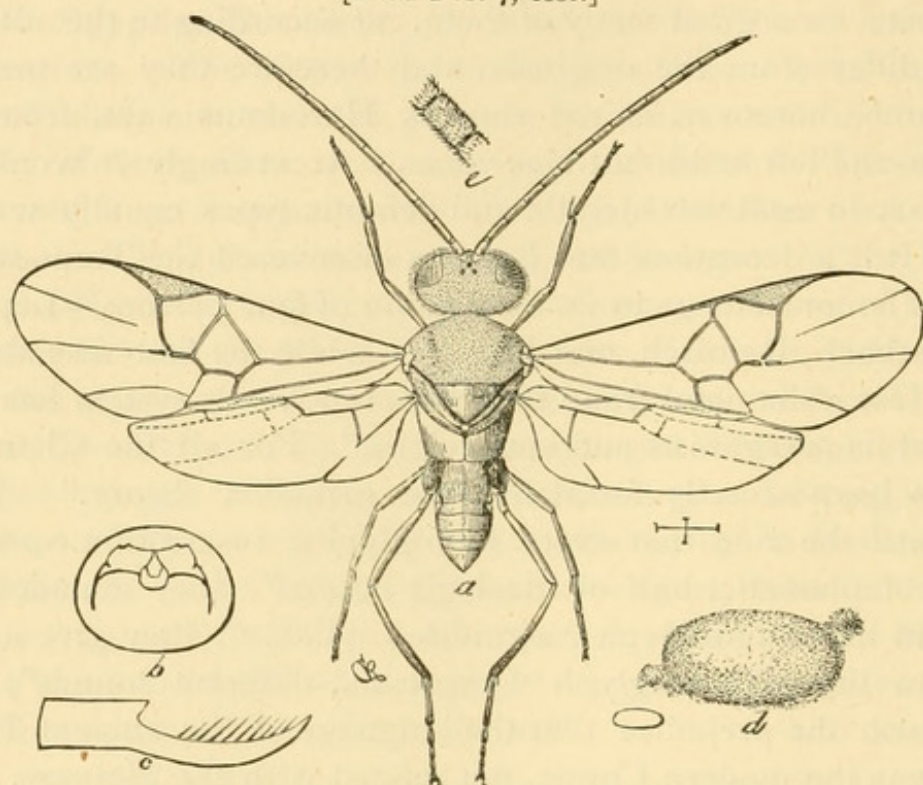


Fig. 1.—*APANTELES ALETIAE*: *a*, female fly; *b*, outline of head of larva in position to show the chitinized parts of the mouth, the mandibles not visible, being withdrawn; *c*, one of its mandibles as seen within the head of a mounted specimen; *d*, cocoon; *e*, joint of antenna—all enlarged: nat. size of *a* and *d* in hair-line. (Riley, del.)

The insects of this group are among the most common parasites of the various caterpillars injurious to vegetation. They are, therefore, among the more important of the farmer's insect friends. Yet they have hitherto been but little studied in this country; for, aside from the eight species described by Say, we have only one species described by Fitch, one by Walsh, one by Packard, two by myself, and two Texan species by Cresson, while notices of the habits of only a few of these have been published. I have during the past fifteen years, in rearing Lepidoptera, obtained quite a number of species, some of which have been sent to Dr. A. S. Packard, Jr., of Providence, R. I., but most of which have been referred to Mr. E. T. Cresson of Philadelphia. Dr. Packard proposes shortly to describe several species, and more particularly those affecting butterfly larvæ, while Mr. Cresson is at the present time working up

the group. It is with a view of assisting in this work that I have been led to prepare these notes and to describe the few species which more particularly interest me. My thanks are due to Messrs. McCalla & Stavely for the loan of figures 6 and 7, and to Mr. W. H. Patton for assistance.

CHARACTERISTICS OF THE GROUP.

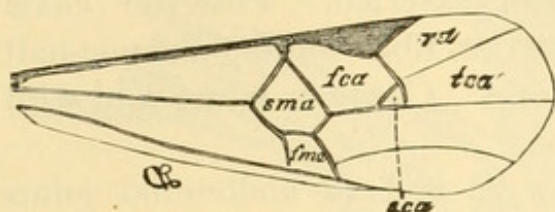


Fig. 2.—Front wing of *Microgaster gelechiæ*, enlarged; *fma*, first median area; *sma*, second do.; *fca*, first cubital area; *sca*, second do., or "the areolet"; *tca*, third do.; *ra*, radial area.

The Microgasters are distinguished from the other members of the family Ichneumonidæ by their hairy eyes and 18-jointed antennæ. The second cubital areolet of the wings in the majority of the species is not closed externally (Fig. 1), but when

complete (Fig. 2, *sca*) this areolet is quite small. The radial area (Fig. 2, *ra*) of the wings is never complete, and that portion of the radial vein extending from the stigma to the second cubital areolet is the only portion of the vein that is distinctly marked, this portion together with the basal vein of the second cubital areolet forming what has been described by some authors as the "outer side" of the first cubital areolet. The ovipositor is generally short, not extending beyond the tip of the abdomen; but in a number of species it is exserted, as in *Microgaster gelechiæ*, where it is one-half the length of the abdomen; and sometimes it is equal to the whole abdomen in length, as in *Apanteles megathymi*. The body is generally black, the legs pale, and the wings transparent with a dark stigma; the abdomen is sometimes marked or banded with red, the antennæ vary from black to red, and the palpi are whitish or reddish. The thorax is more or less densely punctate and the basal joints of the abdomen afford good characters in the presence or absence of sculpture. The size varies greatly in different species, but none equal one-fourth of an inch in length and the majority do not exceed one-eighth.

Foerster, in his "Synopsis der Familien und Gattungen der Braconen," published in 1862, separated two genera from the old genus *Microgaster*, and H. Reinhard, in the "Deutsche Entomologische Zeitschrift" for 1880, p. 353, shows that these genera are well founded. They may be distinguished by the following characters:

MICROPLITIS Fr., 3 cubital cells: 2d and 3d abdominal joints confluent. Ovipositor concealed. Posterior coxæ not large: spurs of posterior tibiæ less than half the length of the first tarsal joint. Mesopleura with a punctured groove. Cocoons leathery, without loose silk.

MICROGASTER Latr., 3 cubital cells: 2d and 3d abdominal joints distinctly separated. Ovipositor exerted. Posterior coxæ unusually large: spurs of posterior tibiæ more than one-half the length of the first tarsal joint. Cocoons white and with loose silk.

APANTELES Fr., 2 cubital cells: 2d and 3d abdominal joints separated. Ovipositor long or short. Mesopleura with no distinct groove. Cocoons with loose silk.

HABITS OF THE GROUP.

The Microgasters are, with few if any exceptions,* confined in their attacks to the larvæ of Lepidoptera. The Microgaster larvæ that I have observed are all apodous grubs, of which that of *Apanteles aleticæ* may serve as an example.

A. ALETIÆ. *Larva*.—4 mm. in length. A smooth, memberless grub, narrowing towards the head and thickest near the posterior end; the head nearly as large as the 1st joint, the sutures between the joints rather indistinct. The mouth parts (Fig. 1, *b*) minute, similar to those of other hymenopterous parasites. The 6th, 7th, 8th and 9th joints behind the head provided with a pair of prominent lateral tubercles; pairs of slighter tubercles on the 5th and 10th joints. Color white, or tinged with green or yellow.

They always emerge from their host before it attains the pupa state to spin their cocoons. Sometimes but a single larva of the Microgaster is nourished by the caterpillar, although in most cases many feed in company, and, emerging at the same time,

* Reinhard (l. c.) gives a list of the exceptions, there being 4 cases of parasitism on Beetles, 2 on Saw-flies, 1 on a Gall-fly, all recorded by Ratzeburg; a case of parasitism on a Gall-fly observed by Mayr; one on a Fly by Haliday and another by Bouché, and two species bred from *Cecidomyia rosaria*, one by Ratzeburg and one by Mayr. But, as all these species have also been bred from Lepidopterous larvæ, Reinhard considers that these comparatively few observations are of questionable accuracy. Still another case of parasitism upon Diptera (*M. obscurus* Nees upon *Trypeta arnicæ*) is mentioned by Giraud and Laboulbène in the "Annales de la Société entomologique de France" for 1877, p. 413; and mention is there also made of the parasitism of *M. gallicolus* upon *Arthrolaxis Guyoni*, a Chalcid, in the galls made by a moth, *Ecocetis Guyonella*, on *Limonastrum*. But no particulars are given regarding the parasitism upon *Trypeta*; and a reference to the original description (Ann. Soc. ent. Fr., 1869, p. 476) shows that it was upon the moth larva that the *M. gallicolus* fed. I find in my notes the record of a species reared from the larva of what may have been *Odontota rubra*, but possibly some Lepidopterous larva was mining the same leaves.

spin their cocoons more or less closely connected together, sometimes to the number of several hundred. In the "Proceedings of the Entomological Society of London" for 1872, p. xxiii., Prof. Westwood notes an instance in which 1,000 individuals were bred from one larva of a large Ceylonese Bombycid.

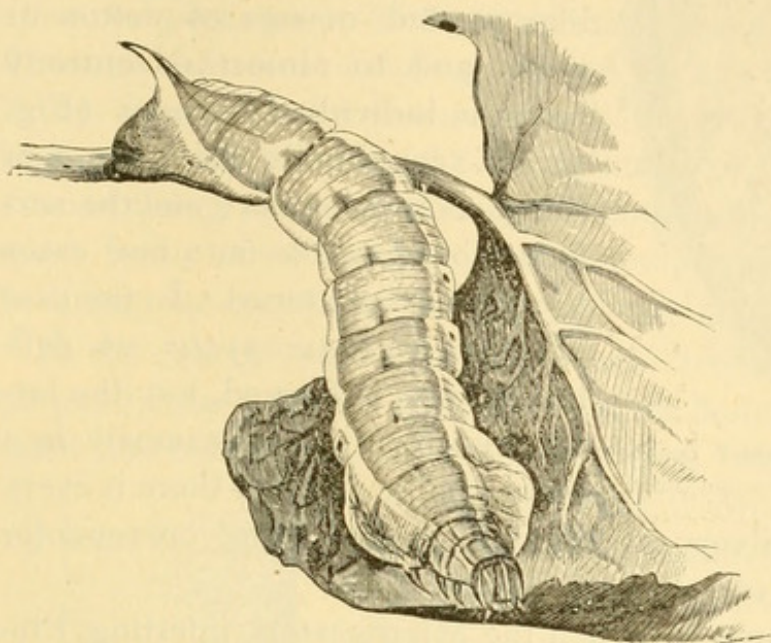


Fig. 3. Healthy larva of *Chærocampa pampinatrix*.
(After Riley.)

The victimized caterpillar ceases feeding as the parasitic grubs attain full growth, and generally shrinks considerably as soon as they have penetrated the skin and spun their cocoons. Fig. 3 shows a healthy full grown "Hog-caterpillar of the Vine" (*Chærocampa pampinatrix*), and Fig. 4 the same caterpillar when shrunk and parasitized.

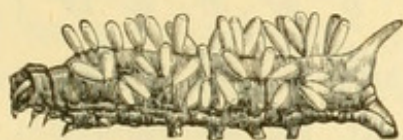


Fig. 4.—Shrunk larva of *Chærocampa pampinatrix*, with *Microgaster* cocoons. (After Riley.)

another, that is writhing with its body full of parasites, will live without food for as many weeks. Indeed, I have known one to rest for three weeks without food in a semi-paralyzed condition, and, after the parasitic flies had all escaped from their cocoons, it would rouse itself and make a desperate effort to regain strength by nibbling at a leaf which was offered to it." *

The cocoons are usually egg-shaped and resemble miniature cocoons of the Mulberry Silk-worm. They are either smooth and glossy, or more or less covered with flocculent silk. When

* Second Report on the Insects of Mo. 1869, p. 73.

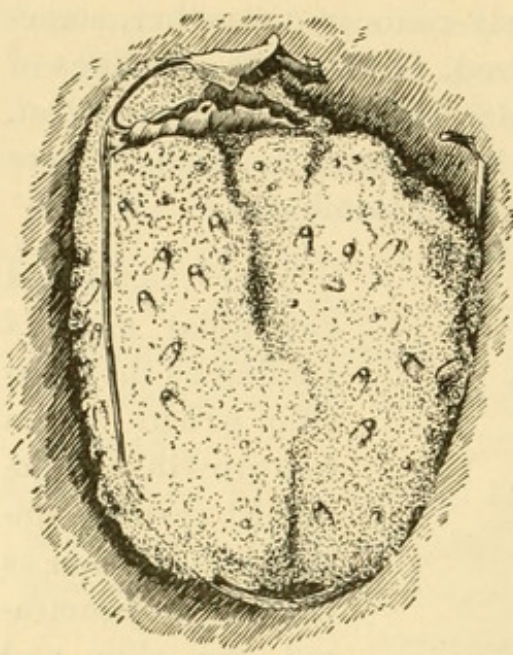


Fig. 5.—Mass of *Microgaster* cocoons with rib of a leaf drawn around them.

spun in association they are held together by this loose silk either irregularly, or in regular single row or double row, and the loose silk may be so abundant as to look like matted masses of cotton or wool, and to almost or entirely hide the individual cocoons (Fig. 5). Exceptionally the texture of the cocoon is leathery and the surface ribbed, while in a few cases the sides are flattened. In the case of *Apanteles acronyctæ* no definite cocoon is formed, but the larvæ transform promiscuously in a mass of silk. In color there is every

variation through silvery-white, dull opaque white, cream-color and different shades of yellow to brown.

The peculiar manner in which the *Microgaster*s infesting *Philampelus* spin their smooth cocoons has been described in the "American Naturalist" for 1878, vol. xii. pp. 558-60. Mr. J. P. Marshall, describing the species parasitic upon *Philampelus*,

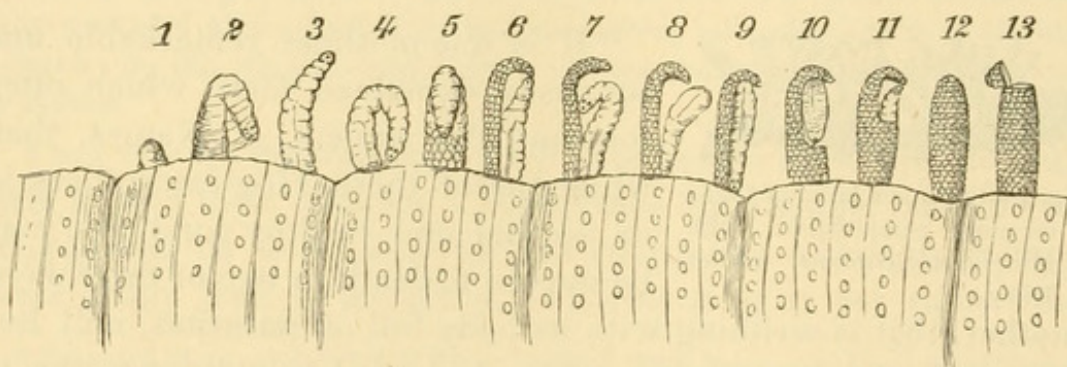


Fig. 6.—Formation of smooth cocoon by the larva of *Microgaster*. (After Marshall.)

states that the first act of the *Microgaster* upon emerging from the caterpillar is to attach its posterior end to its host by some silken threads, as shown in Fig. 6, 4. It then forms a series of loops of silk, as shown greatly enlarged in Fig. 7, moving its head alternately from left to right and then from right to left. After spinning to the top of the cocoon (Fig. 6, 6) the larva reverses its position so as to rest with its head down (Fig. 6, 9), when it spins the other side of its cocoon, gradually contracting its body

as the work proceeds; and finally, to complete the enclosure of the cocoon, again reversing its position so as to appear in the attitude shown in Fig. 6,¹¹. Mr. Wm. A. Buckhout (ibid. p. 752) notes several points of difference in the formation of similar cocoons by the species infesting *Macrosila*. This *Microgaster*, after completing one-half of its cocoon and reversing its position, flexes its body so as to bring its head back to the top of the cocoon, "from which it spins downwards till the back of its host is reached and it is entirely enclosed," the spinning of the two halves of the cocoon being upon practically the same plan, the first half being spun from below upwards, the second from above downwards. In lining the cocoon the larva repeatedly changes its position.

In the case of *Apanteles aletia*, which spins its cocoon not in a perpendicular position as do those on the *Sphinges*, but recumbent upon the cotton-leaf, the outer covering being somewhat more

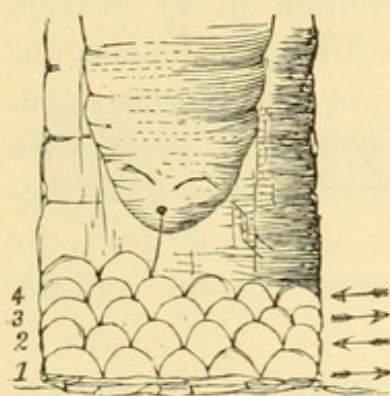


Fig. 7.—Commencement of cocoon by larva of *Microgaster*. (After Marshall.)

loose and "fuzzy," Mr. H. G. Hubbard, in a recent report to me, describes the process as follows. "In quitting its host the parasite maintains its connection therewith by means of a single thread. After crawling to a distance of about half an inch, it fastens this thread to the surface of the leaf and begins its cocoon. The larva forms the exterior by throwing out loops of ropy fluid, which under the lens are seen to become rigid as they fall, and to harden

rapidly, forming a rather coarse strand of white silk, which is often beautifully furred. These loops are piled one upon another, and the walls of the cocoon rise rapidly until they meet overhead. The inside is then lined in the manner usual with Lepidopterous larvæ, until the whole has become opake. The process of spinning occupies about two hours' time."

It is in this as in almost every other genus or group, very difficult to separate species, so called, when a large number of individuals or abundant material is studied. Some of the forms indicated as good species by entomologists, especially if descriptions were based upon one or two individuals without reference to the variation that occurs, are sure to prove to be only varieties. It is quite natural to infer that differences in the host,

especially when associated with difference in the cocoon, would indicate specific difference. But the result of my study shows very clearly that there may be great variation in the characters of the cocoon, and that these are of little value in distinguishing species. Indeed the color, form, texture and arrangement of the cocoons varies greatly not only in the different species, but sometimes in the same species. The same species of caterpillar also often suffers from the attacks of several species of Microgasters, as is the case with the Army-worm; and, conversely, one species of Microgaster often attacks a variety of caterpillars, and in this case the species sometimes presents slight variation in its characters when attacking different hosts. This variation may be considered entomophagic, and when sufficiently marked should be indicated by a variety name, as I have done below in treating of *Apanteles congregatus*. The species *Apanteles cassianus* bred from *Terias nicippe* shows a peculiar variation in the cocoon and also in the time required to perfect the imago. Its cocoons are either yellowish, ovoid, and quite woolly; or brown, four-sided, and without loose silk. Cocoons of the two forms found with the *Terias* on *Cassia marylandica* Sept. 10, 1874, gave forth flies on Oct. 1st following and on Aug. 4th, 1875, the former from the ovate cocoons, the latter from the other form of cocoon, and the flies are indistinguishable.

From the cocoons of Microgasters are often bred secondary parasites. The most common of these are either Ichneumonids of the genera *Hemiteles* and *Mesochorus*, or Chalcids allied to *Pteromalus*. The *Hemiteles cressonii* bred by me from the galls of *Gelechia gallæsolidaginis* is probably a parasite of the *Microgaster* which attacks the maker of the galls. *Mesochorus vitreus* Walsh, which was described as a parasite of the Army-worm (*Leucania unipuncta*), I have bred from the Microgasters truly parasitic on that pest. The Chalcid, *Glyphe viridescens* Walsh, which was bred by Walsh from *Apanteles militaris*, and by Fitch (who, in his 9th Report, described it as new under the name *Pteromalus tabacum*) from *Apanteles congregatus* when parasitic on the Tobacco-worm (*Macrosila quinque-maculata*), I have bred from the last named *Apanteles* when parasitic on the Army-worm.

DESCRIPTIONS OF NEW SPECIES.

MICROPLITIS CERATOMIÆ, n. sp.—Length 2.5 mm. ♂♀. Black; antennæ, labrum and mandibles piceous, palpi whitish; legs red, the coxæ (except at apex), the basal joint of posterior tarsi and all the claws blackish; tegulæ and base of costa testaceous, wings subhyaline, the stigma entirely and the veins piceous. Antennæ longer than the body in both sexes, joints 3-17, constricted in the middle so that each might easily be counted as two joints. Mesothorax confluent punctured, a slight median ridge posteriorly, a deeply impressed groove each side, these grooves slightly approaching posteriorly. Metathorax coarsely reticulated, with a prominent median ridge. Abdomen much shorter than the thorax, ovate, basal segment vertical, finely punctured, second and following segments shining, not punctured, the second segment without oblique grooves. Radial vein arising from the middle of stigma, stout, forming a right angle with the basal nervure of the quadrate areolet and also forming one side of the areolet, beyond the areolet it is slender, a white spot on cubital vein at base of areolet, the vein closing areolet exteriorly also white, the side of stigma bordering the first cubital cell swollen, that bordering radial cell straight, apical nervures of the wing slender but distinct.

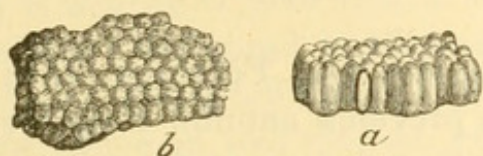


Fig. 8.—Cocoons of *Microplitis ceratomiæ*; *a*, side view; *b*, top view (after Riley).

Described from many specimens which issued March 6th from cocoons formed, in September of the previous year, by larvæ found, in Missouri, emerging from the caterpillar of *Ceratonia quadricornis*.

The cocoons, formed in irregular masses of from four to twenty together, are of a brown color, thick, tough, coarsely ribbed longitudinally, and without loose threads.

The mass of cocoons originally figured in the second volume of the *American Entomologist*, p. 128 (see Fig. 8) and which was received from Mr. G. C. Brackett, Lawrence, Kans., differs from those above described in the cocoons being spun regularly side by side and lacking the ribs. The flies from these cocoons differ only in the slightly greater size, reaching 3 mm. in length. To these large specimens Mr. Cresson has given the MS. name *actuosus*. The same large variety, together with the compact cocoons, also from *C. quadricornis*, I have received from Mr. A. J. Randall, Aviston, Ill. It may be that this is the species bred from *Macrosila 5-maculata* by Mr. Emerton and figured in the Ninth Ann. Report of Dr. Hayden's Survey, p. 781, fig. 48, although the cocoon there figured is solitary.

MICROPLITIS GORTYNÆ, n. sp. — Length 2 mm. ♂♀. Black; mandibles, labrum, palpi and antennæ, the tegulæ, nervures and stigma testaceous; the apical joints of palpi and the base of stigma whitish; legs red; the posterior coxæ black; wings hyaline. Antennæ of the female a little longer than the thorax and the joints no longer than broad; antennæ of the male longer than the body, most of the joints twice as long as broad. Mesothorax punctured, opaque, lateral grooves not sharply defined; metathorax reticulated, with a median carina on its upper face. Abdomen smooth and shining, base of first segment finely punctured, the broad lateral margins of the first segment and the lateral anterior angles of the second of a softer texture and tinged with piceous. Ovipositor not exerted. Venation as in *ceratomiæ*, but the areolet without any distinct side upon the radius.

Described from nine specimens bred from cocoons sent from Iowa by Dr. A. W. Hoffmeister. Parasitic upon *Gortyna* (*Achatodes*) *zeæ* Harr. The cocoons are light reddish-brown and have about a dozen longitudinal ribs of a white color, and are firmly attached together in irregular masses. I have found similar cocoons, more regularly arranged, beneath the bark of a sycamore near the root.

Specimens (1 ♂, 5 ♀) bred in January and February, 1874, from *Hepialus humuli* received the previous autumn from Mr. O. M. Knox, Oneida Co., N. Y., appear to belong to this species, although some of them vary in having darker legs and antennæ, in the stigma being of a uniform color, and in the areolet being quadrate. This species is quite distinct from *ceratomiæ* in having the antennæ of the female short.

In the genus *Microplitis* it is often difficult to decide whether the areolet is open or closed, as the exterior vein is white or transparent. In *Apanteles* this vein is entirely wanting and in *Microgaster* it is as strongly marked as any of the other veins. In this respect, therefore, *Microplitis* stands between the other genera; but in all its other characters, excepting the enlarged coxæ, *Microgaster* occupies the intermediate position.

APANTELES MEGATHYMI, n. sp. — Length of body 3 mm. ♂♀. Black; palpi whitish, antennæ piceous; legs red, the coxæ, and in the males the posterior femora and tarsi and the tips of the posterior tibiæ, black or piceous, in the females the tips of posterior tibiæ and the posterior tarsi dusky; wings, including the stigma, hyaline; tegulæ and nervures white, the costa and the outline of the stigma testaceous. Mesonotum closely punctate, the punctures tending to unite to form striæ, 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 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 larvæ of *Megathymus yuccæ* 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.

The long ovipositor must be of service in enabling this species to attack its host through the lining of the burrow; and it is worthy of note that a smaller species (*Ap. carpatus* Say) which I have bred, in Illinois, from the larval-cases of the Carpet-moth (*Tinea tapetzella* L.) likewise has an ovipositor as long as the abdomen, and that *M. gelechiæ*, which must pierce the walls of the gall inhabited by its host, also has an exerted ovipositor, as have also an *Apanteles* bred from the larva of *Gelechia cercerisella* Cham., which folds the leaf of *Cercis canadensis*, and the following species bred from the larva of *Cacæcia semiferana* (Walk.) which folds the leaf of the Box-elder (*Negundo aceroides*). A group of small species parasitic upon leaf-miners also have a slightly exerted ovipositor.

APANTELES CACÆCIÆ, n. sp. — Length of body 2 mm. ♂♀. Black; palpi whitish, tip of mandibles sometimes testaceous, antennæ piceous; legs black, the anterior pair from middle of femora and the basal half of posterior tibiæ testaceous; wings hyaline, stigma piceous, nervures testaceous. Antennæ of female as long as the body, of male longer than the body. Mesonotum shining, the punctures shallow; metathorax and two basal joints of abdomen with larger, very shallow punctures; remainder of abdomen smooth. Abdomen as long as the thorax; basal joint, excluding the less chitinized sides, longer than broad and longer than the second and third joints taken together; second joint very short, being only half the length of the third. Ovipositor exerted and as long as the abdomen. The vein from the stigma forms a strong curve with the basal vein of the areolet and an angle is sometimes present at their point of union.

Described from nine specimens bred in Missouri, June 21, 1876, from *Cacæcia semiferana* (Walk.) The delicate white cocoons are spun together in a roll of a leaf. From *Apanteles carpatus* (Say) this species differs in its smaller size, shining thorax, and smooth metathorax and abdomen. *Microgaster clavatus* Prov. appears to be a synonym of *carpatus*, although Provancher's description is faulty in making no mention of sculpture. Among a dozen *carpatus* bred in July I find some variation in the color of the legs, in four of the specimens the legs being more or less tinged with piceous.

APANTELES ALETIÆ, n. sp. (Fig. 1, a).—Length 2 mm. ♂♀. Black; palpi white, labrum, mandibles and basal joint of antennæ piceo-testaceous, the flagellum sometimes piceous. Legs light red, the posterior tibiæ whitish on the basal half; tips of posterior tibiæ, the posterior coxæ and tarsi, black or blackish; the posterior femora sometimes dusky. Abdomen testaceous beneath, except along the median line and on the apical third; the edges of the first joint testaceous. Wings hyaline, the tegulæ, veins and *stigma* white. Mesoscutum closely punctured, opaque; scutellum sparsely punctured; metathorax obliquely truncate, its posterior face with a median subtrapezoidal or pentagonal area. Abdomen narrow, basal joint as long as one-half of the remainder, rugose, its posterior border excavated in the middle, remaining joints not sculptured and not highly polished. Ovipositor not exerted. Radial vein arising slightly beyond middle of stigma and forming a curve with the basal vein of the areolet. This species resembles *Ap. hyalinus* Cress., described from Cuba, but differs in the coloration of the legs and in the ovipositor not being thickened at the tip.

Described from many specimens bred from the young larva of *Aletia argillacea*, in Florida, by Mr. H. G. Hubbard, and in Alabama by Mr. E. A. Schwarz and Mr. W. H. Patton. There are several generations during the season, as it has been bred in August, September and October from the different broods of the Cotton-worm. The fly is disclosed about ten days after the cocoon is formed. Mr. Schwarz observed that the larva of this *Microgaster* is found only in the posterior part of the *Aletia* larva. It is a solitary parasite, only one specimen infesting a single Cotton-worm. The cocoon is formed, without concealment, upon the cotton-leaf, and was found quite commonly the past season, although it had not been observed before. It measures from 3 to 4 mm. in length, is of a white color, and is covered with loose silk, this outer covering forming two characteristic tufts at opposite ends of the cocoon and on opposite sides. The fly

emerges through a lid-covered opening which it cuts for itself at one end of the cocoon, as is the habit of other species of the genus. Mr. Hubbard has bred from the cocoons of this species a secondary parasite belonging to the Chalcids and Mr. Schwarz has similarly bred a *Hemiteles*.

APANTELES POLITUS, n. sp. — Length 1.8 mm. ♂♀. Pitchy-black; mandibles, palpi and basal joint of antennæ testaceous; flagellum beneath on basal half piceo-testaceous; legs honey-yellow, the coxæ, and in the posterior legs the tarsi, the apical half of the tibiæ and the tips of the femora piceo-testaceous; wings hyaline, nervures and stigma testaceous; first and second joints of abdomen beneath and their sides broadly above testaceous. Antennæ of female shorter than body, of male a little longer than body. Mesothorax smooth and polished; metathorax depressed, smooth and polished, its upper face limited by a carina on each side. Abdomen smooth; the central portion of basal joint very narrow, twice as long as broad, narrowing behind to meet the triangular central area of the second joint; the second joint with very broad membranose sides separated by deep oblique grooves, this joint only half as long as the first joint. Ovipositor concealed. Radial vein forming an angle of 120° with the basal vein of the areolet.

Described from many specimens bred, in Missouri, from *Scolecocampa ligni* Guen. The cocoons are spun in an irregular, flattened mass beneath the bark, and are of a dirty-white color. In the form and sculpture of the abdomen and in venation this species agrees with *militaris*, but it differs in the smooth thorax and dark posterior coxæ.

APANTELES CASSIANUS, n. sp. — Length 1.5 to 2.2 mm. ♂♀. Black; palpi white; mandibles sometimes testaceous; knees, the four anterior tibiæ, the basal half of posterior tibiæ, and all the tarsi excepting 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 tibiæ often tinged with testaceous. Wings hyaline, the veins white; the stigma, strongly in contrast, piceous; tegulæ tipped with piceous. Antennæ 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.

Described from twelve specimens bred, as mentioned above (p. 302), from cocoons found, at East St. Louis, Ill., upon *Cassia marylandica* with *Terias nicippe*.

APANTELES THECLÆ, n. sp.—Length 2 mm. ♂♀. Black; palpi white; labrum, mandibles, and sometimes the antennæ, piceous; tibiæ and tarsi testaceous, the apical half of posterior tibiæ and the posterior tarsi blackish. Wings hyaline; the tegulæ, stigma, costa beyond stigma, and the radius and veins at base of areolet, piceous. Antennæ 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.

Bred Sept. 26, 1878, from larvæ which emerged Sept. 18th from a larva of a species of *Thecla* found feeding upon cotton plants at Augusta, Ga. Also bred by Mr. E. A. Schwarz at Selma, Ala., Sept. 16, 1880, from cocoons spun Sept. 6th. Also bred from a larva of the same *Thecla* received from Mr. B. F. Cooke, Marion, Ala., July, 1880. The cocoons are white and are spun together in irregular masses, as many as twenty of the parasitic larvæ being sometimes found to infest a single caterpillar of the *Thecla*. *Ap. limenitidis* closely resembles this species, but it is larger, the basal joints of its abdomen are densely rugose, and its cocoon is yellowish and solitary. The three specimens bred from *Gelechia galle-solidaginis* which I mentioned as a variety in the original description of *limenitidis* prove upon further examination to be males and to belong to a distinct species, the basal joints of the abdomen being quite smooth.

APANTELES LIMENITIDIS, form FLAVICONCHÆ.—Under the above name may be recorded a species or variety which is found in Connecticut as well as in Missouri, and which presents all the characters of the species bred from the young larvæ of *Limenitis disippus*, but which spins its cocoons in masses like those of *M. militaris*, with which it is associated in fields infested with the Army-worm. The cocoons also are of a bright lemon-yellow, those of the true *limenitidis* being dull yellow. From *congregatus* the imago of *flaviconchæ* differs in the femora being black except at the tip, the tibiæ and tarsi being dull yellow. The radius forms an angle with the basal vein of the areolet at their point of union: the base of the third abdominal joint is punctate.

As it is probable that *flaviconchæ* is a parasite of the Army-

worm, it may be well to compare it with *militaris*. In *Ap. militaris*, which I have bred from *Nephelodes violans* as well as from the Army-worm, the stigma is not so dark, the radial vein passes into the basal vein of the areolet quite evenly, the base of the abdomen beneath is reddish and the coxæ as well as the femora are red, the knees dusky. It more particularly differs from *flaviconchæ* and from other allied species in a character hitherto unrecorded; the basal joints of the abdomen are quite smooth, and on the second joint two oblique grooves are very distinct.

APANTELES CONGREGATUS (Say). — Under this name* must be grouped a long series of forms attacking various Sphinges, Bombycids and Noctuids, and perhaps other Lepidoptera. But for the present I will mention only those bred in Missouri from *Chærocampa pampinatrix*, *Sphinx 5-maculata*, and two unknown species of Sphingid larvæ, those bred from *Sphinx catalpæ* from Knoxville, Tenn., those bred from *Leucania unipuncta* in Missouri in 1869 and in Connecticut in 1880, and those bred from *Hemileuca maia* and *Saturnia Io* in Missouri. The species is characterized by the rough first and second abdominal joints and by the legs, excepting the posterior coxæ, being red. The antennæ vary from black to testaceous, and the abdomen is either entirely black or is marked with red on some of the joints. The metathorax has an indistinct median line. The radius arises beyond the middle of the stigma and passes into the basal vein of the areolet with quite an even curve, except in the specimens bred from *Saturnia* and *Hemileuca* (to which I would give the variety name *hemileucæ*), which have a distinct angle at the point of union. In var. *hemileucæ*, also, the second abdominal joint is slightly less coarsely sculptured than in specimens bred from Sphinges and Army-worms. This variety agrees with those parasitic on Sphinges in forming clear white cocoons spun separately upon the back of its host and not enveloped in loose silk.

Specimens bred from the Army-worm in Missouri in 1869 from bunches of cocoons enveloped in dull whitish floss silk have the abdomen entirely black, but from similar bunches of cocoons was bred a form which, while agreeing in sculpture, has more or less of the first, the second and base of the third joints red, the

* The insect described by Provancher under this name is not Say's species, but is a synonym of *gelechiæ* Riley.

coxæ red, and the basal half of the antennæ yellow. This variety may be named *rufocoxalis*. That it is only a variety is evident from my having bred in May from similar bunches of cocoons, both in Missouri and in Washington, specimens which agree in all characters, but vary in having the third joint of the abdomen either black, piceous, or red, and in the first and second joints also being more or less red, and in the coxæ being blackish at the base. Army-worm specimens bred in Connecticut in 1880 from irregular masses of whitish cocoons not concealed by a covering of loose silk differ from the typical *congregatus* in having lateral red fasciæ on the third and fourth, and in the male on the fifth, joints of the abdomen, the fasciæ in the male being sometimes continuous. One specimen has a pair of red dots on the third joint only. But in other respects these parasites of the Army-worm agree with those from the Sphinges.* A variety which I have bred from *Arctia virginica* in Missouri, and which may be named *scitulus*, varies further in having the base of the third abdominal joint more or less sculptured and in the abdomen beyond this, except along the middle, and in the entire under surface of the abdomen being red. The radius in some specimens forms an angle with the basal vein of the areolet at their point of union. The cocoons are spun parallel to one another, but not in an even series, on a leaf, and are enveloped in white floss silk.

The difference in the cocoons may easily be due to the difference in the conditions under which they were spun. The Army-worm being amid the grass, the Microgasters can there most readily attach their cocoons in a mass to the blades or stems, but when emerging from a Sphinx caterpillar they have only the body of their host for a support and each one must take care of itself. The Microgasters bred from the cluster of parallel cocoons represented in Fig. 9, and which were referred to in the "American Entomologist," vol. i. p. 224, as found on the branch of a dwarf apple tree by Mr. Henry Kleinhaus of Nyces, Penn., agree with specimens of *congregatus* bred from Sphinges, except in the second abdominal joint being polished and only slightly punctured, or only finely

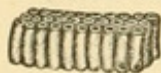


Fig. 9. — Parallel cocoons, found on apple twig.

* I have still another Microgaster parasite bred from the Army-worm. It differs from the others in belonging to the genus *Microplitis* and in being solitary, only a single maggot deriving nourishment from the partially grown Leucania larva. The specimen is, however, too poor to describe from.

striate. They might be considered a variety, but hardly more. I have found similar cocoons at Lawrence, Kansas, and bred the same kind of flies from them, some of the specimens varying in having red marks on the third and fourth joints of the abdomen. The spinning of the cocoons in these honey-comb-like masses seems also to be due to the place of spinning, as they were in each case attached to tree-branches; the larvæ doubtless finding that they could obtain a firm support only in a position transverse to the branch and their host.

From *Sphinx 5-maculata* I have obtained cocoons such as those represented on *Chærocampa* in Fig. 4, and have received from Mr. N. A. Bibikov, Orangeburg, S. C., the same kind of cocoons from a Tomato-worm, and all have produced *Apanteles congregatus*. But, strangely enough, the mass of cocoons represented at Fig. 5 may also have been made by parasites of *Sphinx 5-maculata*, for I have received a similar mass obtained from that species by Mr. E. T. Dale of Yellow Springs, O., and the flies bred therefrom, as far as the few specimens before me will permit of comparison, present no characters distinguishing them from those bred from the other form of cocoons. With more material I hope a closer comparison may be made. These masses of cocoons must be spun under very different circumstances from those under which the others are spun.

APANTELES SMERINTHI, n. sp.—Length 2–2½ mm. ♂♀. Black; labrum, mandibles and palpi testaceous; the tips of the palpi whitish, antennæ dark testaceous; legs light red, the anterior and intermediate coxæ reddish, the posterior coxæ black; wings hyaline, tegulæ and nervures testaceous, the stigma a little darker; lateral edges of the first and second joints of the abdomen testaceous, a spot on each side of the third joint and sometimes the apical margin of this joint red, the three basal joints reddish beneath. Mesothorax even, shining, the punctures being very fine and not close together. Metathorax finely reticulate, with a slight median ridge. Abdomen polished, the basal joints with slight distinct punctures, not rugose. Ovipositor concealed. The radial vein arises beyond the middle of stigma and passes into the basal vein of the areolet quite evenly.

Described from many specimens bred from *Smerinthus ocellatus*, June 10, 1872. At once distinguished from *congregatus* by the shining, delicately punctured mesothorax. In other respects, excepting the finer sculpture of the base of the abdomen, it closely resembles that species. The cocoons are spun in a mass, arranged

parallel to one another in a single row, the whole enveloped in loose white silk and attached to a willow leaf.

A bunch of weathered cocoons, of a dirty whitish color, found on a willow leaf—probably found in the same locality with the above near St. Louis—are peculiar for having the cocoons arranged in a double row, just like the cells in a honey-comb. From these cocoons I have bred flies which have unfortunately been much broken, but they have the peculiar polished thorax of *smerinthis*, and agree otherwise as far as the imperfection of the specimens will permit of comparison.

APANTELES ACRONYCTÆ, n. sp. (Riley MSS., 2d Rep. Ins. Mo., p. 120). Length $2\frac{1}{2}$ mm. ♂. Black; labrum and mandibles testaceous, palpi whitish, antennæ piceo-testaceous; legs light red, posterior coxæ black; wings hyaline, the tegulæ piceous, nervures and stigma testaceous; lateral edges of the first and second joints of the abdomen, and the sides of these joints beneath, testaceous. Mesothorax shining, uneven behind, there being one or two shallow pits before the scutellum caused by the union of the lateral oblique grooves, although these grooves are not clearly defined and are not apparent anteriorly. Metathorax granulated or finely reticulate, with an indistinct median ridge. First and second joints of the abdomen confluent punctate, opaque; remaining joints smooth and shining. The radial vein arises beyond the middle of stigma and passes into the basal vein of the areolet quite evenly.

Differs from *congregatus* and agrees with *smerinthis* in its shining mesothorax, but differs from the latter in the mesothorax being uneven, in the opaque basal joints of the abdomen, and in the lack of red marks on the third joint.

Described from nine specimens bred from larvæ of *Acronycta populi** taken at Bloomington, Ill. The maggots issued Sept. 15th, the flies Sept. 23d. "Many of the *Acronycta* larvæ when full grown will fasten themselves firmly to a leaf in the curled position, and from the body will issue from thirty to forty little maggots. These maggots are each of them 0.17 inch long, of a dull green color, tapering each way, with a dark dorsal mark, a lateral elevated ridge, and a row of shining elevated spots of the same color as the body between the ridge and the back. Each one spins a mass of white silk around its body and creeps out of it and commences spinning afresh, until at last a large aggregate amount of flossy silk is spun, into which the maggots work back

* *A. populi* Riley = *A. Lupusculina* Gn.

to transform, though some transform while lying on the surface.”* The silk is spread out upon the leaf about the caterpillar in an irregular mass and no definite cocoons are visible.

APANTELES PALEACRITÆ, n. sp. — Length $2\frac{1}{2}$ –3 mm. ♂♀. Black; labrum, mandibles and antennæ piceous, palpi whitish; legs red, anterior coxæ piceous, posterior black, the posterior femora at tip, the apical half of posterior tibiæ and the posterior tarsi excepting the base of the joints, black; wings hyaline, tegulæ piceous, nervures testaceous, stigma darker; lateral edges of the basal joints of the abdomen and the sides of these joints beneath piceous or testaceous. Mesothorax densely punctured; metathorax sparsely punctured, without median ridge. First and second joints of the abdomen rugose, the second joint with two distinct oblique grooves (in the Canadian specimens the middle of the joints almost smooth); remaining joints smooth. Ovipositor concealed. The radial vein arises beyond the middle of stigma and passes into the basal vein of the areolet quite evenly.

Described from 3 ♀s, 1 ♂, bred from the larva of *Paleacrita vernata* found at Villa Ridge, Southern Illinois, the flies appearing May 20th, and from 2 ♀s bred from Canker-worm larvæ, probably of the same species, received from Mr. J. Pettit, Canada West. The greenish-white cocoons are spun singly on the under side of a leaf. The flies differ from *congregatus* in the oblique grooves on second joint of abdomen and in the dark posterior tibiæ and tarsi.

LIST OF NORTH AMERICAN SPECIES HERETOFORE DESCRIBED.

All the species following have been described under the generic name *Microgaster*, that term being employed indiscriminately for the three genera treated of in this article, and it may be noted that all specific names should have been feminine. The original spelling is here quoted because the names of such species as may be referred to *Microplitis* or *Apanteles* will retain or take a masculine form. It may ultimately be found that *mellipes* Say, *bistigmata* Say, and possibly some of the other described species, do not really belong among the Microgasters.

UNITED STATES.

calliptera Say, Bost. Journ. Nat. Hist., i. 264 (1836). Probably a
[*Microplitis*.

* Second Report on the Insects of Missouri, 1870, p. 120.

croceipes Cress., Trans. Am. Ent. Soc., iv. 183 (1872) Tex. *Micro-*
maculipennis Cress., " " " " " " " " [plitis?
iridescens Cress., Proc. Ent. Soc. Phila., iv. 68 (1865). Cuba. "

zonaria Say, Bost. Jour. Nat. Hist., i. 263 (1836). Apparently a
gelechiæ Riley, 1st Rep. Ins. Mo., 178 (1869). A true [Microgaster. "

carpata Say, Bost. Journ. Nat. Hist., i. 263 (1836). An *Apanteles*.
congregata Say, Bost. Journ. Nat. Hist., i. 262 (1836).

Fitch, 9th Rep., 222 (1865). = *utilis* French, Can. Ent. xii.
 [42 (1880).
militaris, var. Riley, 8th Rep. Ins. Mo., 54 (1876).

This species was bred by Say from a Sphinx larva, and must, I think, be the same as that described by Fitch. The words "radial cellule with the nervure as obvious as the others; second cubital cellule rounded destitute of the exterior nervure," in Say's description, might throw a doubt on his insect being a Microgaster at all; but there is an inconsistency in the second cubital cellule being open and rounded in the same insect. No other small Ichneumonids are known to attack Sphinx larvæ in the manner he describes, the insect mentioned in my first Report on the Insects of Missouri (p. 96 note) as a species of *Blacus*, on Mr. E. Norton's authority, being this common *Apanteles*.

ensiger Say, Bost. Journ. Nat. Hist., i. 260 (1836). The open areolet of the ♀ would place that sex in *Apanteles*, but the ♂ is said to have the areolet closed. Say must have confounded two quite distinct insects.

limenitidis Riley, 3d Rep. Ins. Mo., 158 (1871). An *Apanteles*.
militaris Walsh, Ins. Inj. to Veg. in Ill., 37 (1863). " "

Riley, 2d Rep. Ins. Mo., 52 (1870).

nephopteris Pack., Proc. Essex Inst., iv. 122, pl. 3, f. 3, 3a (1864).
 An *Apanteles*.

xylina Say, Bost. Journ. Nat. Hist., i. 262 (1836). " "

CANADIAN.

cinctus Prov., Nat. Can., xii. 196 (1881). Quebec. An *Apanteles*.
clavatus, Prov., Nat. Can., xii. 196 (1881). " Probably a sy-
 [nonym of *Ap. carpatus*.

ARCTIC.

Halii Pack., Am. Nat., xi. 52 (1877). Greenland.

unicolor Curtis, Ross's 2d Voyage, App. p. lxii. Arctic America.

CUBAN, ETC.

americanus Latr., Encycl. Meth., Ins. 10, 42 (1825). Martinique.

flaviventris Cress., Proc. Ent. Soc. Phila., iv. 66 (1865.) Cuba. An
[*Apanteles*.

hyalinus Cress., " " " " " 68 " Cuba. "

mediatus Cress., " " " " " 66 " "

marginiventris Cress., " " " " " 67 " " An

pinos Cress., " " " " " " " [*Apanteles*.
" " "

OF DOUBTFUL GENUS.

bistigmata Say, Bost. Journ. Nat. Hist., i. 264 (1836). The open areolet allies it to *Apanteles*, but the distinct radial vein and supplementary stigma render the location of the species doubtful.

mellipes Say, Bost. Journ. Nat. Hist., i. 261 (1836). Agrees with *Apanteles* except in its distinct radial vein and subfusiform abdomen. The "thorax with its two oblique impressed lines confluent behind" is also a peculiar character, although there is an indication of it in *Microplitis ceratomiæ*.

robiniae Fitch, Fifth Report, p. 56 (1859). The open areolet points to *Apanteles*, but the brevity of the description produces doubt.



Riley, Charles V. 1869. "Notes on North American Microgasters, with descriptions of new species." *Transactions of the Academy of Science of St. Louis* 4, 296–315.

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