

THE AMERICAN ORB-WEAVER GENERA *CYCLOSA*, *METAZYGIA* AND *EUSTALA* NORTH OF MEXICO (ARANEAE, ARANEIDAE)

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ABSTRACT. Five species of *Cyclosa*, three of *Metazygia* and thirteen of *Eustala* are found in the region. One species of *Cyclosa* is holarctic in distribution, others are temperate and tropical American. The rarity of the dwarf males of the tropical Florida *Cyclosa bifurca* suggests that the species may be parthenogenetic. *Metazygia* and *Eustala* are known from the Americas only, most species being tropical. The five temperate species of *Eustala*, especially the three eastern ones, are difficult to separate; possibly they hybridize in some areas. Two of the *Eustala* species are new, with the range of southern Florida and the West Indies.

INTRODUCTION

As with most orb-weaver genera, *Cyclosa*, *Metazygia* and *Eustala* have never been revised and until now only some common species could be determined with certainty.

A revisionary study such as this should report the results of the research; that is, it should summarize the diagnostic characters of the species and genera revised, indicate how to separate the species, and provide some general information on the natural history of the species studied.

Much previously unpublished data on natural history can be gleaned from collecting labels; the author's own experience and published literature (if the determinations are reliable) can supply more. A summary of this information is of as much general interest as are the keys and diagnosis.

On the other hand, detailed nondiagnostic

morphological descriptions are of little interest, although they are frequently given in revisionary studies. Of still less interest, except to the writer, is the nomenclatural confusion that preceded the revision. In non-numerical, taxonomic research only the results, not the procedures, are usually given. If the specimens key out and the illustrations are useable, the study is demonstrated to be adequate. Nevertheless, in this paper I have indicated the procedures used to study *Eustala* as a partial answer to those who claim that taxonomic work might be hastened.

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Cyclosa, *Metazygia* and *Eustala*

Cyclosa, like *Mecynogea* and *Cyrtophora* among the araneid orb-weavers, hangs its



Plate 1. *Cyclosa conica* penultimate female and a web built by a penultimate female, New Hampshire.

eggs on a radius of the web, perhaps as a camouflage device (Plates 1, 2). Juveniles make a line of debris. But *Cyclosa* remakes its web almost daily, as do most members of the family, while *Mecynogea* and *Cyrtophora* do not. *Cyclosa* renews the viscid



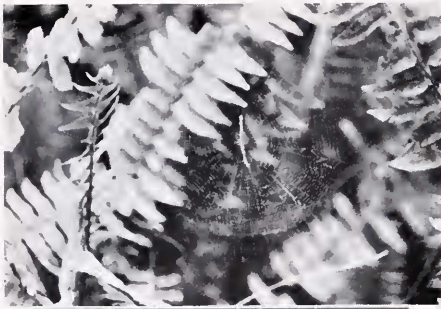


Plate 3. *Cyclosa caroli*, upper and middle photograph web, bottom detail with spider (arrow) in center of line of debris. Upper photograph south central Florida, middle and bottom Panama Canal Zone (upper photograph J. Maluda, middle one W. Eberhard, bottom Y. Lubin).

threads, leaving the egg-sacs hanging (Y. Lubin, personal communication, Plate 4). The holarctic *Cyclosa conica* is the exception. While it does hang debris and silk in the web, it places its egg-sacs on leaves, probably because of the short season in the northern parts of the range. *Uloborus*, a cribellate orb-weaver, also hangs its egg-sacs in the web. But cribellate silk owes its stickiness to its woolly nature, so the webs do not dry and have to be replaced. Females of both *Uloborus* and *Cyclosa* hang among their egg-sacs, head up in some *Cyclosa* species, and resemble their egg-sacs so closely as to be hard to find (Plates 1-5).

Cyclosa bifurca is the only colored species; both spider and egg-sac are green. The female genitalia are reduced secondarily, reverting almost to a haplogyne condition: there is no scape and no ventral opening. Of about 350 specimens examined, only two males were found. Is the species parthenogenetic? The male is dwarfed and the palpal structures are somewhat reduced. For instance, the paramedian apophysis is lacking and the conductor is small (Figs. 86, 87).

The accumulated errors in the literature of several generations posed several riddles. For instance, there has been much speculation as to how the "American" *Cyclosa oculata*, common in the Mediterranean area, was introduced to Europe (Lutz, 1915, Simon, 1928). But *Cyclosa oculata* (Figs. 21-23) is actually a European species which has never been found in America. Because its abdomen resembles that of the American *C. walckenaeri* (Plate 4), Simon (1900) confused and synonymized the two, leading later authors astray.

Besides the poorly known species from the Balkans, five species of *Cyclosa* are known from western and southern Europe (Roewer, 1942, Bonnet, 1956) (Figs. 21-37). Three of these are Mediterranean (*C. algerica*, *C. sierrae* and *C. insulana*). [*C. insulana* is found from France and Africa to India and the southwestern Pacific (Bonnet,

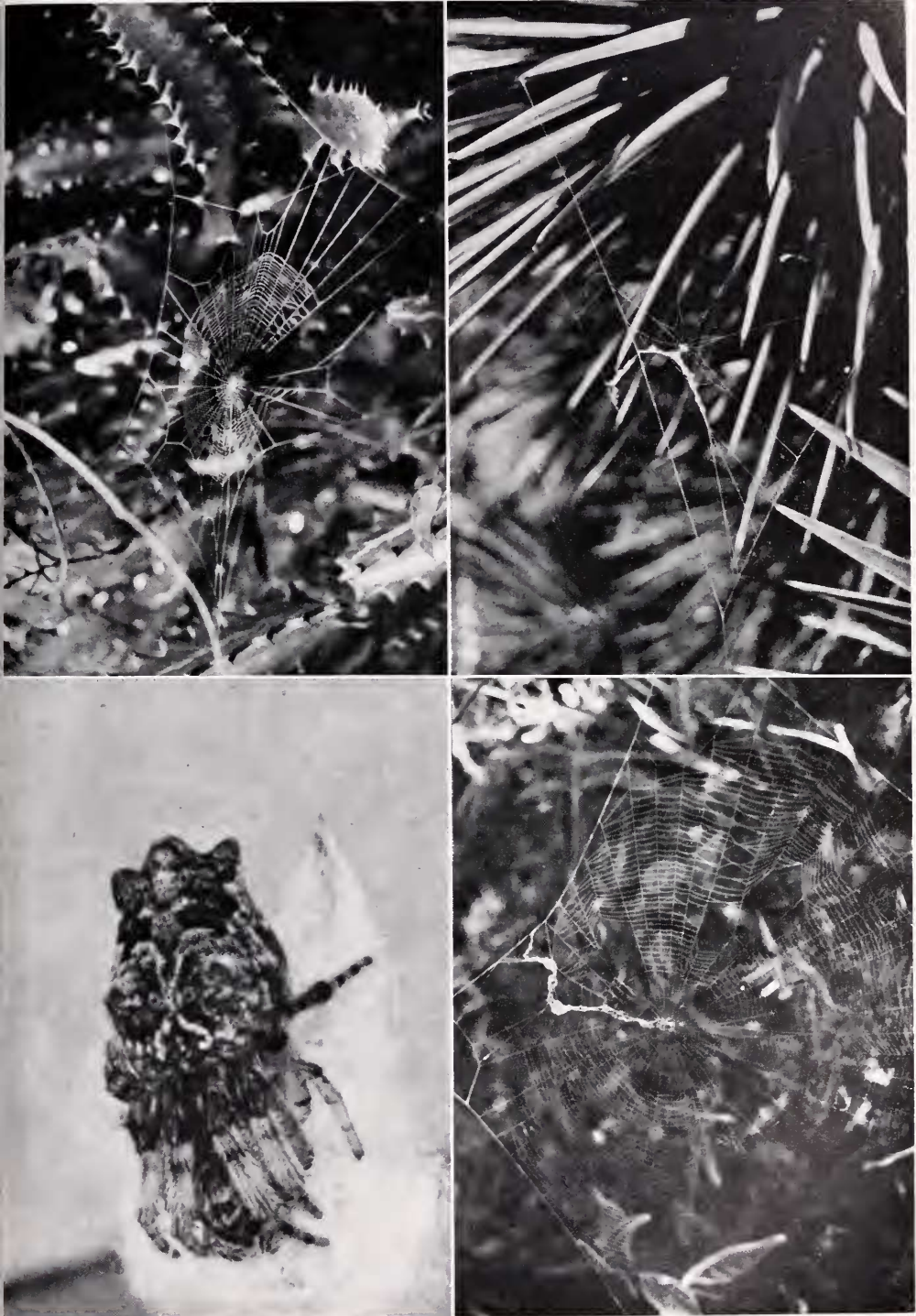


Plate 4. *Cyclosa walckenaeri*, upper left female, upper right horizontal web built by juvenile, 9 cm diameter; lower left web of adult with egg-sacs, 17 cm diameter; lower right incomplete web and egg-sacs.



Plate 5. *Cyclosa bilurca* web with female and egg-sacs, 15 cm diameter, Florida (photo V. Brach).

1956).] All five species are closer to *C. conica* than to the other American species.

Metazygia is mostly made up of tropical American species. The orbs are loose with widely spaced spirals (Plate 6). They are usually left up during the day, while the spider rests in a retreat, and are replaced every evening after dark. *Metazygia wittfeldae*, which often makes its webs on bridges or buildings, occupies a niche similar to that of the more northern *Nuctenea cornuta* (Clerck), and is similar in appearance (Plate 6).

Eustala, although common, is not well-known. Various species are found resting on dead twigs of shrubs or trees. W. Eberhard (in letter) writes that some *Eustala* have their webs up during the day, but most (in southern Colombia) put them up in the

evening and tear them down in the morning. The webs are characteristic with some variation. In construction they are more or less vertical and somewhat asymmetrical with the larger part usually below the hub. They have frame threads that do not span particularly large spaces, and a hub with several well-ordered loops and a medium hole in the center. They are often built in dead branches or tree trunks. In general they are undistinguished webs with nothing particularly remarkable about them. My own observations agree with Eberhard's. *Eustala anastera* in central Florida make their webs in the evening after dark. Usually the webs have disappeared by morning, but once in awhile a web is kept (Plate 7).

Eustala and *Metazygia* webs are similar and may be horizontal or vertical. Both are



Plate 6. *Metazygia wittfeldae*, upper left female; upper right web 15 cm horizontal diameter; lower left 18 cm horizontal diameter; lower right web with dew, 25 cm horizontal diameter.

loose constructions with few threads. And both *Eustala anastera* and *Metazygia wittfeldae* are less likely than many other nocturnal orb-weavers to tear down the web when disturbed by artificial light or when the web is dusted with cornstarch to make it more visible in photographs.

METHODS

At the start of a revisionary study the taxonomist has in front of him perhaps hundreds of specimen collections. Are those collected together all the same species? Can species be separated readily by their genitalia, or by their size, coloration, eye ar-



Plate 7. *Eustala anastera*, Florida; top row female; bottom webs: left with spider in web 13 cm diameter; right spider removed, 38 cm diameter.

rangement, or the shape of the abdomen? Perhaps a system could be based on each character like the one devised by Adanson, in the 18th century, but it might be unnatural, each character giving a separate classification. Some species are so distinct that the diagnostic characters are obvious, but more often the taxonomist has to sort out specimens and try various combinations of characters. Do all those that lack a hump on the abdomen also have distinct genitalic char-

acters, and do all these fall within a certain size range? Might the smaller size, larger eyes, and lack of hump reflect merely fewer instars passed by a spider before maturity, or do they reflect a segregated breeding population for which we can predict also different behavior and habits? In both *Cyclosa* and *Eustala* the numerous genitalic differences between specimens usually represent individual variation of no taxonomic importance. To be diagnostic, differences

must characterize all members of the population.

The separation of populations from the mass of specimens cannot be done by intuition. Numerical and statistical methods are not applicable, as spiders grow allometrically and mature after a variable number of instars. Statistically significant measurements would make specimens maturing in the 8th instar distinct from those maturing in the 9th. This is very different among most mites, which have a fixed number of molts. My own method is to find the diagnostic characters for the population that is most distinct, and try to delineate the more difficult species on the basis of the same characters. But is it valid to assume that other members of the genus differ in the corresponding characters? In the *Cyclosa conica* group of species (Figs. 1-37), the median apophysis of the palpus is a useful character for classifying males, and differences in its shape correlate with differences in size, shape of abdomen, and other characters. The shape of the median apophysis is similarly useful in other American species of *Cyclosa*, but for separating species of *Larinia* and *Eustala*, it is useless. To find the most useful characters, I make numerous outline drawings to scale, few of which will be used in the final presentation of the research. The nontaxonomist, who sees only conclusions, remains puzzled as to the aims and methods of the study.

In *Cyclosa* the females of North American species could readily be separated by the shape of the abdomen as well as by the epigynum. Males of one species were all accompanied by females, and all came from the northern part of North America. But males of other species were much more difficult to separate. An occasional specimen matched females or accompanied females. At first the palpi could not readily be separated, but gradually differences were found in the median apophysis (Figs. 47, 60, 73).

Today's approach is vastly different from that of twenty to fifty years ago, when re-

visers used the smallest possible sample from a population, any specimen that differed would be described as new, and "difficult" specimens were ignored or discarded as abnormal. But these "difficult" specimens represent the variation that makes revisions challenging. The huge numbers of specimens in American collections embrace an enormous amount of variation, aside from abnormalities, making a sound basis for revisionary studies.

The *Eustala* species are difficult. Chamberlin and Ivie (1935) considered the California-Arizona populations distinct because of a series of humps on the posterior of the abdomen, selected a juvenile specimen as type, and named the species *rosae*. In 1944 in the controversial paper on the spiders of the Georgia region, the same authors listed three southeastern species, using (wisely in this instance) old Walckenaerian names. *Eustala anastera* was characterized as having "a sharp conical tip to the abdomen. It occurs in a great variety of color patterns. . . ." Nothing was said about how to separate males. "*Eustala cepina* is smaller than *anastera*, the abdomen is less sharply angulate and is broad. It lacks the silky white hairs found on the top of the head of *anastera* and *triflex*, or at most are much reduced." *Eustala triflex* (= *emertoni*) "differs from *anastera* and *cepina* which occur in the same region by larking [sic] the terminal angulation on the abdomen, the abdomen being rounded behind. There are also differences in the male palpus." But what are these differences in the complicated palpus?

It is not surprising that Kaston (1948) in his discussion on *Eustala anastera*, does not list *cepina* and *triflex* in the synonymy, but indicates that "Chamberlin and Ivie prefer to maintain [*triflex*] as a distinct species. . . ." Chickering (1955), describing Central American *Eustala*, listed *cepina* as a synonym of *anastera*, but did not mention *triflex*. Archer (1951), however, considered *triflex* distinct and described a fourth species, *E. arkansana*,

citing differences of the epigyna (which I could not verify). For *arkansana*, Archer illustrated the epigynum, and for all the species he illustrated a palpal structure he called the "median apophysis." I cannot recognize the palpal structure illustrated; it may be the embolus. Archer did not indicate whether he illustrated the one from the left or the right palpus.

I started my investigation of *Eustala* with the American Museum collection. Gertsch, Archer and Ivie had used the Chamberlin and Ivie (1944) names on only a few specimens (most others were not determined), but Chickering, who examined a small part of the collection, labeled all specimens *E. anastera*. One locality, in eastern Pennsylvania, yielded a large series of males and females. These had labels of the three species (*anastera*, *cepina*, "triflex"), and I started to draw these and study their differences. But I could not find the differences when I tried to use them for separating other collections. Only one character, the ventral row of macrosetae on the second femur of *E. anastera*, remained constant (Fig. 214), and I subsequently sorted out all collections using these "spines." However, such large setae could reflect allometric growth, as the *anastera* were also the largest specimens. I removed all *E. rosae* because they seemed distinct and similar in size to *anastera*, lacked the femoral macrosetae in males, had humps on the abdomen, and had a distinctive epigynum (Fig. 193). To get some new ideas, I examined *E. californiensis*, a distinct North American species. The diagnostic genitalic characters were a differently shaped terminal apophysis and median apophysis in the male palpus (Figs. 147, 148), and the shape of the posterolateral plates of the epigynum (Fig. 139). The embolus of the palpus, which I had previously carefully examined and illustrated was not significantly different. Because it is soft, the median apophysis is a more difficult character to work with. With this new knowledge I returned to *E.*

rosae and confirmed that all females with extra abdominal humps (Fig. 196) also had the extra dorsal lobe on the posterior face of the epigynum (Fig. 193). The males had very distinct "half-spear-shaped" terminal apophyses (Figs. 202, 203, 313) and lacked the ventral setae on the second femur (Fig. 201), characteristic of *anastera*. I returned to *anastera* only to find that it had a similar but less distinct "half-spear-shaped" terminal apophysis (Figs. 215, 216). One specimen, determined by Ivie to be *anastera*, was an exception (Fig. 315). (It turned out to be one of many males with this character.)

Could the bubble-shaped transparent subterminal apophysis (sa in Fig. 232), which differed also in *E. californiensis*, be used? Sketches and comparisons indicated not. But the combined characters of terminal apophysis shape, femoral setae, large size and heavy pigmentation, facilitated sorting out *anastera*. Only one specimen with an *anastera* palp lacked femoral setae. And, several specimens had filamentous terminal apophyses, but were large, dark, and had femoral setae. Do these exceptional specimens represent a new species, intermediates, or perhaps products of introgression? Adopting introgression as a temporary working hypothesis, I began to doubt that I could separate most males of this species. The disturbing thought occurred to me that Ivie, in working through the three large collections from one locality in Pennsylvania, might not have kept difficult-to-place intermediate specimens with the labeled collections.

I decided to re-examine "triflex" males. Preliminary examination had shown the palpus to have an especially long tail on the conductor (Figs. 266, 309-311). Careful examination indicated that the long tail usually was associated with a relatively short terminal apophysis (Figs. 309-311). But there were specimens with a half-spear-shaped embolus. Was *triflex* merely a small *E. anastera* that failed to grow the femoral macrosetae? Some specimens had the char-

acteristic long tail of the conductor but had a long terminal apophysis, as does *A. cepina*. Are these separate species or hybrids? The females associated with these males had the oval abdomen (Fig. 258) described by Chamberlin and Ivie, and also had an epigynum distinct from that of *anastera*, but apparently not from *cepina* (as far as I could tell at this point). My confidence increased and I decided to work on a new, very distinct species found in the West Indies and Florida (*E. cazieri*) to find some new characters to use before returning to the male *E. anastera* for measurements and recording collecting data.

Examination of the new species provided evidence that the main pattern of macrosetae is not merely the result of allometric growth: the large *E. rosae* has no macrosetae ventrally on the second femur (Fig. 201), the small *E. cazieri* has many (Fig. 135).

The next problem was to separate females of *E. cepina*. By making numerous drawings and clearing epigyna, I found that in *cepina* the base of the epigynum has a tiny sclerotized scale dorsally (Figs. 286–290). The scale is absent in *E. "triflex"* and *E. anastera*, and absent or transparent in Florida specimens believed to belong to the species. This character was abandoned late in the study as it is not consistent.

To make sure that these Florida females, which are much smaller than *E. anastera* from the rest of the range, really are the same species, I decided to study the associated males. I went back to various other West Indian species, and found that the males of some differed in the shape of the conductor. I now made outline drawings of the conductor, only to discover that the long tail of *E. "triflex"* was more distinct than I previously thought and, more importantly, that of these three species, *E. cepina* lacked the distal ventral lobe of the conductor (upper right in Figures 303–308), providing an additional diagnostic character. It also reaffirmed the differences pre-

viously noted and compounded the problem that *E. anastera* comes with short (Fig. 315) and long (Fig. 314) terminal apophyses. It seemed that if two species are collected together, specimens are easy to separate, but lone individuals often cannot be placed.

In consulting type specimens and Abbot illustrations, I found that the illustrations labeled *Epeira triflex* were contrastingly marked (Figs. 219, 222), a coloration found only in *E. anastera*, not in any specimen I had available of *E. "triflex."* The name was changed to *E. emertoni*, the next oldest name available.

After the first triumph of finally figuring out that there are differences and the species can be told apart, there comes doubt about being able to place all specimens. If all specimens can be determined, new doubts arise: now that I have finally discovered the obvious, is it worth publishing? But after the doubts are overcome, there comes the challenge to put the conclusions into a form that a nonspecialist can use for separating species. The last generation's specialists indulged in a kind of gamesmanship, just stating that there are differences, but failing to describe them, or hiding them in drawings that made comparison impossible.

After examining, measuring and determining the contents of a few hundred vials, most with many specimens, I found determinations getting easier. I had unconsciously used the relative size of the conductor in males and found now that not only does *E. "triflex"* (= *emertoni*) have a relatively large conductor (Figs. 309–311), but also that *anastera* has a relatively small conductor (Figs. 298–302).

While determining specimens and recording data, I took measurements of specimens from all parts of the range and found that the genitalia of *anastera* and the similar *cepina* do not overlap in size (Figs. 283–290 and 298–308). That the area of the conductor "above" the embolus is larger in *anastera* than in *cepina* and *emertoni*, I did not re-

alize until finishing the illustrations (Figs. 298–311).

But a few problem specimens remained: the male *anastera* with the terminal apophysis short (Fig. 315), and those lacking macrosetae on the second femur; a few *emertoni* (= "*triflex*") with the terminal apophysis long; and a few *cepina* with a distal lobe on the conductor. Problem females may have been overlooked due to relatively arbitrary decisions in separating specimens with fewer characters.

At the end, when determining various borrowed collections, I found that *Eustala anastera* from Nova Scotia and some from Quebec have smaller abdominal humps, males have a much smaller conductor (Fig. 298), and females have the middle piece of the epigynum larger (Fig. 229). Are they a distinct species? One male from Ontario had one Nova Scotia-like palpus and one "normal" *anastera* palpus. I decided that perhaps one palpus was more dehydrated and shrivelled.

A single collection, from Jefferson Co. in northern Florida, included both small females of the central Florida type, and larger sized females similarly marked. Are the smaller ones a distinct species? Adult females collected at Archbold Biological Station in February and March 1976 were all considerably larger than females from the same population collected in July and August 1975 by M. Stowe. The winter ones were predominantly brown, the summer ones green on the abdomen.

Character displacement. Eastern Canadian specimens of *E. anastera* are of slightly smaller size—the males having few macrosetae and a smaller conductor (Fig. 298) and the females having a smaller hump and larger epigynal middle piece (Fig. 229)—resemble *E. cepina* and *E. emertoni*, and are more distinct in the shared range of all three species because of character displacement. Perhaps the Mexican specimens of this group all belong to *E. anastera* but look different in the absence of competing species.

Remaining questions. Other questions remain unresolved. Is *Eustala conchlea* (Figs. 269–279) just a western form of *E. emertoni* with a large abdominal hump? It was arbitrarily decided to keep them separate.

Among the puzzling specimens are the asymmetrical ones. The macrosetae on left and right femora of the same specimens often differ, or there may be one ventral macroseta on one second femur, none on the other. (In the *E. anastera* group of species these were all considered *E. anastera*.) An interesting epigynum is that of an *E. cepina* female from Emmet County, Michigan (A. M. Chickering, collector, in the Museum of Comparative Zoology) (Fig. 248). Only the epigynum is asymmetrical, not the rest of the animal. More startling is the left palpus of a male *E. anastera* from Kisatchie National Forest, Grant Parish, Louisiana (A. F. Archer, collector, in the American Museum of Natural History). The left palpus has a unique bulbous terminal apophysis, the right one a normal, short, pointed one (Fig. 231).

Several collections of the *Eustala anastera* group might be new species, but I am hesitant to name them until more specimens are available. One collection, consisting of two females and a male that appears to be a small *E. anastera*, comes from Black Mesa State Park, Cimarron County, Oklahoma (16 August 1964, H. Fitch in the American Museum of Natural History). The females have three posterior humps in a row on the abdomen, and the epigynum in posterior view has a very small middle piece (Fig. 230). The male lacks macrosetae on the venter of the second femur; the conductor of the palpus is like that of *E. cepina*, and lacks the large lateral conductor lobe present in most specimens of *E. anastera*.

Another new species may be represented by two females, one from Cologne (? Goliad Co.), Texas (7 June 1937, S. Mulaik in the American Museum of Natural History) and another from Little Pine Key, Florida

(27 March 1939 in the American Museum of Natural History). Both look like very large *E. anastera* with the more common spotted patchy pattern, but more contrasting. The females have two posterior humps and, in the epigynum, a very heavy, large scape with parallel sides (Fig. 228). The Texas female, whose epigynum was illustrated (Fig. 228), was 14.0 mm in total length, carapace 4.9 mm long, 4.1 wide. Several very large *E. anastera* males from southern Florida (as compared with the small *E. anastera* from central Florida) may belong with these females. But the question remains whether they represent a separate species or large-sized populations.

After all was completed, the "easy" *Metazygia* illustrated and determined, I felt that I had to return to these difficult *Eustala* specimens. Perhaps I had overlooked characters seen in ventral view of the median apophysis, the paracymbium and sculpturing of the tegulum of the palpus. But no new characters were found. However, on reexamination, the Oklahoma male turned out to be *E. cepina*, the females (Fig. 230) are perhaps a new species to be named when additional specimens are available. I also reexamined most Texas and southern Florida specimens of *E. anastera* in search for additional large females having an epigynal scape with parallel sides (Fig. 228), and perhaps for males, but found only intermediates, all in the collection from Raven Ranch, Kerr County, Texas. The intermediate specimens (Figs. 226, 227) dissuaded me from describing the two specimens as a new species.

While revision of *Eustala* is now completed, I would not be surprised to find additional sibling species among the *Eustala anastera* collections.

Cyclosa Menge

Cyclosa Menge, 1866, Schrift. naturforsch. Gesellschaft. Danzig, neue Folge, 1: 73. Type species *C. conica* (Pallas) by monotypy. The name is feminine.

Parazygia di Caporiacco, 1955, Acta biol. Vene-

zuelica, 1: 345. Type species *P. accentonotata* di Caporiacco [= *C. caroli* (Hentz)] by monotypy. NEW SYNONYMY.

Diagnosis. *Cyclosa* species differ from those of other Araneidae genera and especially from *Araneus* in the narrow head region of the carapace, often separated by shallow grooves from the thoracic region (Figs. 10, 12, 29, 48). The eyes are closely spaced, posterior median eyes almost touching (Figs. 10, 12, 14). *Cyclosa* differs from *Larinia*, which also has the posterior median eyes close, in having banded legs, and in the shape and coloration of the abdomen. There are dorsal, paired, black or gray patches on white (Figs. 10, 29, 48, 61, 74) and a characteristic pair of ventral white spots surrounded and separated by a black band running from epigynum to spinnerets and posteriorly surrounding the spinnerets (Figs. 11, 49, 62, 75). The posterior dorsal end of the abdomen is extended beyond the spinnerets in the female and there may be shoulder humps or additional posterior humps (Figs. 2, 10, 28, 29, 39, 48, 52, 61, 65, 74, 78, 88). *Cyclosa* further differs from *Araneus* and *Larinia* in that the male palpal patella has only one macroseta (Fig. 1).

The web is diurnal, its form diagnostic; lightly spun with few frame threads, it has a stabilimentum containing debris or a vertical row of egg-sacs through the center; the spider rests at the lower end or in a gap in the decoration and is often difficult to find (Plates 1-5).

Description. The head region of the brown carapace is narrow and lighter in color than the thoracic region; the thoracic depression is round (Figs. 10, 29, 48, 61, 74). The carapace is covered with down. The anterior median eyes are slightly larger than the others, which are subequal in size (Fig. 16). The anterior median eyes are their diameter apart, usually one, but not more than two and one-half diameters from laterals. Posterior median eyes touching or less than their diameter apart, one and one-half to three diameters from laterals (Figs. 10, 29, 48, 61, 74, 88). The clypeus height

equals about the diameter of the anterior median eyes (Fig. 16). The sternum is dark brown, often enclosing white pigment patches. The coxae are light, sometimes with dark marks. The legs are light with dark bands with short setae and macrosetae. The spinnerets are usually dark brown. *Cyclosa bifurca* departs from the drab coloration of other species by being green. The widespread *C. insulana* (Fig. 29) of Eurasia and Africa to the Pacific has a silvery abdomen, perhaps an adaptation to the open sunny areas it frequents (M. H. Robinson *et al.*, 1974).

Males are smaller than females, more sclerotized, darker in color, and have the abdomen almost spherical with humps only faintly indicated. The markings are dark with few paired light spots, but with some indications of the humps (Figs. 1, 12, 38, 50, 51, 63, 64, 76, 89). The endites have a lateral tubercle facing a minute cone on the palpal femur (lacking in the small male of *C. bifurca*). The first coxa of the male has a small hook (also lacking in *C. bifurca*) that fits into a groove of the male second femur. In addition, the fourth coxae of *C. conica* are armed with two macrosetae (Fig. 15). The second tibia is only slightly thicker than the first with a few more macrosetae (Figs. 1, 12, 50, 51, 63). The male of *C. bifurca* is dwarfed (Fig. 89).

Genitalia. The epigynum has a small weak scape, the shape of which may be diagnostic: straight and pointed in *C. conica* (Fig. 4), oval in *C. turbinata* (Fig. 41), almost circular in *C. caroli* (Fig. 54), and usually with parallel sides in *C. walckenaeri* (Fig. 67). The scape is absent in *C. bifurca* (Fig. 80). The seminal receptacles of all are sclerotized (Figs. 3, 5, 40, 42), but the connecting ducts and their openings to the outside are so thin-walled that they are hard to find, and once found their course is difficult to follow. They open in a fold on the venter of the base on each side of the scape (Figs. 40, 53), except that in *C. bifurca* they open on the posterior not far from the fertiliza-

tion ducts (Figs. 79, 81), a peculiar, probably secondary modification approaching haplogyne condition. Some material may be found in the depression having the openings of the epigynum, but I believe that these are an epigynal plug formed from mucus and not a part of the palpus left behind. (It is not known whether males or females can mate several times.)

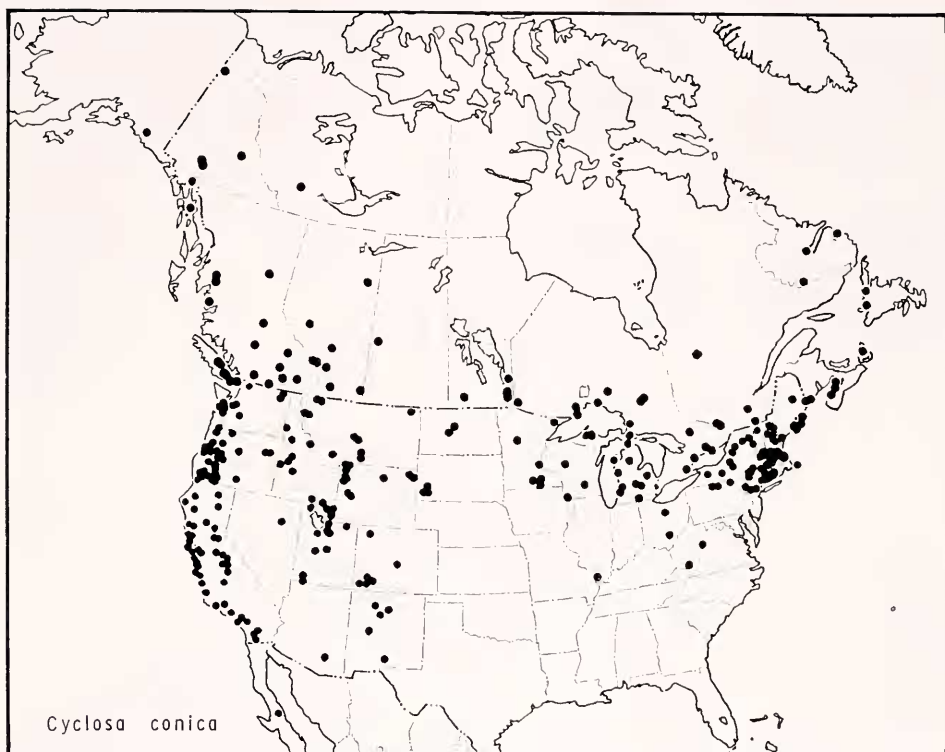
The palpal patella has one macroseta (Fig. 1). The bulb has a large conductor holding the tip of the embolus ("c" in Figs. 7, 17, 20), a small terminal apophysis ("a" in Figs. 17, 20), and a paramedian apophysis (pm), the latter apparently absent in *C. bifurca*. The embolus (e) is thread-shaped in all and the median apophysis has moved to the ventral side in all except *C. bifurca* ("m" in Figs. 8, 17, 20, 46). The complex median apophysis is species specific (Figs. 9, 23, 27, 33, 37, 47, 60, 73, 87), apparently fitting the epigynal scape into which it hooks during mating.

Natural History. The web has few frame threads (Plates 1-5). That of *C. conica* is almost circular, with about 40 radii (Wiehle, 1931); in each sector are 20-30 viscid threads separated by 2 to 3 mm (Plate 1).

The spider hangs in the middle of the web; juveniles have a detritis-covered stabilimentum (Plates 1, 4). Adults place the egg-sacs in a vertical line in the center, the spider resting at one end or the middle (Plates 1-5). Only *Cyclosa conica* does not place her egg-sacs in the web, no doubt an adaptation to the short season of the more northern areas it frequents. The sacs are left hanging when the viscid threads of the web are renewed (Y. Lubin, personal communication).

Some *Cyclosa* species are known to hang with the head up rather than down, like the widespread Eurasian *Cyclosa insulana* (Wiehle, 1928).

The shape of the stabilimentum of young *Cyclosa* cannot be used to separate species as it may differ greatly even in successive webs of the same individual (Marson, 1947).



Map 1. Distribution of *Cyclosa conica* (Pallas) in North America.

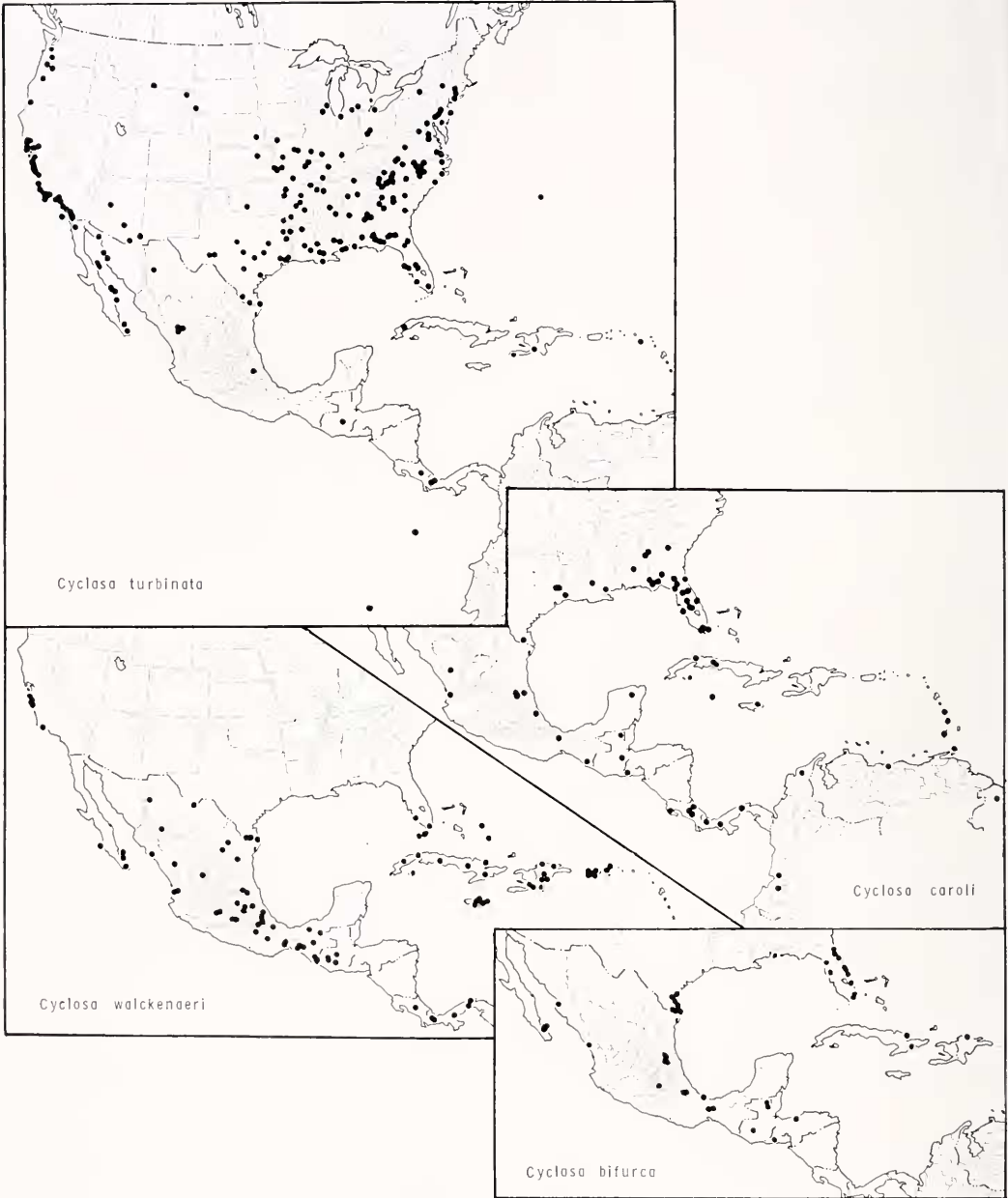
All species shake the web when disturbed, then may drop on a thread.

Species. Of the five species north of Mexico, *C. conica* is northern and holarctic, the remainder southern (Maps 1, 2). There are numerous tropical American species. The species north of Mexico can be separated by the shape of the abdomen of the female (Figs. 2, 39, 52, 65, 78), the shape of the epigynum, especially the scape (Figs. 4, 41, 54, 67), and the matching median apophysis of the palpus (Figs. 9, 47, 60, 73). It is ironic that A. Archer, who tried to separate all Araneidae species on the shape of the median apophysis alone, did not study *Cyclosa*, one genus in which the structure is of diagnostic importance.

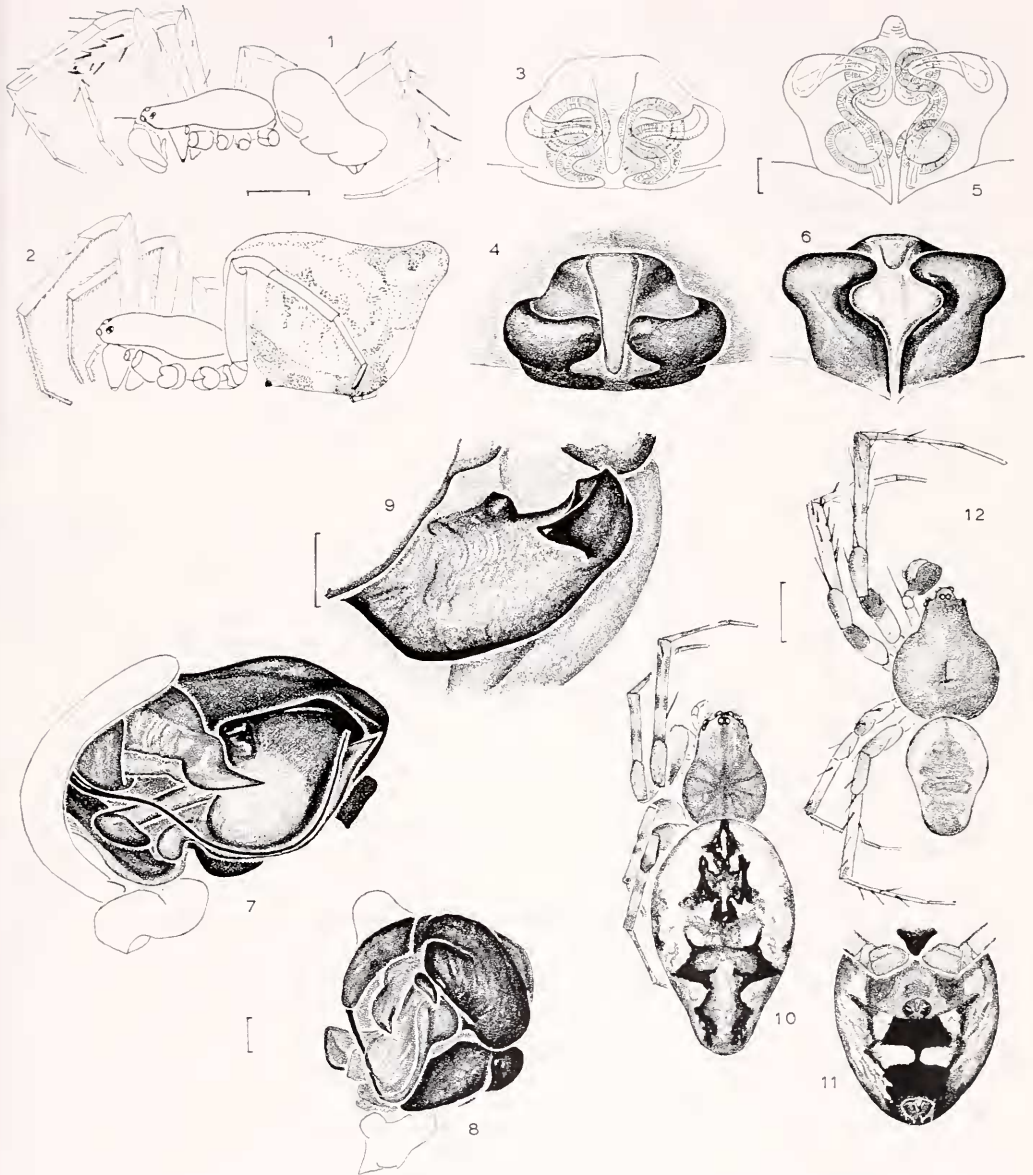
Distribution. *Cyclosa* species are found in all parts of the world.

KEY TO FEMALE *CYCLOSA* NORTH OF MEXICO

1. Posterior tip of abdomen bifurcated (Fig. 88); epigynum without scape (Figs. 80, 84); Florida, Alabama coast and southern Texas *bifurca*
- Abdomen with a single posterior hump (Fig. 10) or four posterior tubercles (Fig. 74) 2
- 2(1) Epigynum with sclerotized lobe on each side of scape (Fig. 4); Alaska, south to Virginia, Arizona and California *conica*
- Epigynum base without sclerotized lateral lobes (Figs. 41, 67); Connecticut to Washington and south 3
- 3(2) Abdomen with a pair of dorsal tubercles on anterior half of abdomen (Figs. 39, 65) 4
- Abdomen without dorsal tubercles; abdomen posterior to spinnerets longer than part in front of spinnerets (Fig. 62), epigynum scape an oval to circular lobe (Fig. 54); Georgia to Texas *caroli*
- 4(3) Abdomen with a single posterior hump (Fig. 39), epigynal scape a rounded lobe



Map 2. Distribution of *Cyclosa turbinata* (Walckenaer), *C. caroli* (Hentz), *C. walckenaeri* (O.P.-Cambridge) and *C. bifurca* (McCook).



Figures 1-12. *Cyclosa conica* (Pallas). 1. Male from side. 2. Female from side. 3-6. Epigynum: 3, 4. Ventral, 5, 6. Posterior. 3, 5. Cleared. 7-9. Left male palpus: 7. Mesal. 8. Ventral. 9. Median apophysis, ventral. 10. Female, dorsal. 11. Female abdomen, ventral. 12. Male, dorsal. Scale lines. 0.1 mm, except Figs. 1, 2, 10-12, 1.0 mm.

(Fig. 41); from Connecticut to Washington and south

Abdomen with four posterior humps (Fig. 65), epigynal scape usually with sides parallel (Fig. 67), southern Florida, southern Texas, California

KEY TO MALE *CYCLOSA* NORTH OF MEXICO

1. Fourth coxae each with a pair of macrosetae (Fig. 15); palpus with median apophysis heavily sclerotized and its distal tip folded over (Fig. 9); Alaska south to Virginia, Arizona and California

- Fourth coxae never with macrosetae (Fig. 77); median apophysis lightly sclerotized, tip not folded 2
- 2(1) Median apophysis mesal (Fig. 86); tip of abdomen bifurked (Fig. 89); total length less than 2 mm; Florida, Alabama coast and southern Texas.....*bifurca*
- Median apophysis almost hidden in mesal view (Figs. 45, 58, 71), posterior tip of abdomen with a tubercle or four tubercles; total length more than 2.1 mm 3
- 3(2) Abdomen usually extended beyond spinnerets (Fig. 51); median apophysis of the palpus short without a middle spine but with a rounded keel proximal to distal tip (Fig. 60); Georgia to Texas *caroli*
- Abdomen with only a posterior hump, or four slight posterior humps (Figs. 38, 64); median apophysis with a spine in middle, with or without distal keel (Figs. 47, 73) 4
- 4(3) Posterior tip of abdomen usually with indications of four tubercles (Fig. 64); median apophysis long, with a tiny median spine and a more distal keel ending in distal tip (Fig. 73); southern Florida, southern Texas, California *walckenaeri*
- Posterior of abdomen with at most a dorsal hump (Fig. 38); median apophysis with a large median spine but no keel distally in ventral view (Fig. 47), in subapical view keel extending from distal to median spine, from Connecticut to Washington and south *turbinata*

Cyclosa conica (Pallas)

Plate 1, Figures 1-19, Map 1

Aranea conica Pallas, 1772, *Spicilegia Zoologica*, 9: 48, pl. 1, fig. 16. Female specimen from Germany, believed lost.

Epeira canadensis Blackwell, 1846, *Ann. Mag. Natur. Hist.* (ser. 1), 17: 81. Juvenile type from vicinity of Toronto, in the Hope Museum at Oxford, lost.

Cyclosa conica.—Emerton, 1884, *Trans. Connecticut Acad. Sci.*, 6: 321, pl. 34, fig. 3, pl. 38, fig. 11, ♀, ♂. Keyserling, 1893, *Spinnen Amerikas*, 4: 276, pl. 14, fig. 205, ♀, ♂. McCook, 1894, *American Spiders*, 3: 225, pl. 17, figs. 3-4, ♀, ♂. Emerton, 1902, *Common Spiders*, p. 183, figs. 428, 429, ♀, ♂. F.O.P.—Cambridge, 1904, *Biologia Centrali-Americana, Araneidea*, 2: 493, pl. 46, figs. 19, 20, ♀, ♂. Wichle, 1931, in *Dahl, Tierwelt Deutschlands*, 23: 18, figs. 8, 17-21, ♀, ♂. Comstock, 1940, *Spider Book*, rev. ed., p. 465, figs. 463-464, ♀, web. Roewer, 1942, *Katalog der Araneae*, 1: 754. Kaston, 1948, *Bull.*

Connecticut Geol. Natur. Hist., 70: 236, figs. 711-713, fig. 2037, ♀, ♂, web. Locket and Millidge, 1953, *British Spiders*, 2: 166, fig. 111, ♀, ♂. Bonnet, 1956, *Bibliographia Araneorum*, 2: 1310.

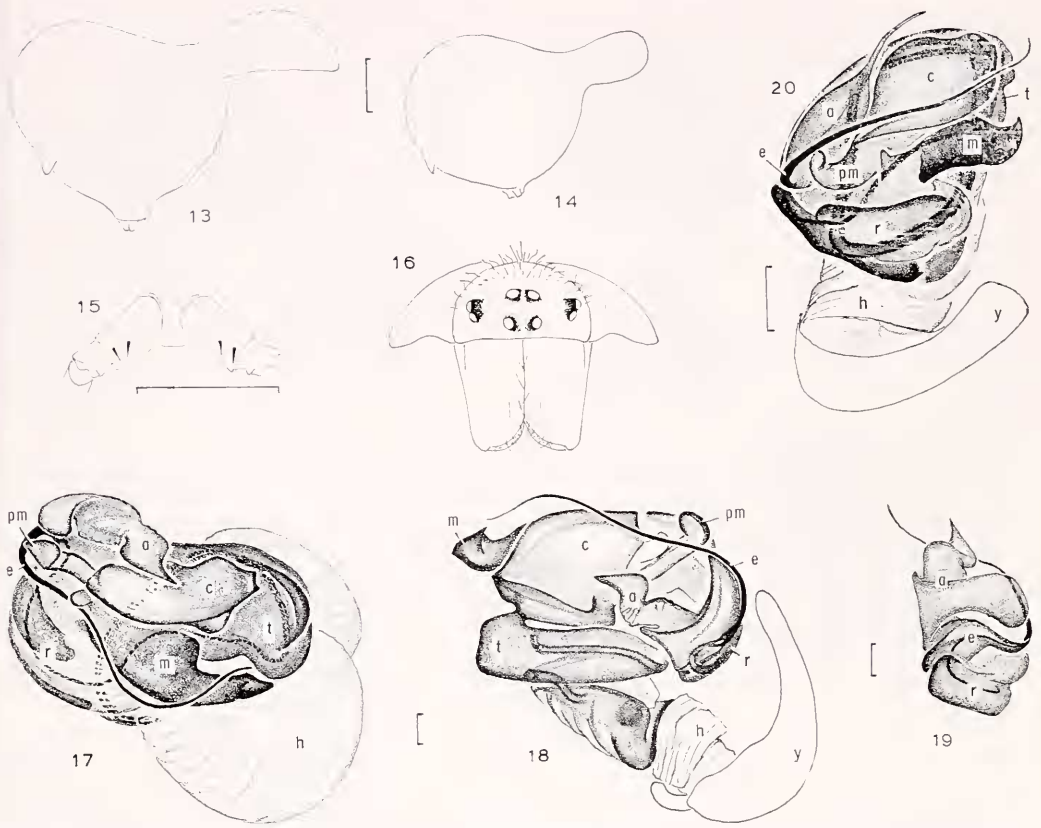
Note. Many specimens of *C. turbinata* in collections had been erroneously labeled as *C. conica*, thus literature citations of "*C. conica*" are not reliable, and records from the southern states, Mexico, Central and South America are all erroneous.

Measurements. Female from Wyoming: Total length 5.5 mm. Carapace 1.9 mm long, 1.4 wide. First femur, 2.1 mm; patella and tibia, 2.3; metatarsus, 1.4; tarsus, 0.7. Second patella and tibia, 2.0 mm; third, 1.3; fourth, 1.9.

Male from Wyoming: Total length 3.5 mm. Carapace 2.2 mm long, 1.6 wide. Head 0.7 mm wide. First femur, 2.6 mm; patella and tibia, 2.7; metatarsus, 1.6; tarsus, 0.7. Second patella and tibia, 2.1 mm; third, 1.4; fourth, 1.7.

Variation. Females vary in total length 3.6 to 7.9 mm, carapace 1.7 to 2.5 long, 1.3 to 1.7 wide. Males vary in total length 3.5 to 4.9 mm, carapace 2.0 to 2.3 long, 1.5 to 1.6 wide. The largest specimens came from the northeastern states. Specimens from Oregon and Washington had greater size variation than those from other parts of the range. The caudal hump varies in length and is quite long in some populations (Figs. 13, 14). Rarely are females almost all black. All long-tailed and black individuals came from the southernmost localities. One specimen (Fig. 13) had a long tail as well as a relatively long epigynal scape with its tip twisted.

Diagnosis. In North America *C. conica* is the only *Cyclosa* species over most of its range; only in the south does its range overlap with that of *C. turbinata*. *Cyclosa conica* is larger than *C. turbinata* and lacks the two anterior dorsal abdominal humps (Figs. 2, 10). The epigynum base in *C. conica* has a sclerotized lobe on each side of the scape (Figs. 4, 6), unlike *C. turbinata*, and the median apophysis of the palpus is



Figures 13–19. *Cyclosa conica* (Pallas). 13, 14. Female abdomen: 13. (Southern California) 14. (Minnesota) 15. Male, fourth coxae, ventral. 16. Eye region and chelicerae of female. 17–19. Left male palpus, expanded (17, 19, without cymbium). 17. Submesal view. 18. Subdorsal view. 19. Embolic division, dorsal.

Figure 20. *Cyclosa turbinata* (Walckenaer) male palpus, expanded, submesal view.

Abbreviations. a, terminal apophysis; c, conductor; e, embolus; h, hematodocha; m, median apophysis; pm, paramedian apophysis; r, radix; t, tegulum; y, cymbium.

Scale lines. Figs. 13–15, 1.0 mm; Figs. 17–20, 0.1 mm.

sclerotized, its distal tip folded over and pointed (Figs. 8, 9, 17). Two macrosetae on the fourth coxae of males (Fig. 15) are only rarely absent. In southern Europe *C. conica* can be confused with the very similar *C. sierrae* Simon (Figs. 30–33) and *C. algerica* Simon (Figs. 34–37). The males of these also have two macrosetae on the fourth coxa.

Natural History. The orb of *C. conica* is found on shrubs and understory of coniferous forests, sometimes deciduous, where it is the most common orb-weaver. According to Kaston (1948) the orb is wider than high,

with 40 to 50 radii, and lacks a retreat, the spider resting in the center (Plate 1). When disturbed the spider shakes the web or may drop out of the web. There may or may not be a stabilimentum in webs of the same individual. Objects falling into the web and insect remains are incorporated into the stabilimentum. Mature males do not build orbs. The three to five egg-sacs of loose silk are elliptical, yellowish brown, 3×7 mm, and are attached to dead twigs or under leaves, but not to the orb. The egg-sacs contain 10 to 130 eggs (Kaston, 1948).

Males are mature from May to July in

New England and from March to June in California. Mature females can be found from June to late August in New England and from March to September in California. The species overwinters in juvenile stages.

Distribution. Holarctic, in America from Alaska to southern West Virginia, southern Illinois to southern New Mexico and Baja California Norte (Map 1).

Cyclosa turbinata (Walckenaer)

Plate 2, Figures 20, 38–50, Map 2

Epeira turbinata Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 140. Female types are figures no. 79 and 80 from Georgia in Abbot's Georgia Spiders manuscript in the British Museum, Natural History. Copy in the Museum of Comparative Zoology, examined.¹

Epeira caudata Hentz, 1850, *J. Boston Soc. Natur. Hist.*, 6: 23, pl. 3, fig. 14, ♀. Female types from United States in Boston Natural History Museum, destroyed.

Singa vanbruyssellii Becker, 1879, *Ann. Soc. Entomol. Belgique*, 22: 78, pl. 1, figs. 4–6, ♂. Male holotype from Pascagoula, Mississippi in the Institut Royal des Sciences Naturelles de Belgique, Brussels, examined.

Cyclosa index O.P.—Cambridge, 1889, *Biologia Centrali-Americana, Araneidea*, 1: 51, pl. 6, fig. 6, ♀. Female holotype from Tamahn, Guatemala in the British Museum, Natural History, examined. F.P.—Cambridge, 1904, *Biologia Centrali-Americana, Araneidea*, 2: 496, pl. 47, fig. 12, ♀. NEW SYNONYMY.

¹Note added in proof. C. Dondale made me aware recently that, according to Article 72 of the *International Code of Zoological Nomenclature*, the type has to be a specimen; thus the Abbot illustration cannot be the type. A neotype may be designated (Art. 75); this has not been done here.

Cyclosa caudata,—Keyserling, 1893, *Spinnen Amerikas*, 4: 279, pl. 14, fig. 206, ♀, ♂.

Cyclosa culta O.P.—Cambridge, 1893, *Biologia Centrali-Americana*, 1: 112, pl. 14, fig. 12, ♂. Two male syntypes from near Omilteme, Guerrero, Mexico in the British Museum, Natural History, examined. F.P.—Cambridge, 1904, *Biologia Centrali-Americana, Araneidea*, 2: 493, pl. 47, fig. 2, ♂. NEW SYNONYMY.

? *Cyclosa tuberculifera* O.P.—Cambridge, 1898, *Biologia Centrali-Americana, Araneidea*, 1: 269, pl. 36, fig. 10, ♂. Male holotype without palpi from Teapa, Mexico in the British Museum, Natural History, examined. F.P.—Cambridge, 1904, *Biologia Centrali-Americana, Araneidea*, 2: 493, pl. 47, fig. 1, ♂. Doubtful NEW SYNONYMY.

Cyclosa turbinata,—McCook, 1893, *American Spiders*, 3: 224, pl. 17, figs. 5, 6, ♀, ♂. Comstock, 1940, *Spider Book*, p. 468, fig. 467, ♀. Roewer, 1942, *Katalog der Araneae*, p. 761. Kaston, 1948, *Bull. Connecticut Geol. Natur. Hist. Surv.*, 70: 237, fig. 710, ♀. Bonnet, 1956, *Bibliographia Araneorum*, 2: 1325.

Cyclosa nanna Ivie and Barrows, 1935, *Bull. Univ. Utah, biol. ser.* 3(2): 18, figs. 52, 53, ♀, ♂. Male holotype and female paratype from Naples, Georgia, lost. NEW SYNONYMY.

Note. Specimens of *C. nanna* are not in the American Museum or University of Utah or Ohio State University collections. The illustration shows the epigynum of *C. turbinata*.

Specimens in many collections of *C. turbinata* had been misidentified as *C. conica*. Many *C. conica* records appear to be this species.

Measurements. Female from Louisiana: Total length 4.3 mm. Carapace 1.5 mm long, 1.0 wide. First femur, 1.3 mm; patella and

Figures 21–37. Old-world *Cyclosa*.

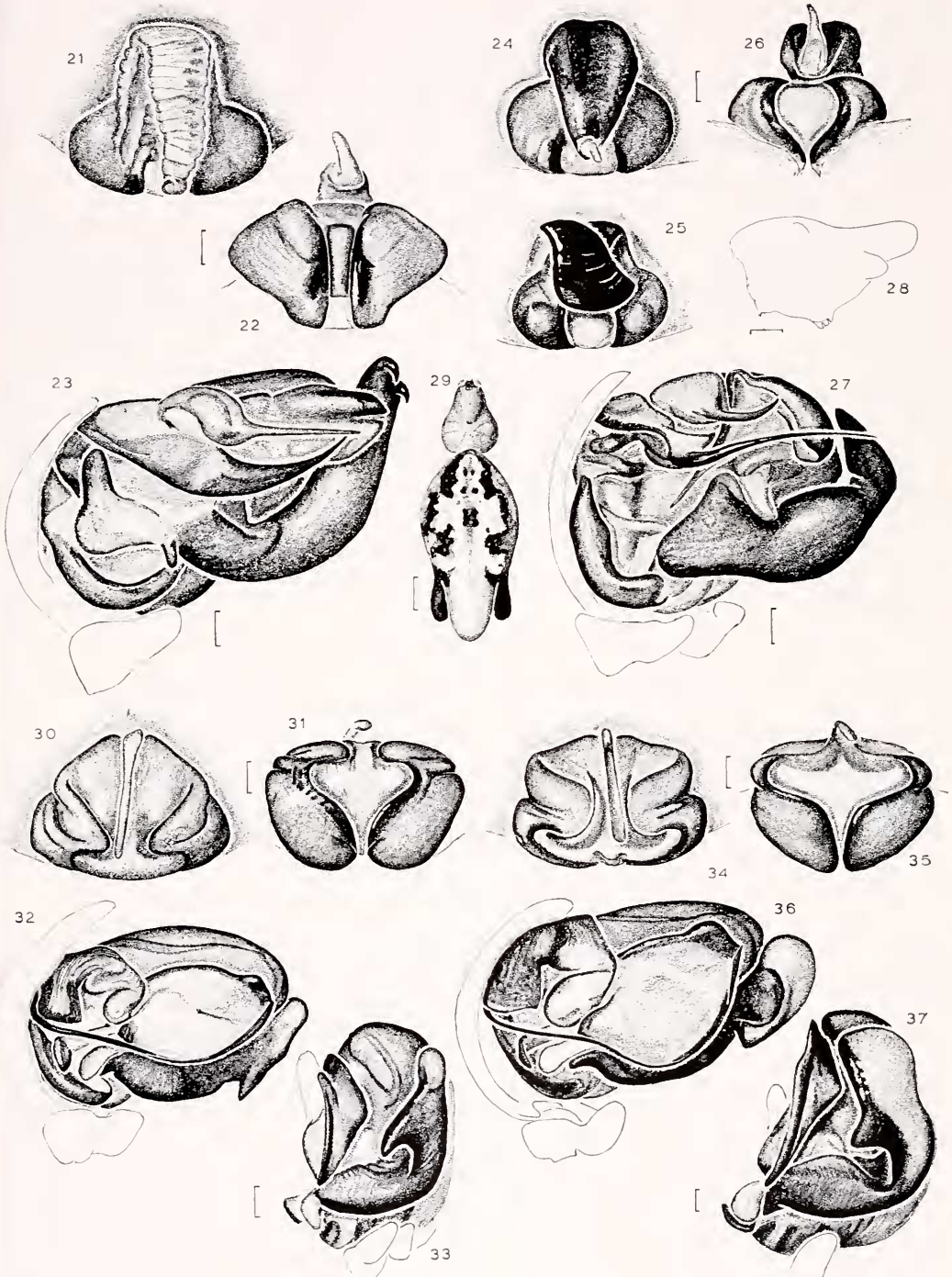
Figures 21–23. *C. oculata* (Walckenaer) (Central Europe): 21, 22. Epigynum. 21. Ventral. 22. Posterior. 23. Left male palpus, mesal view.

Figures 24–29. *C. insulana* (Costa): 24–26. Epigynum: 24, 25. Ventral. 26. Posterior. 27. Palpus, mesal view. 28. Female abdomen from side. 29. Female, legs removed. 24, 26, 28, 29. (Southern France). 25, 27. (New Guinea).

Figures 30–33. *C. sierrae* Simon (Central Italy): 30, 31. Epigynum: 30. Ventral. 31. Posterior. 32, 33. Palpus: 32. Mesal. 33. Ventral.

Figures 34–37. *C. algerica* Simon (Southern France): 34, 35. Epigynum: 34. Ventral. 35. Posterior. 36, 37. Palpus: 36. Mesal. 37. Ventral.

Scale lines, 0.1 mm, Figs. 28, 29, 1 mm.



tibia, 1.4; metatarsus, 0.8; tarsus, 0.5. Second patella and tibia, 1.2 mm; third, 0.8; fourth, 1.3.

Male from Louisiana: Total length 2.5 mm. Carapace 1.4 mm long, 1.1 wide. First femur, 1.2 mm; patella and tibia, 1.3; metatarsus, 0.7; tarsus, 0.4. Second patella and tibia, 1.1 mm; third, 0.7; fourth, 1.0.

Variation. Females vary in total length 3.3 to 5.2 mm, carapace 1.4 to 1.7 long, 0.9 to 1.3 wide. Males vary in total length 2.1 to 3.2 mm, carapace 1.3 to 1.6 long, 1.0 to 1.2 wide. Small and large individuals appeared in many collections, but Florida specimens are usually small. Some females from Central America have a much longer posterior tail.

Diagnosis. Female *C. turbinata* differ from *C. conica* by being smaller in size and having a pair of anterior dorsal humps (often indistinct) on the abdomen (Figs. 39, 48) and by the lightly sclerotized base of the epigynum (Fig. 41). In North America, females differ from other species by the abdomen shape and the details of the epigynum (Figs. 39, 41). The males differ from those of *C. conica* by lacking macrosetae on the fourth coxae, and by their smaller size (less than 3.3 mm total length); from *C. caroli* by usually having the abdomen only slightly overhanging the spinnerets (Fig. 38); and from the related *C. caroli* and *C. walekenacri* by having a median apophysis in the palpus with a terminal hook and a large median proximally directed tooth (Figs. 46, 47). There is no such tooth in *C. caroli*, and that of *C. walekenacri* is small and the median apophysis is relatively longer.

Natural History. The web with stabilimentum is illustrated in Plate 2. The cocoons are attached to the stabilimentum and are covered with insect remains. The lowest ones may have spiderlings while the upper one has only eggs (Kaston, 1948).

Specimens have been collected by sweeping lawns in West Virginia, by sweeping abandoned fields and in a garden in North

Carolina, in a blueberry patch near Lake Michigan, from oak dunes in Indiana, by beating underbrush in Arkansas, from a roadcut in Missouri, in salt marshes, coastal oak woods and by sweeping a meadow in California. Judging by these notes, *C. turbinata* prefers more open areas than *C. conica*, but according to Berry (1970) *Cyclosa turbinata* has no clear habitat preferences in North Carolina. H. K. Wallace's field notes report specimens from a slope near a stream, the web attached to a stump, from a stream bottom, from a slope near a stream in Giles County, Virginia and in an old field on a stream bank and in a sterile area with fetterbush (*Leucothoë*) in Florida. I have collected specimens in central Florida in dry grassy "prairie." Males are mature from July to August in New York, Pennsylvania and Virginia, from June to September in the Southeast, from March to August in Florida, to October in Texas, and from March to September in California. Females have been collected from May to September in northern part of the range, in all seasons except December to February in Florida.

Distribution. Connecticut, central New York, southern Michigan to Washington, south to Central America, West Indies, and also Bermuda, Cocos Island and Galapagos Islands (Map 2).

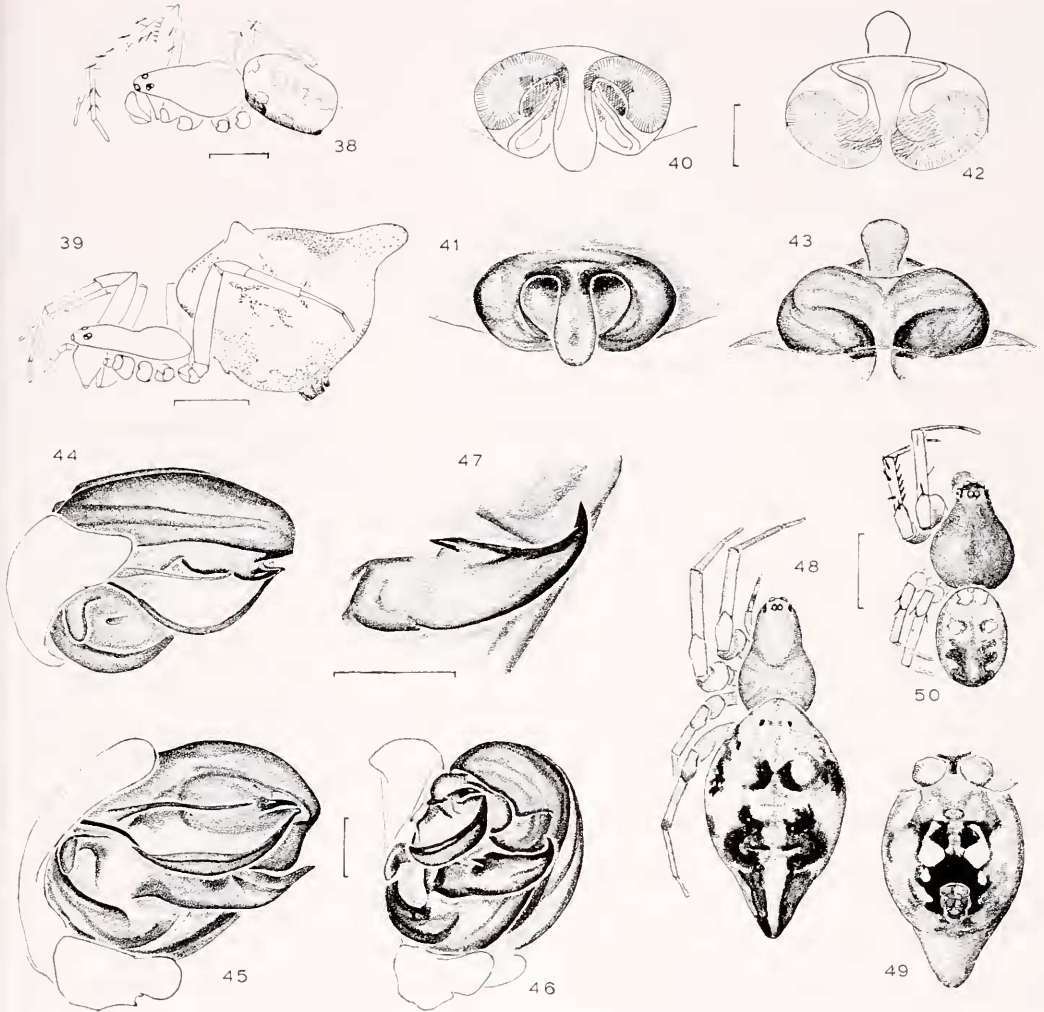
Cyclosa caroli (Hentz)

Plate 3, Figures 51–63, Map 2

Epeira caroli Hentz, 1850, J. Boston Soc. Natur. Hist., 6: 24, pl. 3, fig. 15, ♀. Female type from Alabama, destroyed. Keyserling, 1863, Sitzungsber. Naturges. Isis Dresden, p. 137, pl. 6, figs. 17–19, ♀.

Cyclosa lacerta O.P.—Cambridge, 1889, Biologia Centrali-Americana, Araneidea, 1: 50, pl. 7, fig. 14, ♂ (as *Epeira lacerta*). Male lectotype here designated from Guatemala or Panama in the British Museum, Natural History, examined. Keyserling, 1893, Spinnen Amerikas, 4: 275, pl. 14, fig. 204, ♂. F.P.—Cambridge, 1904, Biologia Centrali-Americana, Araneidae, 2: 494, pl. 47, fig. 3, ♂. NEW SYNONYMY.

Cyclosa caroli.—McCook, 1893, American Spiders, 3: 277, pl. 17, figs. 7, 8, ♀, ♂. Keyserling, 1893, Spinnen Amerikas, 4: 272, pl. 14, fig. 202, ♀.



Figures 38-50. *Cyclosa turbinata* (Walckenaer): 38. Male from side. 39. Female from side. 40-43. Epigynum: 40, 41. Ventral. 42, 43. Posterior. 40, 42. Cleared. 44-47. Male left palpus: 44. Apical. 45. Mesal. 46. Ventral. 47. Median apophysis, ventral. 48. Female, dorsal. 49. Female abdomen, ventral. 50. Male, dorsal.

Scale lines. 0.1 mm, except Figs. 38, 39, 48-50, 1.0 mm.

♂. F.P.—Cambridge, 1904, *Biologia Centrali-Americana, Araneida*, 2: 494, pl. 47, fig. 4, ♀. Comstock, 1940, *Spider Book*, rev. ed., p. 467. Roewer, 1942, *Katalog der Araneae*, 1: 761. Bonnet, 1956, *Bibliographia Araneorum*, 2: 1310. *Cyclosa conigera* F.P.—Cambridge, 1904, *Biologia Centrali-Americana*, 2: 494, pl. 47, fig. 5, ♀. Ten female syntypes from Omilteme, Mexico in the British Museum, Natural History, examined. NEW SYNONYMY. *Cyclosa clongata* Franganillo, 1930, *Mem. Inst.*

Nac. Invest. Cient., 1: 68. Type specimens from Sierra Maestra and Montañas de Trinidad in Cuban Academy of Sciences, lost.

Parazygia accentonotata di Caporiacco, 1955, *Acta biol. Venezuelica*, 1: 345, fig. 30, ♂. Male holotype from Rancho Grande, Aragua, Venezuela in the collections of Universidad Central, Caracas, Venezuela, examined. NEW SYNONYMY.

Measurements. Female from Florida: Total length 6.0 mm. Carapace 1.7 mm

long, 1.1 wide. First femur, 1.4 mm; patella and tibia, 1.7; metatarsus, 0.9; tarsus, 0.4. Second patella and tibia, 1.4 mm; third, 0.9; fourth, 1.4.

Male from Florida: Total length 2.7 mm. Carapace 1.4 mm long, 0.9 wide. First femur, 1.3 mm; patella and tibia, 1.2; metatarsus, 0.7; tarsus, 0.4. Second patella and tibia, 1.1 mm; third, 0.6; fourth, 1.1.

Variation. Females vary in total length from 3.7 to 6.8 mm, carapace 1.3 to 1.9 long, 0.8 to 1.2 wide. Males vary in total length from 3.0 to 3.4 mm, carapace 1.5 to 1.7 long, 1.1 to 1.2 wide. The largest individuals came from Mississippi and Panama, the smallest from Florida and Trinidad. The tail of the female and especially of the male varies in length.

Diagnosis. Females of *C. caroli* found north of Mexico can be separated from other species by the shape of the abdomen (Figs. 52, 61). The epigynal scape of *C. caroli* is almost always oval to round (Fig. 54) and is lightest in the center, unlike the scape of Central and South American species with a similar abdomen. Male individuals almost always have a small abdominal tail (Fig. 51), lacking in *C. turbinata* males. Males differ from related species also in the shape of the short palpal median apophysis, which has a distal hook and a convexly curved distal keel below the hook (Figs. 59, 60). The middle spine present in *C. turbinata* and *C. walckenaeri* median apophysis is absent.

Natural History. Field notes of H. K. Wallace report it from dense palmettos in palmetto, in live-oak-hammock and in a ravine, both in Alachua Co., Florida. I have collected specimens in Baygall woods and mixed cypress forest in central Florida. Comstock (1940) observed the species in a "jungle near Miami, Fla. The orb of the adult is six inches in diameter. The female fastens her egg-sacs in a series which extend across the web from the hub to the upper margin like a stabilimentum, and looks like a dead twig caught in the web. This band

of egg-sacs and the spider are of the same gray colour. When disturbed the spider rushes to the band and appears as if it were part of it. And here he will cling motionless even when the band is removed from the web. . . . I also observed smaller individuals shake their webs; these clung to the stabilimentum, projecting the body at right angles to it and in this position shook the web violently." (Plate 3.)

Ruth Buskirk, in a note with the collections, says she found the "species very common in woods and woods edge in Costa Rica. The orb has 25 radii, 22 spiral turns . . . a radius of 8–12 cm, always vertical orientation, debris and insect [remains] wrapped with silk into long straight lines, . . . ♀'s often with egg cases in upper line."

Adult males have been collected in February, July, September and December in Florida, in June and July in Central America. Females are mature in all seasons.

Distribution. Georgia, Florida, Gulf states, Mexico, Central America, West Indies, to southern Colombia, Venezuela and Guyana (Map 2).

Cyclosa walckenaeri (O.P.—Cambridge)

Plate 4, Figures 64–77, Map 2

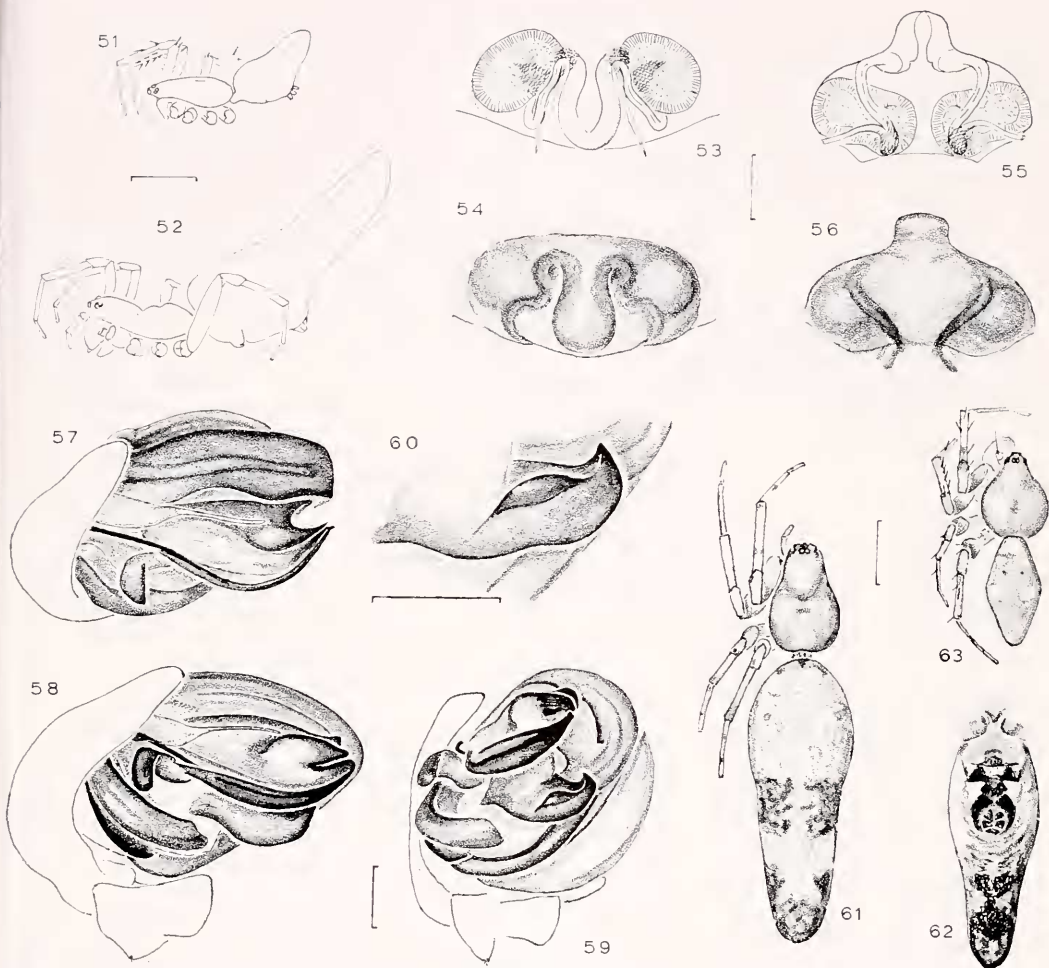
Epeira bifurcata,—Keyserling, 1863, Sitzungsber. Naturf. Gesell. Isis, Dresden, p. 142, pl. 6, figs. 22–23, ♀. Specimens from Bogota, Colombia. Not *Epeira bifurcata* Walckenaer, 1841.

Turckheimia walckenaerii O.P.—Cambridge, 1889, Biologia Centrali-Americana, Araneidea, 1: 47, pl. 8, fig. 6, ♀. Three female syntypes from Volcan de Fuego, Guatemala in the British Museum, Natural History, examined.

Epeira walckenaerii Keyserling, 1892, Spinnen Amerikas, 4: 98, pl. 5, fig. 73, ♀, ♂. Types from Bogota, Colombia, Guatemala, Taquara do Mundo novo and Rio Grande do Sul, Brazil in the British Museum, Natural History.

Cyclosa walckenaeri,—McCook, 1893, American Spiders, 3: 226, pl. 17, fig. 1, ♀, ♂. F.P.—Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 495, pl. 47, fig. 9, ♀. Petrunkevitch, 1930, Trans. Connecticut Acad. Sci., 30: 315, figs. 188, 189, ♀.

Cyclosa trifida F.P.—Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 495, pl. 47, fig. 7, ♀. Three female syntypes, slightly dam-



Figures 51-63. *Cyclosa caroli* (Hentz): 51. Male from side. 52. Female from side. 53-56. Epigynum: 53, 54. Ventral. 55, 56. Posterior. 53, 55. Cleared. 57-60. Male left palpus: 57. Apical. 58. Mesal. 59. Ventral. 60. Median apophysis. 61. Female, dorsal. 62. Female abdomen, ventral. 63. Male, dorsal.

Scale lines. 0.1 mm except Figs. 51, 52, 61-63, 1.0 mm.

aged from Cohabon, Guatemala, in the British Museum, Natural History, examined. NEW SYNONYMY.

? *Cyclosa cuadrifuberosa* Franganillo, 1936. Arácnidos de Cuba, p. 84. Juvenile holotype from Cuba in the Cuban Academy of Science, in poor condition, examined. It appears to lack lateral posterior tubercles.

Note. Specimens of this species and several similar South American species in both the American Museum and the Museum of Comparative Zoology had been la-

beled *Cyclosa oculata*. *Cyclosa oculata* (Walckenaer) (Figs. 21-23) is a European species not found in the Americas. The type specimens of the name came from Paris. This error dates from Simon (1900), who listed *C. oculata* as occurring in Hawaii, the United States, Antilles and Venezuela and indicated that *Epeira walckenaeri* Keyserling is probably a synonym. Simon did not examine genitalia carefully and the shape of the abdomen of the two species

is similar. E. B. Bryant (1940), skeptical of the synonymy, borrowed specimens of *C. oculata* from Paris and got specimens determined by Simon which were the same species as *C. walckenaeri*. Not surprisingly, they came from America: Hispaniola.

The three syntypes of *C. trifida* have the characteristic epigynum but the abdomen is flattened, apparently damaged when collected. They have the four posterior tubercles, but not the two anterior ones.

Measurements. Female from Texas: Total length 6.3 mm. Carapace 2.2 mm long, 1.5 wide. First femur, 2.0 mm; patella and tibia, 2.2; metatarsus, 1.1; tarsus, 0.6. Second patella and tibia, 1.9 mm; third, 1.0; fourth, 1.7.

Male from Texas: Total length 3.8 mm. Carapace 1.7 mm long, 1.4 wide. First femur, 1.7 mm; patella and tibia, 1.7; metatarsus, 1.0; tarsus, 0.6. Second patella and tibia, 1.2 mm; third, 0.7; fourth, 1.4.

Variation. Total length of females 3.8 to 6.8 mm, carapace 1.3 to 2.0 long, 1.0 to 1.2 wide. Total length of males 2.1 to 3.8 mm, carapace 1.1 to 1.7 long, 0.8 to 1.3 wide. The smallest females came from Florida, the largest individuals from Guatemala. Some specimens have the abdomen longer. Rarely, the sides of the scape of the epigynum are curved out and the scape slightly oval. One female from Oriente Province, Cuba had an epigynum like that of *C. walckenaeri*, but the abdomen was like that of *C. caroli*, with only faint indications of humps.

Diagnosis. The four humps on the posterior tip of the abdomen and two dorsal humps anterior of the middle separate the species from other *Cyclosa* in North America. Unlike *C. caroli* and *C. turbinata* the sides of the epigynum scape are usually parallel, making it a narrow rod (Fig. 67). Males can usually be readily separated by the indications of the four posterior abdomen humps (Figs. 64, 76). The median apophysis of the palpus is very long, but unlike that of *C. turbinata*, the middle spine is minute and the distal hook continues into

a keel proximally (Figs. 72, 73). That of *C. caroli* lacks the middle tooth entirely and is short.

Natural History. Specimens of *C. walckenaeri* have been found on large aloe and in open shrubs at edge of woods in Jamaica, in dry shrubs in the Virgin Islands, in a garden in Cuba, on shrubby edge of woods along coast of Florida Keys, on mangroves in Baja California and in a pine-oak forest in Chiapas. The eggs are hung in the web. Webs of juveniles observed in Florida had a narrow stabilimentum of debris (Plate 4) and the only one containing egg-sacs had been destroyed and left unfinished.

Males have been collected in May, August, September and October in the southern states and northern Mexico and females in all seasons.

Distribution. Southern Florida, southern Texas, central California coast to Panama and West Indies (Map 2).

Cyclosa bifurca (McCook)

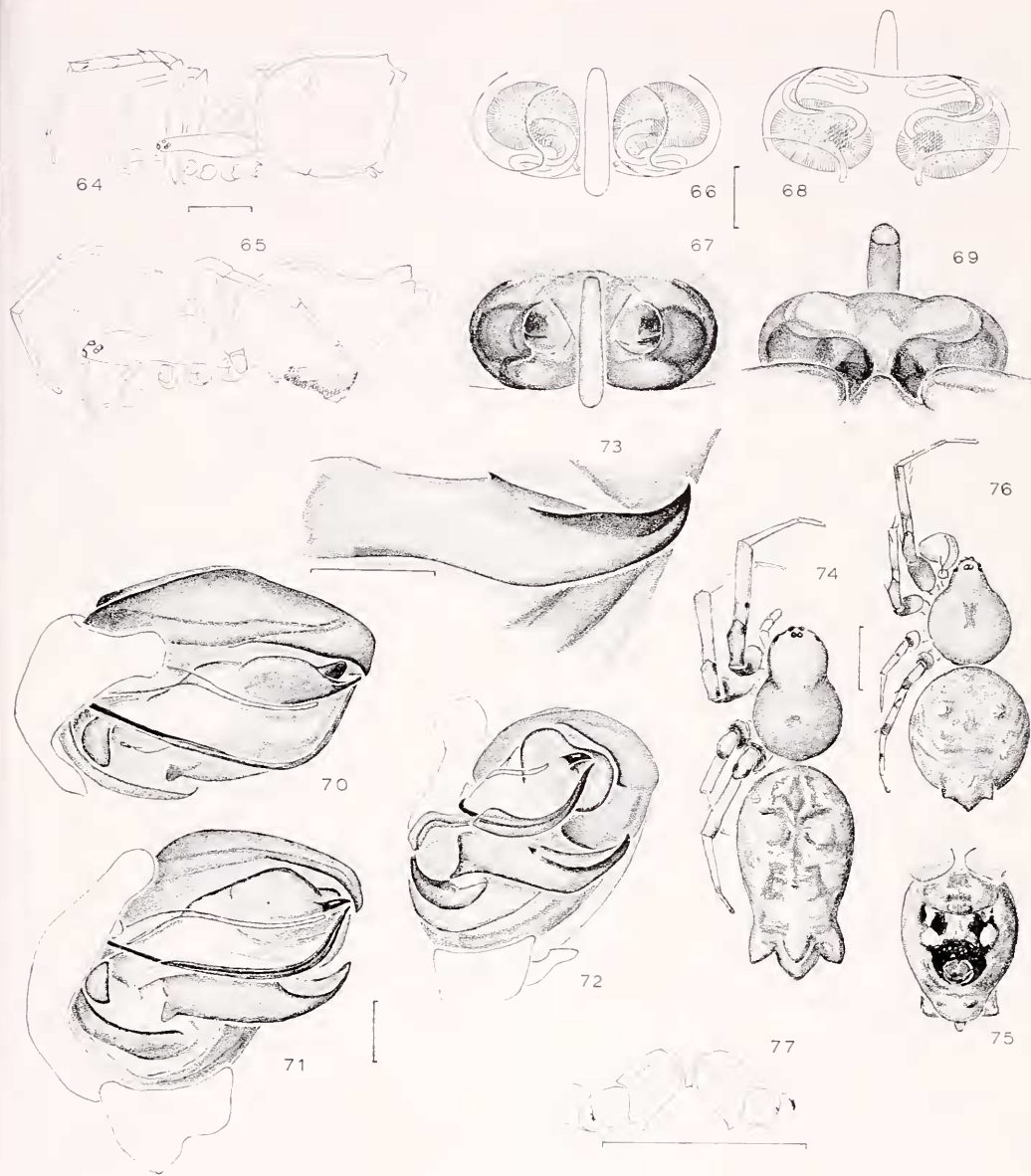
Plate 5, Figures 78-89, Map 2

Cyrtophora bifurca McCook, 1887, Proc. Acad. Natur. Sci. Philadelphia, 3: 342. Female, male syntypes from Fairyland, Merritt's Island on the Indian River, Florida in the Philadelphia Academy of Sciences, lost.

Cyclosa fissicauda O.P.—Cambridge, 1889, Biologia Centrali-Americana, Araneidea, 1: 49, pl. 8, fig. 7, ♀. Fifteen syntypes in two vials, from near Dolores, Guatemala in the British Museum, Natural History, examined. Keyserling, 1893, Spinnen Amerikas, 4: 274, pl. 14, fig. 203, ♀.

Cyclosa bifurca.—McCook, 1893, American Spiders, 3: 227, pl. 17, figs. 9, 10, ♀, ♂. F.P.—Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 495, pl. 47, fig. 8. Comstock, 1940, Spider Book, p. 467, figs. 465, 466, ♀, egg-sacs. Roewer, 1942, Katalog der Araneae, 1: 759. Bonnet, 1956, Bibliographia Araneorum, 2(2): 1309.

Description. Female from Florida: In alcohol, carapace yellow-white, sternum brown with a central longitudinal white band and white patches near base of anterior three coxae. Legs yellow-white with some indistinct dark bands distally. Dorsum of abdomen white with indistinct



Figures 64-77. *Cyclosa walckenaeri* (O.P.—Cambridge): 64. Male from side. 65. Female from side. 66-69. Epigynum: 66, 67. Ventral. 68, 69. Posterior. 66, 68. Cleared. 70-73. Male left palpus: 70. Apical. 71. Mesal. 72. Ventral. 73. Median apophysis. 74. Female, dorsal. 75. Female abdomen, ventral. 76. Male, dorsal. 77. Male coxae.

Scale lines. 0.1 mm except Figs. 64, 65, 74-77, 1.0 mm.

marks, sides with indistinct gray marks. Venter with a white square whose sides are lateral to the spinnerets. The legs are thick (Fig. 88). Total length 6.5 mm. Carapace 2.2 mm long, 1.7 wide. First femur, 2.5 mm; patella and tibia, 2.7; metatarsus, 1.6; tarsus, 0.8. Second patella and tibia, 2.2 mm; third, 1.2; fourth, 2.1.

Male from Florida: Carapace and abdomen yellowish white with a median black longitudinal line on carapace, some indistinct black pigment spots on the abdomen. Posterior median eyes 0.6 diameter of anterior medians. Anterior laterals 0.5, posterior laterals 0.6 diameters. Anterior median eyes their diameter apart, 0.7 from laterals. Posterior median eyes their diameter apart, 1.5 from laterals. Neither coxae nor legs modified. The abdomen is like that of female, but the humps are barely visible. Total length 1.8 mm. Carapace 0.9 mm long, 0.7 wide. First femur, 1.0 mm; patella and tibia, 1.1; metatarsus, 0.9; tarsus, 0.4. Second patella and tibia, 0.8 mm; third, 0.4; fourth, 0.6. Another male measured 1.7 mm total length.

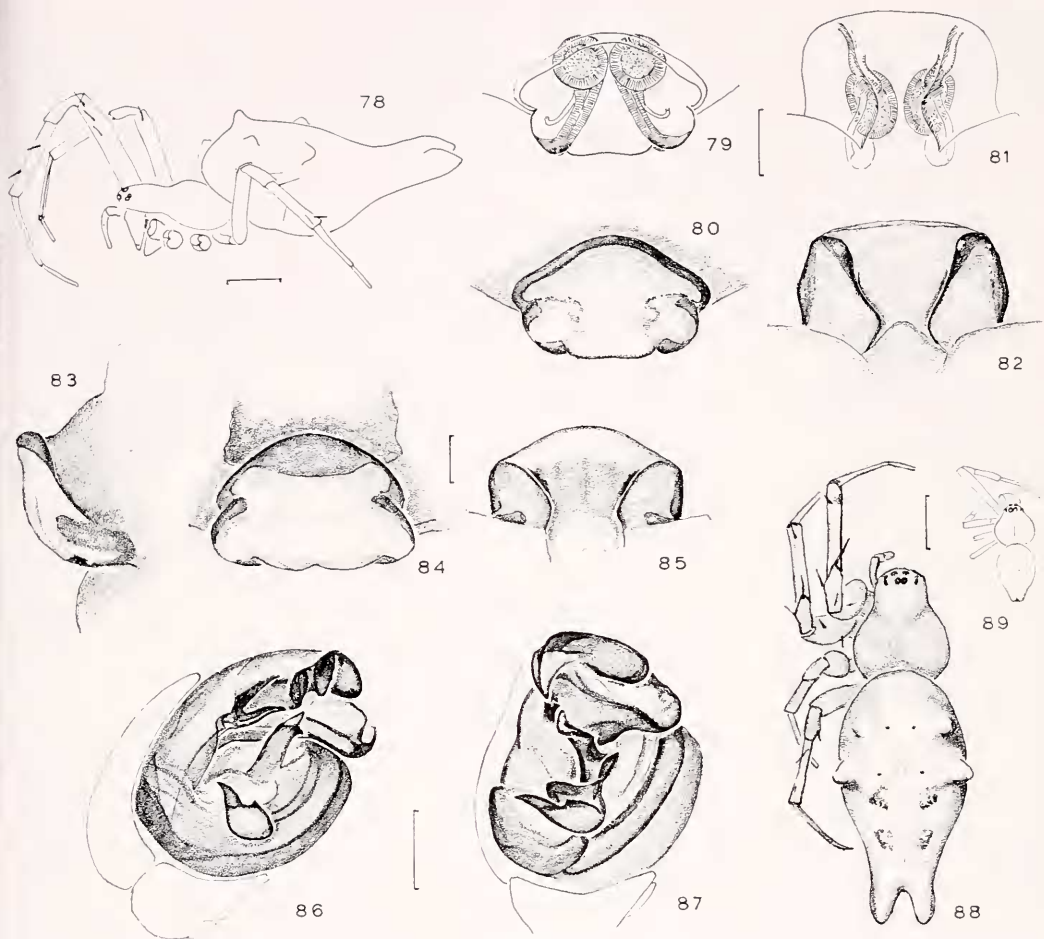
Note. The live spider and the egg-sacs are green, the venter of the abdomen having a bright red patch between epigynum and spinnerets (Comstock, 1940). The color washes out in alcohol. The egg-sac is an irregular octagon, and as many as 10–14 egg-sacs may be strung together (McCook, 1887). The male is minute. Only one male was found in a collection of 207 specimens. About another 130 specimens yielded only one more male.

Variation. Total length of females 5.1 to 9.0 mm long, carapace 2.0 to 2.9 mm long, 1.5 to 2.3 mm wide. Some individuals have more black pigment than others and have the legs ringed.

Diagnosis. North of Mexico no other American species of *Cyclosa* has a forked tail (Figs. 78, 88). *Cyclosa furcata* O.P.—Cambridge is similar in appearance but the epigynum has a scape and the base differs in shape.

Natural History. J. Boursot collecting in El Salvador reported on notes in the vial:

“with contracted legs these spiders crouch at one end of the stabilimentum composed of rejected chewed food which they match identically. Discovered only on tarred surface of huge water tank.” C. B. Worth (1940) reported on the shape and coloration of the animals whose vertical webs, six inches in diameter, he saw on the walls of a Florida house, parallel to the walls: “The egg-sacs are arranged in a row, occupying the position of the hands of a clock at exactly noon. The spider herself reposes at the center of the web, that is immediately below and touching the lowermost egg-sacs. She invariably faces the ground, so that her abdomen appears as an additional egg-sac in the row above her. . . .” The “mass of objects in the web is that of a catkin. . . . This appearance is heightened by the spider’s disposition of captured food. Such prey is wrapped in silk and anchored below the spider, forming an uneven row of objects as a direct short continuation of the line of egg-sacs. The average length of the ‘catkins,’ i.e. egg-sacs, spider food-sacs . . . is from two-and-a-half to three inches, which means that they occupy about half the diameter of the web. The usual number of egg-sacs ranges from five to nine with eight on an average. But the most remarkable feature of all is the resemblance of the egg-sac to the abdomen of the female. The latter is light green with dark green central and lateral stripes and in these details the egg-sacs agree precisely with their maternal source. The spider’s abdomen moreover bears a series of tubercles and projections, which again are reproduced faithfully in the egg-sacs even including the terminal bifurcation. The egg-sacs are finally deposited in the web in a shingled or overlapping series, and the spider takes a position at the center of the web so that her abdomen overlaps the lowermost egg-sac in an exact continuation of the series above her. . . . The spider’s light green color and smooth integument give it a translucent appearance when seen close at hand. Even this quality of



Figures 78-89. *Cyclosa biturca* (McCook): 78. Female from side. 79-85. Epigynum: 79, 80, 84. Ventral. 81, 82, 85. Posterior. 83. Lateral. 79, 81. Cleared. 79-83. (Florida). 84, 85. (Texas). 86, 87. Male left palpus: 86. Mesal. 87. Ventral. 88. Female, dorsal. 89. Male, dorsal.

Scale lines. 0.1 mm except Figs. 78, 88, 89, 1.0 mm.

translucence is duplicated in the smooth-woven texture of the egg-sacs." (Plate 5.)

The spider has been collected on a torn-down building in a wooded area of Australian pines (*Casuarina* sp.) and cabbage palms (*Sabal palmetto*) and on a saw palmetto leaf (*Serenoa* sp.) in Florida, from the nest of a wood rat (*Neotoma* sp.), and from a wasp nest. One record is from an arid, subtropical area in San Luis Potosí. Comstock (1940) found it in a "jungle near the shore" and also on the "ceiling of a

veranda by the hundred." Mature females have been collected in every month in Florida and Texas.

Distribution. Florida, southern Alabama, southern Texas, Mexico to El Salvador, Cuba and Hispaniola (Map 2).

Metazygia F.P.—Cambridge

Metazygia F.P.—Cambridge, 1903, *Biologia Centrali-Americana, Araneida*, 2: 501. Type species by original designation *M. wittfeldae* (McCook). The name is feminine.

Diagnosis. The abdomen is spherical (Fig. 108) to round and dorsoventrally flattened (Figs. 98, 109) as in *Nuctenea* and *Zygiella*, but differs from those two genera by having no pigment ventrally between genital groove and spinnerets (Figs. 99, 117). The carapace differs from that of *Nuctenea* by lacking fine setae (Figs. 96, 108), and the epigynum differs by lacking a scape. In place of the scape is a laterally flattened knob (Figs. 90–92), which can expand and project anteriorly in *M. zilloides* (Figs. 104–106) so as to resemble the epigynum of *Eustala* species. There is no such knob in *M. carolinensis* (Fig. 112).

Males differ from *Nuctenea* in having only one macroseta on the palpal patella, as in *Zygiella*, and differ from *Zygiella* in the very different structure of the palpus. *Metazygia*, unlike *Zygiella*, has a hook-shaped paracymbium (p in Fig. 103), a transparent subterminal apophysis (sa), and a knob-shaped median apophysis (m), ventrally attached (Figs. 101–103). *Metazygia* resembles *Zygiella* in having the tegulum (t) of the palpus modified; however, the modification is apical (Figs. 102, 111). The palpus is similar to that of *Eustala* but the median apophysis (m) is always knob-shaped (Figs. 101–103, 110, 111), not cone-shaped as in *Eustala*.

Description. Carapace smooth with few hairs, often darker anteriorly than posteriorly (Fig. 96), or with a median longitudinal pigment line (Fig. 108), with little or no thoracic depression.

Eye sizes subequal (*M. carolinensis*) or anterior median eyes slightly larger than others (*M. wittfeldae*, *M. zilloides*). Laterals some distance from medians (Fig. 97) except in the small *M. zilloides* in which the eyes of the anterior row are equally spaced. Height of clypeus slightly less than diameter of anterior median eyes (Fig. 97). Chelicerae very strong, bulging proximally (Fig. 97), narrower distally, especially in *M. carolinensis*. Legs thick and strong (Figs.

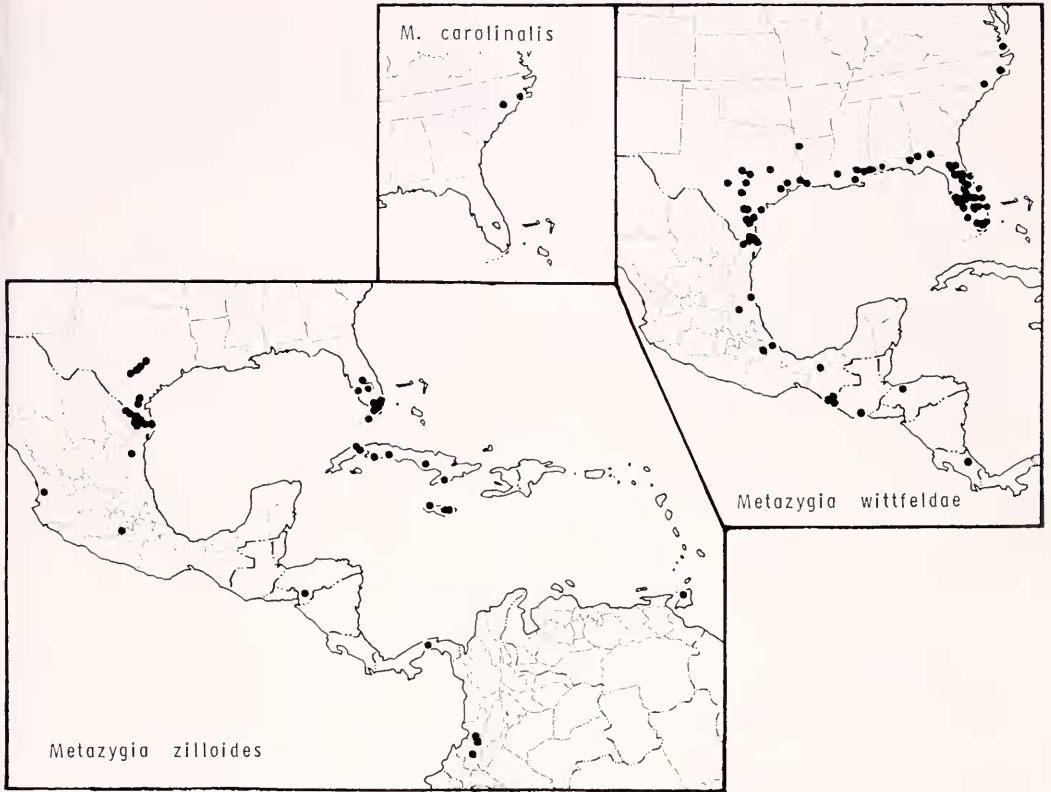
96, 108), not banded, with many macrosetae and setae. First leg longest, legs 1,2,4,3. Abdomen oval to round, more or less dorsoventrally flattened (Figs. 96, 98, 108, 109, 116). In *M. carolinensis* the abdomen has dorsal sclerotized discs (Fig. 116). No black pigment on venter (Figs. 99, 117).

Males slightly smaller (Fig. 100) than females, with similar coloration and eyes. The chelicerae and fangs of some tropical species are modified, perhaps for copulation. Legs differ from those of females by being slightly longer and having more macrosetae (Fig. 100), especially on the second tibia. The distal margin of first coxa has a hook that fits into a groove on the second femur.

Genitalia. The base of the epigynum has a ventral, laterally compressed knob in place of the scape (Figs. 90–92, 104–106); the knob is absent in *M. carolinensis*; in *M. zilloides* it projects anteriorly if expanded, resembling that of *Eustala*.

The male palpus, similar to that of *Eustala*, differs in several ways. The terminal apophysis is a prong (a in Figs. 103, 110, 111), the subterminal apophysis often a transparent bubble (sa in Figs. 101–103, 110). The embolus (e), hidden in the temperate species, may have a piece that breaks off during mating and (in *M. zilloides*) remains in the epigynum. (But this is not certain, as the two common species north of Mexico have the embolus hidden behind the conductor and subterminal apophysis.) The conductor is a complex sclerite and the median apophysis (m) a simple knob (Figs. 102, 103, 110, 111), not a cone hanging down as in *Eustala*. The *Metazygia* palpus has a large sclerite mesally which may be the stipes (Figs. 101, 103, with texture in 110); it differs in shape in related tropical species.

Natural History. Unlike the related *Eustala*, *Metazygia* makes a retreat near the orb web. *Metazygia wittfeldae* is often found on bridges and buildings; *Metazygia witt-*



Map 3. Distribution of *Metazygia carolinialis* (Archer), *M. wittfeldae* (McCook) and *M. zilloides* (Banks).

feldae becomes active after dark, tearing down remnants of the old web and making new radii, scaffolding and viscid threads. The old web is usually left until a new one is built, which may not be every night. Threads coated with cornstarch (dusted by photographers the previous night) are hauled in, two sections at a time, balled up, and thrown horizontally away from the web, with some force, at the rate of a ball every minute or two. Silk not dusted is probably eaten. During the day the spider remains in a crevice; at night it hangs in the center of the web. The light from a flashlight may cause the spider to move away. The webs observed at the Archbold Biological Station, Lake Placid, Florida were loose with few frame threads and 10 to 18

radii. The number of viscid threads in several webs was 18, 16, 22, 25, 15 below the hub and 11, 3, 3, 17, 10 above the hub. The webs had solid hubs (Plate 6) and horizontal diameters ranging from 10 to 27 cm. Webs, as many as five next to each other in a suitable corner, were vertical between railings of a ramp 35 cm above the ground; at 2.7 m above the level of the ramp, under the ceiling, the webs were almost horizontal. The spiders avoided the area near a light fixture, but used areas some distance away, where they harvested insects attracted to the light.

Species. There are three species north of Mexico; most other species are tropical American (Map 3); none is known outside of America.

KEY TO FEMALE *METAZYGIA*

1. Epigynum without ventral median knob (Fig. 112); dorsum of abdomen with 4 pairs of sclerotized discs (Fig. 116); North Carolina *carolinialis*
- Epigynum with a ventral median, laterally compressed knob (Figs. 90-92, 104-106); abdomen without sclerotized discs; Virginia south to Texas 2
- 2(1) Median knob very narrow, areas to side and anterior to it soft and expandable (Fig. 104); openings of epigynum on ventral face on each side (Fig. 104); dorsum of abdomen with a pair of anterior black marks (Fig. 108) *zilloides*
- Median knob wide; areas to side and anterior to it not expandable (Fig. 90); openings of epigynum posterolateral of base (Figs. 91, 92); dorsum of abdomen with a series of dark brackets, farthest apart anteriorly, and a median dark line (Fig. 96) *wittfeldae*

KEY TO MALE *METAZYGIA*(M. *CAROLINALIS* MALE UNKNOWN)

1. Terminal apophysis prong of palpus pointed (Figs. 101-103) *wittfeldae*
- Terminal apophysis prong of palpus with blunt tip, wider at tip than proximally (Figs. 110, 111) *zilloides*

Metazygia wittfeldae (McCook)

Plate 6, Figures 90-103, Map 3

Epeira wittfeldae McCook, 1893, American Spiders, 3: 168, pl. 7, figs. 6, 7. Three female, two male and one male juvenile syntypes from Florida in the Academy of Natural Sciences, Philadelphia, examined.

Metazygia wittfeldae,—F.P.—Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 501, pl. 47, figs. 22, 23, ♀, ♂. Roewer, 1942, Katalog der Araneae, 1: 868. Bonnet, 1957, Bibliographia Araneorum, 2(3): 2820.

Description. Female from Florida: Carapace with head region much darker brown than thorax (Fig. 96). Sternum, legs orange. Dorsum of abdomen light brown with pairs of dark marks approaching each other posteriorly (Fig. 96). Total length 8.0 mm. Carapace 4.2 mm long, 3.0 wide. First femur, 3.6 mm; patella and tibia, 4.0; metatarsus, 2.7; tarsus, 1.2. Second patella and tibia, 3.7 mm; third, 2.3; fourth, 2.9.

Male: Total length 5.8 mm. Carapace

3.5 mm long, 2.4 wide. First femur, 3.6 mm; patella and tibia, 4.4; metatarsus, 3.4; tarsus, 1.4. Second patella and tibia, 4.0 mm; third, 2.2; fourth, 2.7.

Variation. Females varied in total length from 6.0 to 10.2 mm; carapace 2.9 to 4.2 long, 2.5 to 3.4 wide. Males varied, total length 5.0 to 7.0 mm; carapace 3.0 to 4.0 long, 2.2 to 3.1 wide.

Diagnosis. Females of *M. wittfeldae* differ from a similar West Indian species and from *M. dubia* (Keyserling) in Central and South America by the epigynum, which, in posterior view, has overhanging lateral bulges of the median area (Figs. 91, 92). Males differ by having the embolus hidden by the large subterminal apophysis (Figs. 101-103), a tooth at the base of the conductor (c in Figs. 102, 103) and a pocket at the distal edge of the tegulum (t in Figs. 102-103).

Natural History. This species is commonly found under the eaves of buildings from Virginia to Florida, and also on houses, and on and under bridges. In Florida, it has been found in cypress swamp, in tall grass, in citrus tree foliage, in vegetation bordering a canal, on canal banks with heavy cut grass and ragweed, and on slash pine (*Pinus elliottii*). Many specimens came from wasp nests. The web (Plate 6) is described above in the introduction to the genus *Metazygia*.

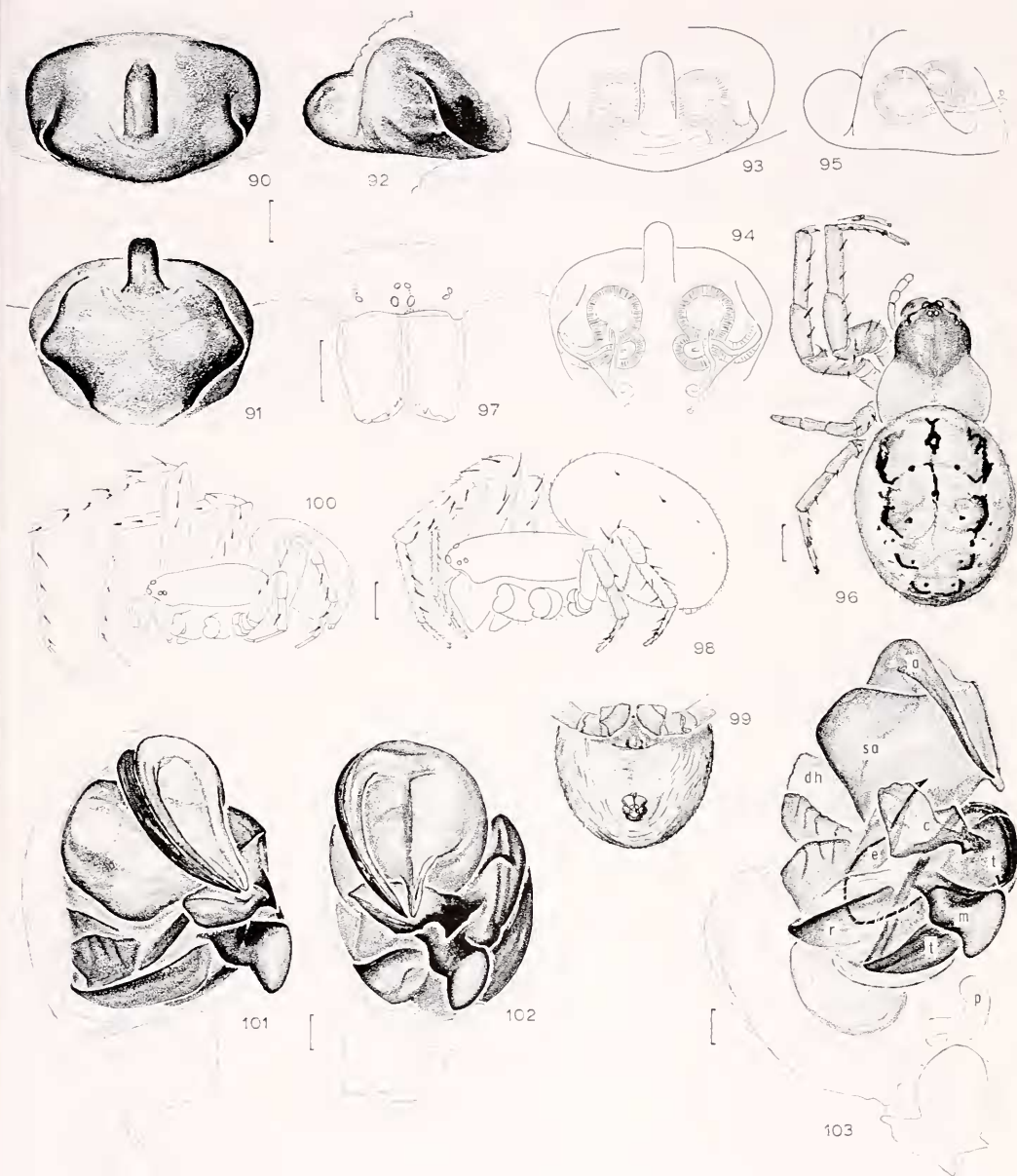
Distribution. From Norfolk, Virginia (numerous collections from buildings around Stumpy Lake) to Florida, Gulf states to Texas to Central America (Map 3).

Metazygia zilloides (Banks), new combination

Figures 104-111, Map 3

Epeira zilloides Banks, 1898, Proc. California Acad. Sci., 3 ser., 1: 255, plate 15, fig. 2, ♀, ♂. Three female, one male, one juvenile syntypes from Tepic, Mexico in the Museum of Comparative Zoology, examined.

Aranea dilatata F.P.—Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 513, pl. 49, fig. 9, ♂. Male lectotype here designated from [no locality] Guatemala in the British Museum, Natural History, examined. There are three



Figures 90-103. *Metazygia wittfeldae* (McCook): 90-94. Epigynum: 93-95. Cleared. 90, 93. Ventral. 91, 94. Posterior. 92, 95. Lateral. 96. Female, dorsal. 97. Female, eye region and chelicerae. 98. Female from side. 99. Female abdomen, ventral. 100. Male from side. 101-103. Left male palpus: 101. Mesal. 102. Ventral. 103. Mesoventral, expanded.

Abbreviations. a, terminal apophysis; c, conductor; dh, distal hematodocha; e, embolus; m, median apophysis; p, paracymbium; r, radix; sa, subterminal apophysis; t, tegulum.

Scale lines. 0.1 mm, except Figs. 96-100, 1.0 mm.

paralectotypes, of which one is *Metazygia incerta*. NEW SYNONYMY.

Metazygia keyserlingi Banks, 1929, Bull. Mus. Comp. Zool., 69: 94, fig. 63. Female holotype from Barro Colorado Island, Canal Zone, in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

Metazygia albonigra.—Bryant, 1940. Bull. Mus. Comp. Zool., 86: 339, figs. 107–109, 111, ♀. ♂, erroneous determination, not *Larinia albonigra* Franganillo.

Araneus pallidulus.—Kraus, 1955, Abhandl. Senckenbergischen Naturf. Gesell., 493: 24, fig. 66, ♀. Erroneous determination.

Note. American Museum specimens had been labeled *Metazygia incerta*, Museum of Comparative Zoology West Indian specimens as *Metazygia albonigra* (Franganillo) and Florida and Texas specimens as *Epeira pallidula* (Keyserling) by Bryant, and as *M. keyserlingi* by Chickering. The name *Metazygia incerta* belongs to a different species. The name *Larinia albonigra* is a synonym of *L. directa* and the specimens were incorrectly determined by Bryant. *M. keyserlingi* is a synonym of *M. zilloides*.

Description. Female from Florida: Carapace light yellowish brown with a narrow, median, longitudinal dark band on carapace. Sternum, legs, light brownish. Dorsum of abdomen white with anterior pair of dark patches and four pairs of dark spots (Fig. 108). Total length 6.1 mm. Carapace 2.3 mm long, 1.8 wide. First femur, 2.2 mm; patella and tibia, 2.7; metatarsus, 1.8; tarsus, 0.8. Second patella and tibia, 2.2 mm; third, 1.3; fourth, 2.0.

Male from Florida: Total length 4.0 mm. Carapace 2.2 mm long, 1.7 wide. First femur, 2.7 mm; patella and tibia, 3.5; metatarsus, 2.7; tarsus, 1.0. Second patella and tibia, 2.8 mm; third, 1.4; fourth, 2.0.

Variation. Some specimens have the posterior of the abdomen dark and there are white rings around the black spots. Total length of females 3.6 to 7.4 mm, carapace 1.8 to 3.2 long, 1.4 to 2.4 wide. Total length of males 3.4 to 4.8 mm, carapace 1.7 to 2.6 long, 1.3 to 2.0 wide. Males from Cuba

have the distal edge of the tegulum smooth, with no teeth.

Diagnosis. Most specimens have the anterior black patches on the abdomen and a series of dark spots (Fig. 108). Females differ from both *M. wittfeldae* and *M. incerta* (O.P.—Cambridge) by having anteroventrally directed openings on each side of the epigynal base (Fig. 104). Males differ from *M. wittfeldae* by the blunt terminal apophysis (Figs. 110, 111), and from *M. wittfeldae* and *M. incerta* by the shape of the (textured) stipes (Fig. 110), the shape of the conductor (under terminal apophysis, Fig. 111), and the toothed edge on the distal surface of the tegulum (Fig. 111).

Natural History. The species has been collected by sweeping flowers in Texas, in Florida in palmetto-poisonwood flats, among roadside weeds along a canal, in shrubs and vegetation, and on *Casuarina* (Australian pine). Males have been collected in Florida in June.

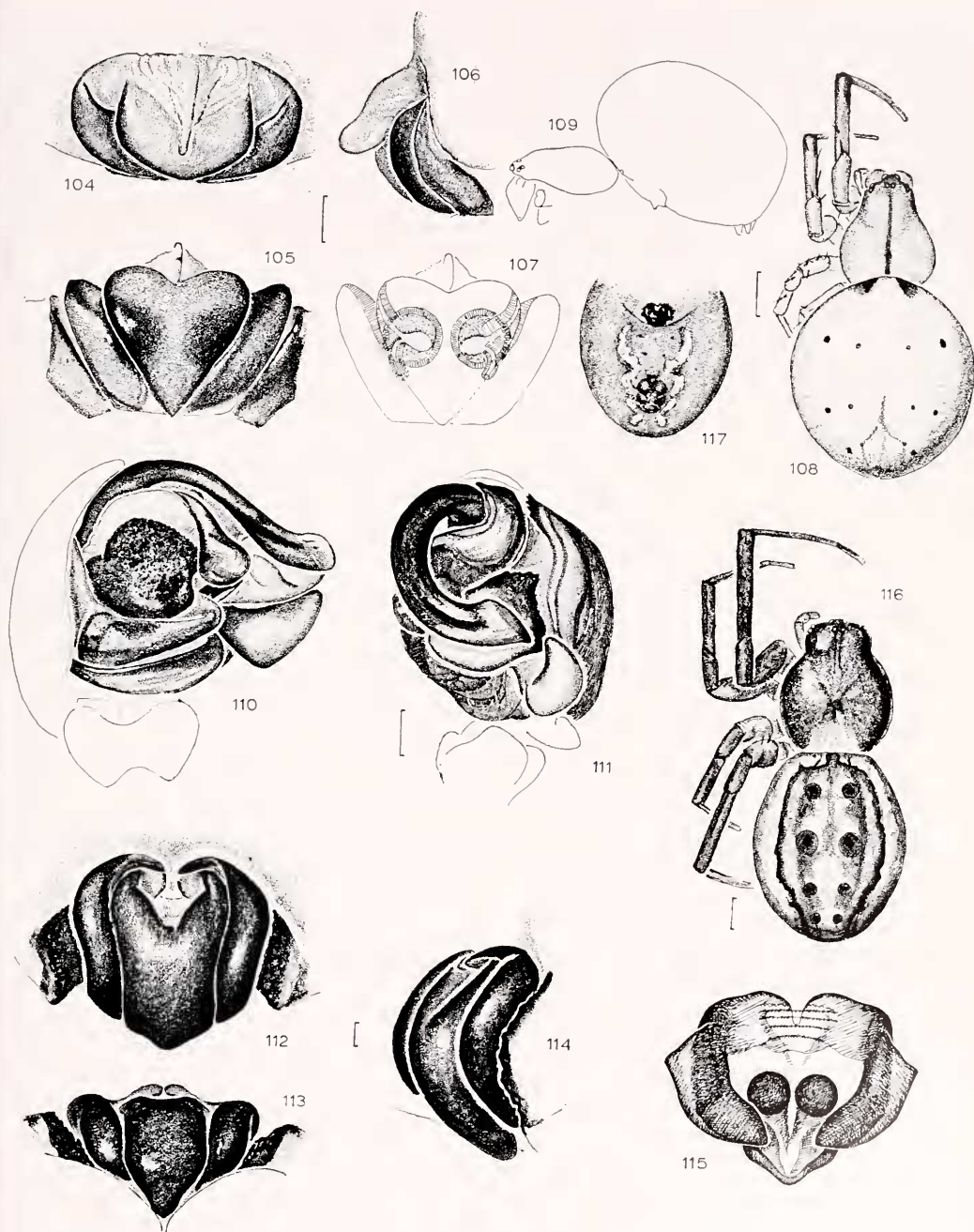
Distribution. Southern Florida, central and southern Texas to Colombia; Cuba, Jamaica and Trinidad (Map 3).

Metazygia carolinialis (Archer), new combination

Figures 112–117, Map 3

Epeira carolinialis Archer, 1951, Amer. Mus. Novitates, no. 1487: 40, fig. 57, ♀. Female holotype from White Lake, Bladen County, North Carolina, in the American Museum of Natural History, examined.

Description. Female: Carapace dark brown on sides, brown above. Legs brown. Sternum light brown. Dorsum of abdomen with sclerotized discs brown, white pigment spots, and two dark lines, one on each side, approaching each other anteriorly and posteriorly (Fig. 116). Venter with a pair of indistinct white brackets, no black pigment (Fig. 117). The carapace is flat and very low (Fig. 116). Abdomen oval, dorsoventrally flattened (Fig. 116). Total length 11.0 mm. Carapace 4.5 mm long, 3.7 wide. First femur, 3.7 mm; patella and tibia, 5.5;



Figures 104-111. *Metazygia zilloides* (Banks): 104-107. Epigynum: 104. Ventral. 105. Posterior. 106. Lateral. 107. Posterior, cleared. 108. Female, dorsal. 109. Female, lateral. 110, 111. Left male palpus: 110. Mesal. 111. Ventral.

Figures 112-117. *Metazygia carolinensis* (Archer): 112-115. Epigynum: 112. Ventral. 113. Posterior. 114. Lateral. 115. Dorsal, cleared. 116. Female, dorsal. 117. Female abdomen, ventral.

Scale lines. 0.1 mm except Figs. 108, 109, 116, 117, 1.0 mm.

metatarsus, 3.7; tarsus, 1.4. Second patella and tibia, 4.8 mm; third, 2.7; fourth, 4.3.

Diagnosis. Unlike other *Metazygia* species, *M. carolinialis* lacks a ventral knob (Fig. 112) on the epigynum.

Note. The placement of this species in *Metazygia* is doubtful. Archer thought *M. carolinialis* close to *Nuctenea cornuta* and placed it with *cornuta* in *Epeira*. He may have been right. But the following facts speak against this placement. *Nuctenea* is mainly a Palearctic genus with a few species in North America having a holarctic distribution. One of the main characters of *Nuctenea* females is the black venter with the comma-shaped white marks on each side. This is not present in *M. carolinialis*. The placement of the species will remain uncertain until the male is found.

Natural History. The flattened shape of the spiders, especially the low carapace, suggests that the spider has its retreat in crevices, probably under bark.

Records. North Carolina: Bladen Co., ♀ paratypes, Sept. 1929 (J. C. Beakley); Craven Co.: New Bern, May 1900, 2 ♀, 1 juv. (J. H. Emerton) (Map 3).

Eustala Simon

Eustala Simon, 1895, *Histoire Naturelle des Araignées*, 1: 795. Type species *Epeira anastera* Walckenaer by original designation. The name is feminine.

Diagnosis. *Eustala* differs from other Araneidae, especially from *Araneus*, by the epigynum, which has its scape projecting anteriorly (Figs. 118, 138, 140) instead of posteriorly as in all other genera, and by the male palpus, which has only one patellar macroseta, and has the median apophysis, a white cone-shaped structure, hanging down the venter of the palpus (Figs. 126, 147, m in Fig. 232).

The carapace has a deep longitudinal cleft in the thoracic region (Figs. 163, 183, 197). The abdomen is usually triangular, pointed above the spinnerets (Figs. 142–144, 209–210). Like *Larinia* and *Metepeira*,

but unlike many other Araneidae genera, *Eustala* has a central, ventral white patch on the abdomen (Figs. 155, 173, 185, 211). The white patch is absent in those tropical *Eustala* that have the abdomen elongate, like that of *Larinia*. Juvenile *Eriophora*, which look like *Eustala*, lack the white patch and have a dark trapezoid on the venter.

The related *Metazygia* has the scape of the epigynum projecting ventrally (Figs. 90, 91) and the median apophysis is a soft knob (Figs. 101–103, 110, 111). The carapace is smooth (Figs. 96, 108), and the abdomen is oval, slightly flattened dorsoventrally, with indistinct ventral markings (Figs. 96, 98, 99, 108, 109).

Description. The carapace is shaped as in *Araneus*, but with a deep longitudinal thoracic cleft (Figs. 163, 183, 197). The carapace is covered with setae and the thoracic area is high in some species (Figs. 133, 154, 172). The posterior median eyes are slightly smaller than the anterior medians, sometimes equal, rarely slightly larger. The laterals are always smaller than the medians. Anterior medians are their diameter apart, or 1.5 diameters at most; the posterior medians are separated by about the same distance. The laterals (except in the smallest species) are two to several diameters from medians. The clypeus height equals the diameter of the anterior median eyes (Fig. 225) except in *E. clavispina* where it is about one and one-half the diameter of the anterior median eyes as a result of the projection of the eye area. There often is a dark transverse band between anterior median and anterior lateral eyes (Figs. 163, 210, 225). The legs are more or less banded. The abdomen is generally triangular with a posterior hump (Figs. 209, 210), but this may be absent (Figs. 122, 123, 257, 258) or there may be several humps (Figs. 163, 164, 196, 197, 223, 224). Most species are variable in coloration with dark and light individuals, but most have a folium pattern on the dorsum,

exceptions being some specimens of *E. anastera* that are contrastingly colored with black patches on white in alcohol (Figs. 219, 222). In most *Eustala* species, unlike most species of *Araneus*, the venter has a more or less distinct median ventral white patch (Figs. 185, 198). In a few species this white patch is as distinct and contrasting (Fig. 173) as in *Metepeira*. Living specimens of *E. anastera* from central Florida have a greenish abdomen, but the green washes out of alcohol-preserved specimens.

Males are smaller than females, slightly darker in color, their abdominal humps are less distinct than in females (Figs. 199, 212). The distal margin of the first coxa has a hook (Fig. 201) which fits into a groove on the second femur. Except for being longer and having stronger macrosetae, especially on the second tibia, the legs of *Eustala* are not modified. Some species have a ventral row of macrosetae on one or more femora (Figs. 125, 156, 189, 214). This is a species characteristic and has been illustrated. The males are exceedingly difficult to match with females: species with the (seemingly) most specialized palpi do not necessarily have the most specialized epigyna (e.g. *E. californiensis*, Figs. 138-148).

Genitalia. The epigynum has an unusual, anteriorly projecting scape, annulate in most species but smooth in *E. devia* (Fig. 118) and *E. cazieri* (Fig. 128). The three plates in posterior view of the epigynum are of diagnostic importance: the median and two laterals, varying in shape. The seminal receptacles are usually spherical; between the openings is another smaller spherical structure which appears to contain a winding duct (Figs. 208, 256).

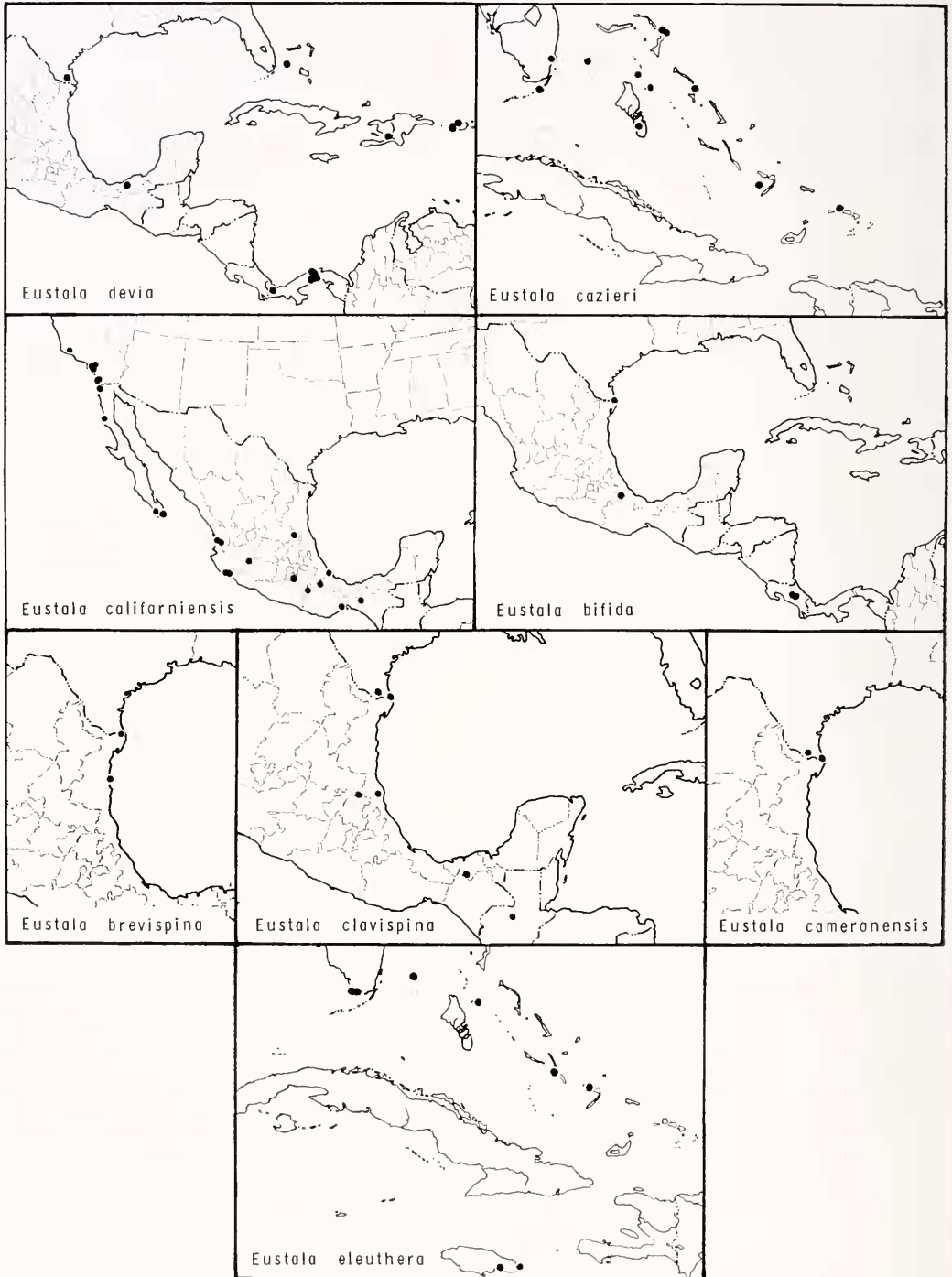
The palpal patella has one macroseta (Figs. 217, 252). The bulb, which is similar to that of *Metazygia*, has a huge conductor (c), variously shaped in different species, and a white, soft, conical median apophysis (m), which hangs down on the venter of the bulb in all *Eustala* species (Fig. 232).

The embolus (e) is a hook, similar in all species, and has a large sclerotized base, the stipes. The terminal apophysis is a sclerotized prong (a), slightly different in different species, resting on a bubble-like, transparent, spherical subterminal apophysis (a in Fig. 232). In some species the terminal apophysis is different in shape (Figs. 126, 136, 147, 157). The mesal side of the palpus faces ventrally, the ventral side laterally in resting position (Fig. 231).

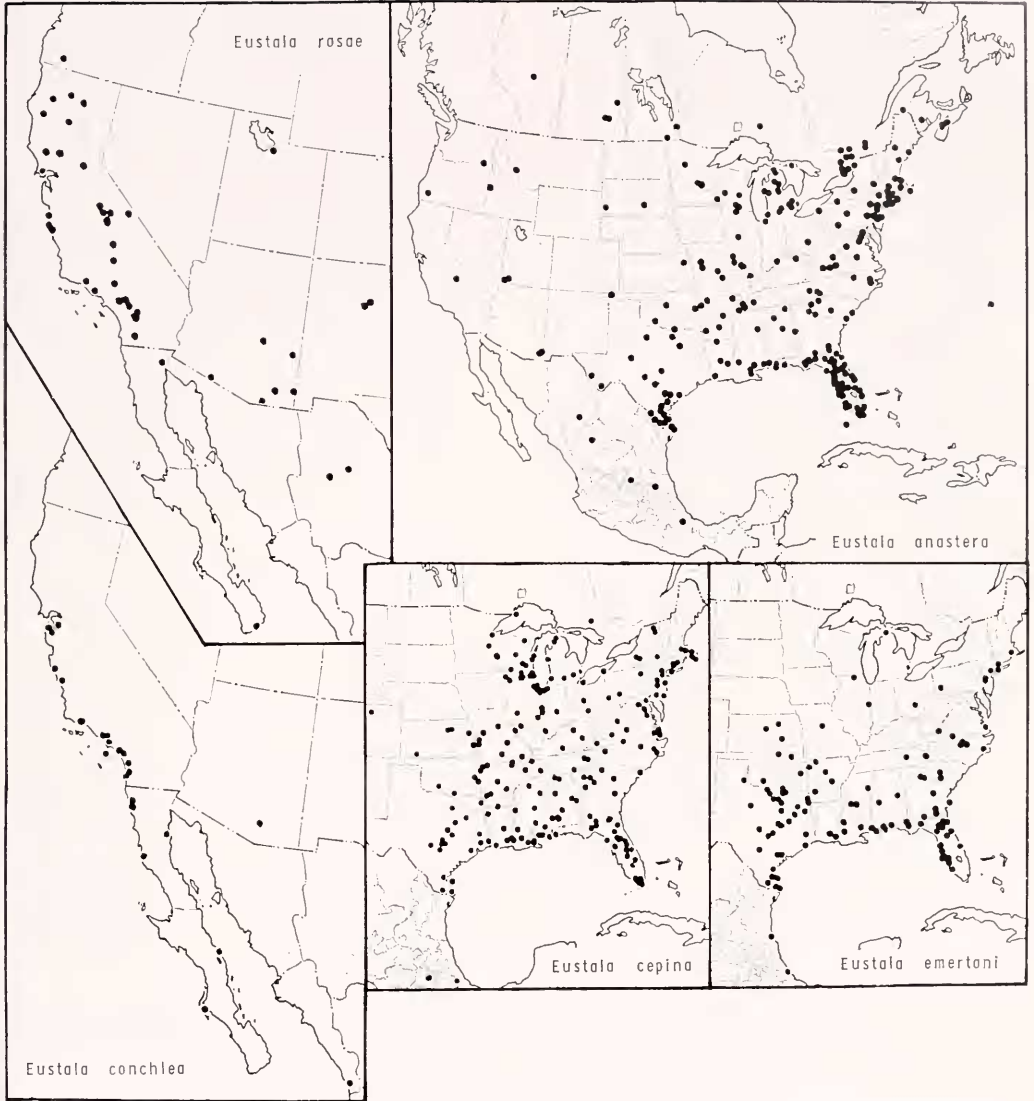
Natural History. Considering the common occurrence of many *Eustala* species, surprisingly little was known about them. *Eustala* apparently is nocturnal and removes its web at daytime. During the day it rests on a dead branch; there is no retreat. *Eustala* species are commonly collected by sweeping and are found also as prey in mud-dauber wasp nests.

Eustala anastera observed at the Archbold Biological Station, Lake Placid, Florida made webs every evening after dark. The webs usually had disappeared by the morning, but once in awhile the webs are not taken down. The webs of juveniles had 17 to 25 radii, that of an adult, 18 and 21. The webs of these juveniles had 28, 37, 41, 31 and 15 viscid threads below the hub and above the hub had 36, 38, 39, 28, 32. The web of an adult had 30, 33 below, 31, 28 above. The horizontal diameter of juveniles' webs ranged from 12 to 25 cm; of adults' webs 19 and 30 cm. There were few frame threads, the hub was solid (Plate 7). The webs were built in dead branches, usually away from leaves and within a wire fence, having vertical wires 15.5 cm apart. *Eustala* has no retreat; when not in the center of the web, it sits appressed to branches. Most webs are vertical but a horizontal web was seen. The lowest webs are 3 to 4 feet above the ground; the maximum height is not known.

Eustala anastera in central Florida feeds on a wide variety of medium-sized prey, and when resting in the web usually keeps its legs slightly spread like *Eniophora revilla*,



Map 4. Distribution of *Eustala devia* (Gertsch and Mulaik), *E. cazieri* n. sp., *E. californiensis* (Keyserling), *E. bifida* F.P.-Cambridge, *E. brevispina* Gertsch and Davis, *E. clavispina* (O.P.-Cambridge), *E. cameronensis* Gertsch and Davis and *E. eleuthera* n. sp.



Map 5. Distribution of *Eustala rosae* Chamberlin and Ivie, *E. anastera* (Walckenaer), *E. cepina* (Walckenaer), *E. emertoni* (Banks), *E. conchlea* (McCook).

but unlike many other genera (M. Stowe, personal communication).

Species and Distribution. *Eustala* is only known from the Americas. Most species are tropical, and only five species are found in temperate North America. Another eight tropical species have been collected in southern Florida, southern Texas or south-

ern California. The many species in the American tropics are probably very difficult to separate by morphological characters alone.

KEY TO *EUSTALA* FEMALES NORTH OF MEXICO

1. Tropical species, southern California, southern Texas, southern Florida (Map 4) 2
- Temperate species (Map 5) 9

- 2(1) Scape of epigynum without annulations (Figs. 118, 128) 3
 - Scape with annulations (Figs. 138, 149) 4
 3(2) Epigynum wider than long in both ventral and posterior view (Figs. 118, 119); lightly sclerotized; Texas to Panama, West Indies *devia*
 - Epigynum as wide as long in ventral view (Fig. 128), longer than wide in posterior view (Fig. 129); sclerotized; Florida, West Indies *cazieri*
 4(2) Middle piece of epigynum wide and large, almost hiding framing parts to the sides (Figs. 167, 168); Texas to Costa Rica *bifida*
 - Middle piece of epigynum narrower (Figs. 139, 150, 160) 5
 5(4) Abdomen setae dilated at base; eye region projecting slightly (Fig. 163); scape of epigynum in side view unusually deep (Fig. 161); Texas to Guatemala *clavispina*
 - Abdomen setae not modified, eye region not projecting; scape of epigynum not deep (Figs. 140, 151) 6
 6(5) Epigynum in posterior view with lateral constrictions ventrally (Figs. 139, 150) 7
 - Epigynum without such lateral constrictions (Figs. 180, 206); if constricted, constriction dorsally (Fig. 193) 8
 7(6) Epigynum in posterior view with lateral pieces dorsally expanded, middle piece wide ventrally (Fig. 139); abdomen with one hump; California, Mexico *californiensis*
 - Epigynum in posterior view with lateral pieces not so expanded (Fig. 150), middle piece narrow (Fig. 149); abdomen with two or three large humps (Figs. 153, 154); Texas *brevispina*
 8(6) Scape thick, finger-shaped with rounded tip (Figs. 179, 181); epigynum in posterior view long and middle piece small (Fig. 180); tropical Florida, West Indies *cleuthera*
 - Scape tapering to a point (Figs. 192, 205, 228); epigynum in posterior view more or less square in outline with middle piece larger (Figs. 193, 206, 234, 254); whole region 9
 9(1) Epigynum in posterior view with dorsal, lateral lobes (Fig. 193); abdomen with three humps in a row (Figs. 196, 197); California to New Mexico *rosae*
 - Epigynum in posterior view without the dorsal lobes (Figs. 206, 234, 254) 10
 10(9) Middle piece of epigynum in posterior view larger than each lateral area (Fig. 270) and abdomen with a distinct hump (Figs. 273, 274); California, Arizona, northwestern Mexico *couchlea*
 - Middle piece of epigynum smaller or as large as lateral area (Figs. 206, 244); if middle piece of epigynum in posterior view larger than lateral area, abdomen without hump; eastern and central United States and Canada 11
 11(10) Abdomen longer than wide with a distinct posterodorsal hump (not in Florida) (Figs. 209, 210); posterior median piece of epigynum smaller in area than either lateral one (Figs. 206, 280-285); total length 5.7 to 10.0 mm, of southern Florida specimens 5.4 mm, 0.36 (Florida), 0.44 to 0.58 mm wide *anastera*
 - Abdomen, if longer than wide, posterior tubercle indistinct (Figs. 257, 258), or almost as wide as long (Figs. 237-241); area of posterior median piece of epigynum of same size or larger than either lateral one (Figs. 286-295); total length less than 7.6 mm, epigynum less than 0.5 mm wide 12
 12(11) Abdomen egg-shaped, longer than wide, without tubercle, with pattern as in Figs. 258, 260; middle piece of epigynum in posterior view distinctly larger than each lateral one (Figs. 254, 262, 291-295). Total length 3.4 to 7.6 mm; southern Florida specimens 5.0 to 6.1 mm; epigynum 0.35 to 0.5 mm wide *emertoni*
 - Abdomen almost as wide as long, subtriangular, with small posterior dorsal tubercle, with variable pattern (Figs. 237-241); middle piece of epigynum about the same area as lateral ones or slightly larger; epigynum with a minute posterodorsal sclerotized scale (Figs. 234, 244-247, 286-290); total length 3.4 to 7.9 mm; southern Florida specimens the smallest; epigynum 0.28 to 0.38 mm wide *cepina*

KEY TO *EUSTALA* MALES NORTH OF MEXICO

1. Conductor of palpus very large with a tail (Figs. 232, 250, 266, 297-312); temperate and tropical 2
 - Conductor of palpus without a tail and usually small (Figs. 126-127, 136-137, 147-148, 157-158, 165, 174, 187, 190); subtropical (southern Florida, southern Texas, southern California only, Map 1) 7
 2(1) Second femur with a ventral row of macrosetae or at least one macroseta (Fig. 214); whole region *anastera*
 - Second femur never with a ventral macroseta (Figs. 201, 249, 265) 3
 3(2) Pacific states and southwestern states (Map 5) 4
 - Eastern states and central states (Map 5) 5

- 4(3) Terminal apophysis shorter than bubble-like subterminal apophysis (Fig. 277), conductor very large with a tail more than twice as visible part of embolus (Figs. 277, 312, 318) *conchlea*
- Terminal apophysis overhanging bubble-like subterminal apophysis (Fig. 202); conductor small with tail, equal in length to visible part of embolus (Figs. 202, 297, 313) *rosae*
- 5(3) Conductor with tail shorter than embolus height (Figs. 215, 298-302, 314-315); total length 3.9 to 9.5 mm, Florida males smallest; palpus 0.9 to 1.6 mm wide *anastera*
- Conductor with its tail as long or longer than embolus height (Figs. 303-311). Total length less than 5.0 mm; palpus less than 1.2 mm wide 6
- 6(5) Terminal apophysis shorter than bubble-like subterminal apophysis (Figs. 266, 309-311, 317); conductor bulging "above" embolus and with a tail about 5 times as long as wide and much longer than embolus is high (Figs. 309-311). Total length 3.8 to 5.0 mm; palpus 0.8 to 1.2 mm wide *emertoni*
- Terminal apophysis as long or longer than bubble-like subterminal apophysis, overhanging it (Figs. 250, 303-308, 316); conductor not bulging "above" embolus, with a tail less than 4 times as long as wide (Figs. 303-308), equal in length or slightly longer than embolus height (Figs. 303-308). Total length 2.5 to 4.3 mm; southern Florida specimens smallest; palpus 0.65 to 0.72 mm wide *cepinu*
- 7(1) Palpus with bubble-like semitransparent subterminal apophysis below stylet-shaped terminal apophysis (Figs. 165, 174, 187, 190) 11
- Palpus lacking bubble-like semitransparent subterminal apophysis or if present, distal to ("above") stylet-shaped terminal apophysis (Figs. 126, 136, 147, 157) 8
- 8(7) Second femur without ventral row of macrosetae (Fig. 146); palpus as in Figures 147, 148; southern California, Mexico *californiensis*
- Second femur with a ventral row of macrosetae (Figs. 125, 135, 156); palpus not as in Fig. 147; southern Texas and Florida 9
- 9(8) Terminal apophysis covering embolus, subterminal apophysis distal in palpus (Figs. 126, 127); Texas to Panama and West Indies *devia*
- Subterminal apophysis not distal and terminal apophysis not hiding embolus (Figs. 136, 157) 10
- 10(9) Terminal apophysis of palpus a non-transparent lobe overhanging embolus (Fig. 136); Florida, West Indies *cazieri*
- Terminal division of palpus as in Fig. 157; Texas *brevispina*
- 11(7) Embolus twisted with embolus base extending beyond tip (Fig. 174); Texas to Costa Rica *bifida*
- Embolus hook-shaped (Figs. 165, 187, 190) 12
- 12(11) Terminal apophysis with a constricted neck, and knife-blade-shaped tip (Fig. 165); conductor large (Figs. 165, 166); Texas to Guatemala *clavispina*
- Terminal apophysis otherwise (Figs. 187, 190); conductor small (Figs. 187, 190) ... 13
- 13(12) Embolus partly hidden by bubble-like subterminal apophysis (Fig. 190); Texas *cameronensis*
- Embolus below bubble-like subterminal apophysis (Fig. 187); Florida *eleuthera*

Eustala devia (Gertsch and Mulaik),
new combination

Figures 118-127, Map 4

Neosconella devia Gertsch and Mulaik, 1936, Amer. Mus. Novitates, no. 863; 16, fig. 38, ♀. Female holotype from Edinburg, Texas, in the American Museum of Natural History, examined.

Eustala minima Chickering, 1955, Bull. Mus. Comp. Zool. 112: 471, figs. 94-96, ♀. Female holotype from Barro Colorado Island, Panama Canal Zone, in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

Note. The epigynum of specimens of *E. minima* from Panama differs some from that of specimens from the Bahama Islands and the holotype of *E. devia* (Figs. 118, 119).

Description. Female holotype: Carapace yellowish with some black patches. Posterior median eye area black and lateral eyes on black spots. Sternum yellow, legs yellow with black patches and rings. Dorsum of abdomen light and with folium. Venter of abdomen with white pigment spots behind epigynum and a gray trapezoid and a gray transverse band in front of spinnerets (Fig. 124). The abdomen is almost as wide as long and without humps. Female from South Bimini: Total length 3.6 mm. Carapace 1.5 mm long, 1.2 wide. First femur

2.0 mm; patella and tibia, 2.3; metatarsus, 1.5; tarsus, 0.6. Second patella and tibia, 1.9; third, 1.1; fourth, 1.6.

Male from South Bimini: Total length 2.8 mm. Carapace 1.4 mm long, 1.2 wide. First femur, 2.1 mm; patella and tibia, 2.4; metatarsus, 1.6; tarsus, 0.7. Second patella and tibia, 1.8; third, 0.8; fourth, 1.5.

The illustrations were made from the female holotype and from a South Bimini male.

Diagnosis. The abdomen of the female lacks a distinct hump (Figs. 122, 123). As in *E. cazieri*, the epigynum has a smooth scape without annuli, but unlike that of *E. cazieri*, the scape is tipped by a knob (Figs. 118, 120). The male differs from other species of *Eustala* in having the terminal apophysis covering the embolus in mesal view (Fig. 126), and the subterminal apophysis apical. The similar West Indian *E. perdita* Bryant has a differently shaped terminal apophysis.

Distribution. Southern Texas to Panama, Bahamas, Hispaniola, Puerto Rico (Map 4).

Records. *Mexico.* *Tabasco.* 2 mi. NE of Comalcalco, ♂. *Panama.* Boquete; Arraijan; El Valle; Porto Bello; all ♀♀. *Canal Zone.* Barro Colorado Island; Ft. Randolph; Chilibre; Madden Dam; Forest Reserve; all ♀♀. *Bahamas.* South Bimini, ♀, ♂. *Haiti.* Kenskoff, ♀. *Puerto Rico.* Mayagüez; Camalche Forest east of Arecibo.

Eustala cazieri new species

Figures 128–137, Map 4

Holotype. Female from Plantation Key, Monroe County, 4 miles south of Tavernier, Florida, 11 March 1963 (H. and L. Levi), edge of hardwood forest, in the Museum of Comparative Zoology. The species is named

after Prof. M. A. Cazier, collector of many specimens of this species in South Bimini.

Description. Female from Bimini: Carapace orange-brown with paired black patches and white down. Legs orange-brown, indistinctly banded. Dorsum of abdomen with lines outlining the folium and sometimes with a black longitudinal band (Fig. 132). Venter with little black pigment (Fig. 134). Thoracic depression a median longitudinal line. Posterior median eyes 0.9 diameter of anterior, laterals 0.8 diameter. Anterior median eyes 1.5 diameters apart, posterior median eyes 1.5 diameters apart. The abdomen is triangular, pointed above spinnerets. Total length 5.4 mm. Carapace 2.2 mm long, 1.9 wide. First femur, 2.5 mm; patella and tibia, 3.0; metatarsus, 1.9; tarsus, 0.7. Second patella and tibia, 3.0 mm; third, 1.4; fourth, 2.5.

Male from Miami: Coloration like that of female. Eye sizes about as in female, anterior median eyes slightly larger. Anterior median eyes their diameter apart, posterior median eyes slightly more than their diameter apart. First coxa with a hook. Total length 4.7 mm. Carapace 2.4 mm long, 1.9 wide. First femur, 3.6 mm; patella and tibia, 4.3; metatarsus, 2.8; tarsus, 1.1. Second patella and tibia, 3.0 mm; third, 1.5; fourth, 2.4.

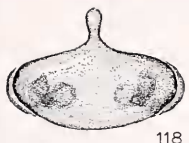
Female illustrated came from South Bimini, male from Miami.

Variation. Females may lack a pattern on the dorsum of the abdomen, and some have a median longitudinal dark band. Total length of Florida females, 5.2 to 6.8 mm, carapace 2.0 to 2.5 long, 1.8 to 2.0 wide. Males vary in total length 3.3 to 4.7 mm, carapace 2.1 to 2.4 long, 1.7 to 1.9 wide.

Diagnosis. Females differ from other

Figures 118–127. *Eustala devia* (Gertsch and Mulaik): 118–121. Epigynum: 118. Ventral. 119. Posterior. 120. Lateral. 121. Posterior, cleared. 122. Female carapace and abdomen, dorsal. 123. Female, legs removed, lateral. 124. Female abdomen, ventral. 125. Male, ventral macrosetae on left femora. 126, 127. Left male palpus: 126. Mesal. 127. Ventral.

Figures 128–137. *Eustala cazieri* n. sp.: 128–131. Epigynum: 128. Ventral. 129. Posterior. 130. Lateral. 131. Posterior, cleared. 132. Female, dorsal. 133. Female, legs removed, lateral. 134. Female abdomen, ventral. 135. Male, ventral macrosetae of left femora. 136, 137. Male palpus: 136. Mesal. 137. Ventral.



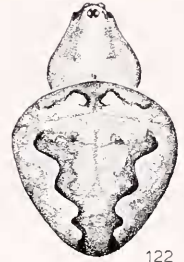
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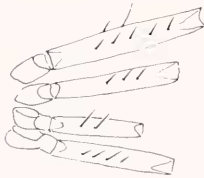
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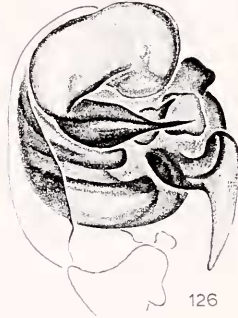
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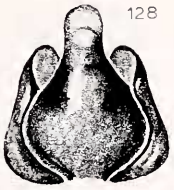
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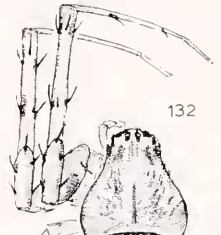
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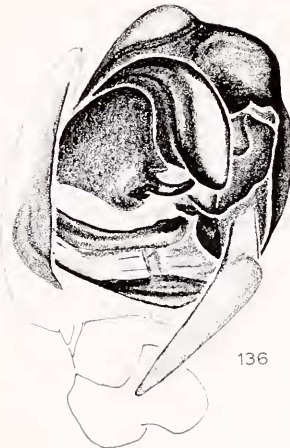
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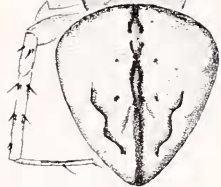
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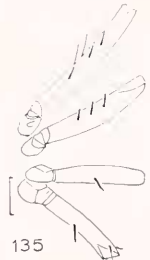
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135

Florida species by the angular abdomen (Figs. 132, 133) and by lacking annuli on the smooth, anteriorly directed scape of the epigynum (Figs. 128–130). The scape lacks the knob present in *E. devia*. Unlike males of most *Eustala* species, those of *E. cazieri* have no bubble-like transparent subterminal apophysis (Fig. 136); they have an ovoid terminal apophysis overhanging the embolus (Figs. 136, 137).

Distribution. Southern Florida and Bahama Islands (Map 4).

Records. Florida. Dade Co.: Miami; Miami Beach. Monroe Co.: Tavernier. *Bahama Islands.* North Bimini; South Bimini; Crooked Isl.; Eleuthera; Great Abaco Isl.; North Caicos Isl.; Berry Isl.; Andros Isl.; New Providence.

Eustala californiensis (Keyserling),
new combination

Figures 138–148, Map 4

Cyrtophora californiensis Keyserling, 1885, Verhandl. Zool. Bot. Ges. Wien, 34: 525, pl. 13, fig. 24, ♀. Female holotype from "California" in the Museum of Comparative Zoology, examined. Keyserling, 1893, Spinnen Amerikas, 4: 263, pl. 13, fig. 196, ♀. Roever, 1942, Katalog der Araneae, 1: 751. Bonnet, 1956, Bibliographia Araneorum, 2(2): 1361.

Araneus diegensis Schenkel, 1950, Verh. Naturf. Gesell., Basel, 61: 67, fig. 23, ♀. Female holotype from Missions Bay, San Diego, California, in the Natural History Museum, Basel, examined. NEW SYNONYMY.

Eustala abdita Chickering, 1955, Bull. Mus. Comp. Zool., 112: 410, figs. 19–23, ♂. Male holotype from Huajuapán, Oaxaca, Mexico in the American Museum of Natural History, examined. NEW SYNONYMY.

Eustala mexicana Chickering, 1955, Bull. Mus. Comp. Zool., 112: 465, figs. 88–89, ♀. Female

holotype from Lo Bajo, Guerrero, Mexico in the American Museum of Natural History, examined. NEW SYNONYMY.

Description. Female from Oaxaca: Carapace light brown with paired dark brown patches and dark longitudinal mark in thoracic cleft. Legs light brown with some black rings, more distinct ventrally. Dorsum of abdomen whitish with folium (Fig. 142). Sides with gray lines. The abdomen is triangular, narrow with a dorsal posterior hump (Figs. 142–144). Total length 5.4 mm. Carapace 2.2 mm long, 2.0 wide. First femur, 3.2 mm; patella and tibia, 3.7; metatarsus, 2.0; tarsus, 0.9. Second patella and tibia, 3.0 mm; third, 1.5; fourth, 2.6.

Male from Oaxaca: Coloration as in female. Total length 3.6 mm. Carapace 1.8 mm long, 1.5 wide. First femur, 2.9 mm; patella and tibia, 3.0; metatarsus, 1.9; tarsus, 0.9. Second patella and tibia, 2.0 mm; third, 1.1; fourth, 1.9.

Female illustrated was from Oaxaca and males from Colima and Veracruz.

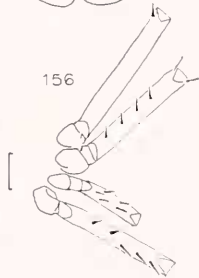
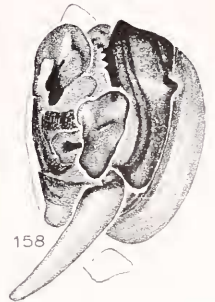
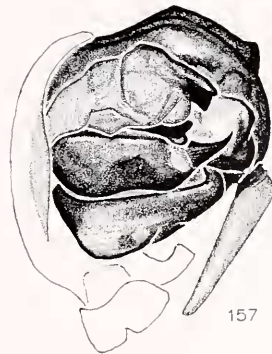
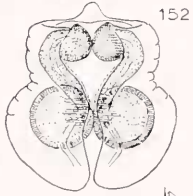
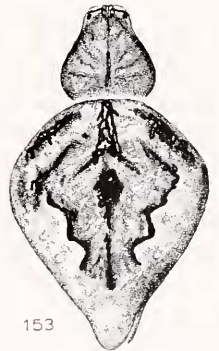
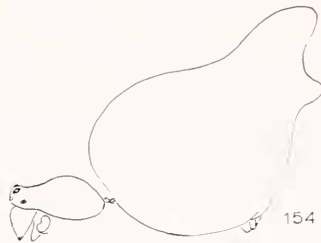
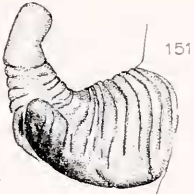
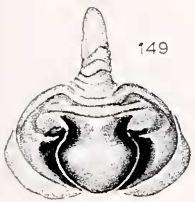
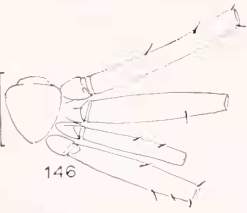
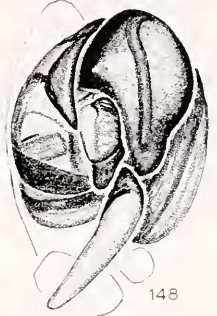
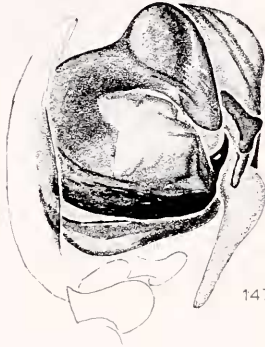
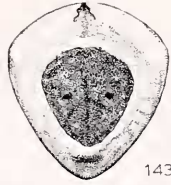
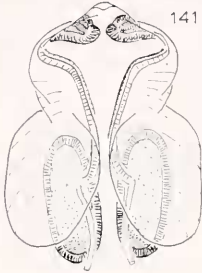
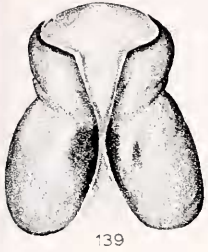
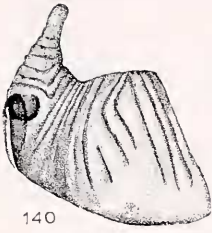
Variation. Females usually have the abdomen narrow (Fig. 142), but it may be wider and may have a dorsal triangular dark mark (Fig. 143). Total length of females is 3.9 to 7.0 mm, carapace 1.6 to 2.6 long, 1.4 to 2.1 wide. Total length of males 3.0 to 4.3 mm, carapace 1.6 to 2.3 long, 1.3 to 1.9 wide.

Diagnosis. Females can be separated from all related species by the posterior view of the epigynum, which shows a ventral constriction with laterally expanded dorsolateral lobes on each side (Fig. 139). The terminal apophysis of the palpus (Figs. 147, 148), lacking the usual sclerotized

Figures 138–148. *Eustala californiensis* (Keyserling): 138–141. Epigynum: 138. Ventral. 139, 141. Posterior. 140. Lateral. 141. Cleared. 142. Female, dorsal (Mexico). 143. Female abdomen, dorsal (California). 144. Female, legs removed, lateral. 145. Female abdomen, ventral. 146. Male, ventral macrosetae on left femora. 147, 148. Male left palpus: 147. Mesal. 148. Ventral.

Figures 149–158. *Eustala brevispina* Gertsch and Davis: 149–152. Epigynum: 149. Ventral. 150. Posterior. 151. Lateral. 152. Posterior, cleared. 153. Female carapace and abdomen. 154. Female, legs removed, lateral. 155. Female abdomen, ventral. 156. Male, ventral macrosetae of left femora. 157, 158. Male palpus: 157. Mesal. 158. Ventral.

Scale lines. 0.1 mm except Figs. 142–146, 153–156, 1.0 mm



prong, is distinct from that of related species.

Distribution. Southern California, San Luis Potosí south to Chiapas (Map 4).

Eustala brevispina Gertsch and Davis
Figures 149–158, Map 4

Eustala brevispina Gertsch and Davis, 1936, Amer. Mus. Novitates, 881: 12, figs. 9, 10, ♀, ♂. Male holotype from Cameron Co., Texas in the American Museum of Natural History, examined.

Description. Female: Carapace brown with black marks and white setae. Legs brown with narrow black bands on distal articles. First, second and fourth femora mostly black. The abdomen is contrastingly marked and has two posterior humps (Figs. 153, 154). Total length 8.5 mm. Carapace 2.7 mm long, 2.4 wide. First femur, 3.2 mm; patella and tibia, 3.9; metatarsus, 2.5; tarsus, 1.0. Second patella and tibia, 3.5 mm; third, 1.7; fourth, 2.9.

Male holotype: Total length 5.8 mm. Carapace 3.0 mm long, 2.6 wide. First femur, 4.1 mm; patella and tibia, 4.7; metatarsus, 3.0; tarsus, 1.2. Second patella and tibia, 4.0 mm; third, 2.1; fourth, 3.6.

Diagnosis. This large species can be told from related species by the large abdominal humps (Figs. 153, 154) not present in *E. californiensis*. Like *E. californiensis* the epigynum in posterior view has a diagnostic constriction (Fig. 150), but the lateral pieces are differently shaped from those of *E. californiensis*. Unlike most *Eustala* species the male lacks the transparent subterminal apophysis. The shape of the terminal apophysis of the palpus (Figs. 157, 158) is unlike that of related species.

Distribution. Texas. Cameron Co.: Brownsville, 25 May 1934, ♀ allotype; 1 June 1934, 3♀; 8 June 1934, 3♀ (J. N.

Knull). *Tamaulipas*. La Pesca, 17 May 1952, 1♀ (W. J. Gertsch).

Eustala clavispina (O.P.—Cambridge)
Figures 159–166, 176–177, Map 4

Epeira clavispina O.P.—Cambridge, 1889, Biologia Centrali-Americana, Araneidea, 1: 37, pl. 7, fig. 11, ♀. Two female syntypes from Cubilguitz in Vera Paz, Guatemala, in the British Museum, Natural History, examined. Keyserling, 1892, Spinnen Amerikas, 4: 102, pl. 5, fig. 75, ♀.

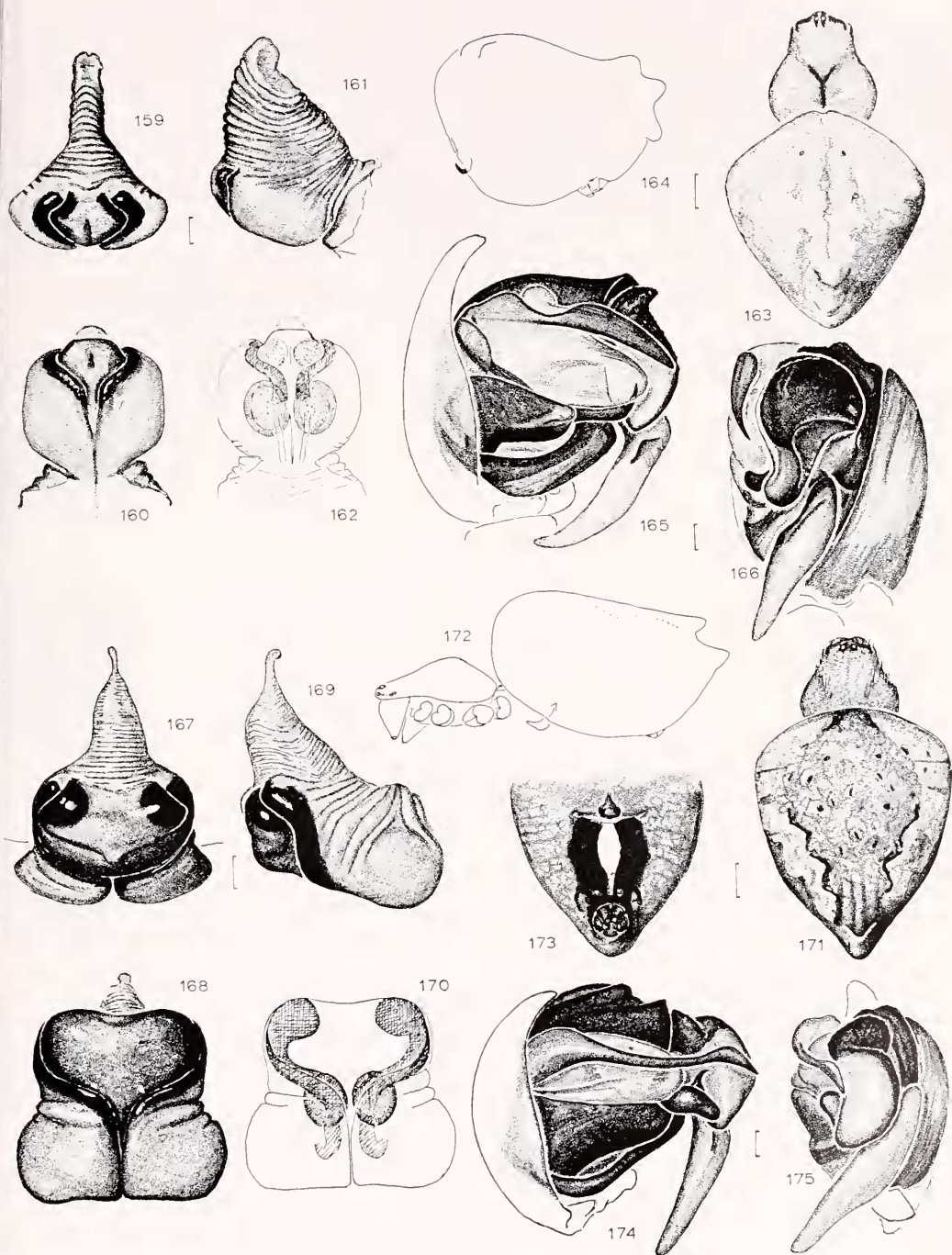
Ananra nigromaculata O.P.—Cambridge, 1895, Biologia Centrali-Americana, Araneidea, 1: 155, pl. 19, fig. 5. Female holotype from Teapa, Tabasco, Mexico in the British Museum, Natural History, examined.

Eustala clavispina,—F.P.—Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 509, pl. 48, fig. 19, ♀. Roewer, 1942, Katalog der Araneae, 1: 764. Chickering, 1955, Bull. Mus. Comp. Zool., 112: 428, figs. 45–48, ♀.

Eustala rosae,—Gertsch and Davis, 1936, Amer. Mus. Novitates, no. 881: 14, fig. 11, 12, ♀, ♂. Not *E. rosae* Chamberlin and Ivie.

Note. This name is not a synonym of *E. conchlea* McCook as thought by Bonnet (1955, Bibliographia Araneorum, 2(2): 1839).

Description. Female from Texas: Carapace brown with dark brownish black Y (Fig. 163). Posterior median eyes surrounded by black. Sternum maculated with black and white pigment. Legs with contrasting bands on femora, spots and dark patches on distal articles. Dorsum of abdomen with indistinct folium (Fig. 163). Median eye area of carapace swollen. There are lateral abdominal humps, the second pair indistinct, and three pairs of posterior humps in a row (Figs. 163–164). Total length 11.5 mm. Carapace 4.0 mm long, 3.0 wide. First femur, 4.7 mm; patella and tibia, 6.0; metatarsus, 3.9; tarsus, 1.3. Second patella and tibia, 5.3 mm; third, 2.6; fourth, 4.6.



Figures 167–175. *Eustala bifida* F.P.-Cambridge: 167–170. Epigynum: 167. Ventral. 168. Posterior. 169. Lateral. 170. Posterior, cleared. 171. Female carapace and abdomen. 172. Female, legs removed, lateral. 173. Female abdomen, ventral. 174, 175. Male palpus: 174. Mesal. 175. Ventral.

Scale lines. 0.1 mm except Figs. 163, 164, 171–173, 1.0 mm.

Male from Texas: Coloration like that of female. Carapace with two setae within median eye quadrangle. The abdomen has some strong macrosetae on dorsum and there are two posterior humps on the triangular abdomen only. Total length 6.7 mm. Carapace 3.1 mm long, 2.5 wide. First femur, 4.4 mm; patella and tibia, 5.8; metatarsus, 4.0; tarsus, 1.4. Second patella and tibia, 4.3 mm; third, 2.2; fourth, 4.0.

Specimens illustrated came from Texas.

Variation. The leg banding is less distinct in some specimens. Some lack the characteristic basally dilate macrosetae on the abdomen; perhaps they were broken off in collecting. The eye region projects more in southern specimens, little in northern ones. Specimens from Teapa, Mexico have paired black patches on the dorsum of the abdomen, and have indications of a dorsal fold on the posterior side of the epigynum, as in *E. rosae*. Total length of females 8.4 to 11.5 mm, carapace 3.4 to 4.0 long, 2.6 to 3.1 wide. Total length of males 6.7 to 7.3 mm, carapace 3.1 to 3.7 long, 2.5 to 2.7 wide.

Diagnosis. This is the only *Eustala* species of the area having a projecting eye region (Fig. 163) and basally expanded setae on the abdomen. (The setae may be broken off and the eye region projects only little in northern specimens.) Unlike all other species, the scape of the epigynum appears laterally compressed, thus deeper than wide (Fig. 161). The embolus of the palpus is partly hidden by the subterminal apophysis

and the terminal apophysis is kitchen-knife-blade-shaped (Fig. 165).

Distribution. Southern Texas to Guatemala (Map 4).

Records. Texas. Hidalgo Co.: 7 mi. E. of Edinburg; Edinburg. Cameron Co.: Rangelville. Mexico. San Luis Potosí. Tamauchale. Veracruz. Cerro Azul. Tabasco. Teapa. Guatemala. Vera Paz. Cubilguitz.

Eustala bifida F.P.—Cambridge Figures 167–175, 178, Map 4

Eustala bifida F.P.—Cambridge, 1904, *Biologia Centrali-Americana, Araneidea*, 2: 507, pl. 48, figs. 9, 10, ♀, ♂. Female, male syntypes from San José, Costa Rica in the British Museum, Natural History, examined. Roewer, 1942, *Katalog der Araneae*, 1: 764. Chickering, 1955, *Bull. Mus. Comp. Zool.*, 112: 421, figs. 35–40, ♀, ♂. Bonnet, 1956, *Bibliographia Araneorum*, 2(2): 1839.

Description. Female syntype: Carapace brown, sternum brown with white pigment in center. Legs brown, banded with blackish brown. Dorsum of abdomen with indistinct folium, black and gray marks (Fig. 171). Venter black between epigynum and spinnerets with a median white longitudinal line through the center, widest anteriorly, fading out behind (Fig. 173). Abdomen triangular with two posterior humps in a row (Figs. 171, 172). Total length 9.0 mm. Carapace 4.0 mm long, 3.1 wide. First femur, 4.2 mm; patella and tibia, 5.8; metatarsus, 3.6; tarsus, 1.3. Second patella and tibia, 5.0 mm; third, 2.5; fourth, 4.4.

Male syntype: Coloration like that of fe-

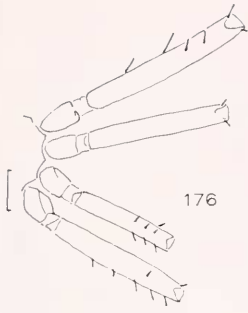
Figures 176, 177. *Eustala clavispina* (O.P.—Cambridge): 176. Male, ventral macrosetae of left femora. 177. Female abdomen, ventral.

Figure 178. *Eustala bifida* F.P.—Cambridge. Male ventral macrosetae.

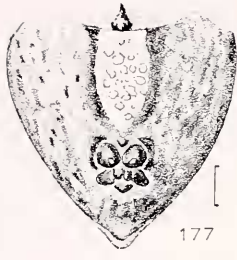
Figures 179–188. *Eustala eleuthera* n. sp. 179–182: Epigynum: 179. Ventral. 180. Posterior. 181. Lateral. 182. Posterior, cleared. 183. Female carapace and abdomen. 184. Female, legs removed, lateral. 185. Female abdomen, ventral. 186. Male, ventral macrosetae of left femora. 187, 188. Male left palpus: 187. Mesal. 188. Ventral.

Figures 189–191. *Eustala cameronensis* Gertsch and Davis, male: 189. Ventral macrosetae of left femora. 190, 191. Palpus: 190. Mesal. 191. Ventral.

Scale lines. 0.1 mm except Figs. 176–178, 183–186, 189, 1.0 mm.



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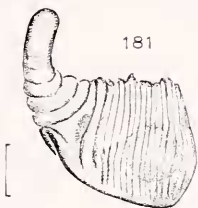
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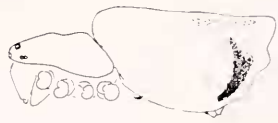
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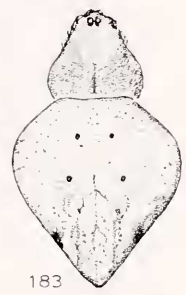
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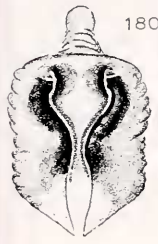
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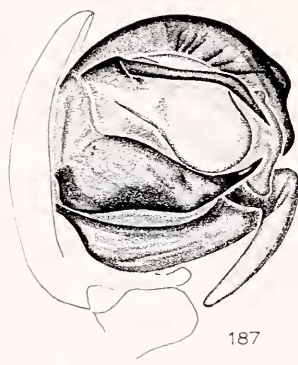
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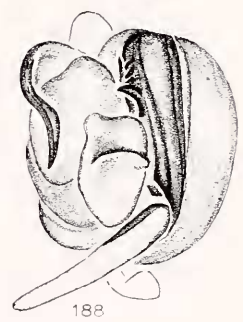
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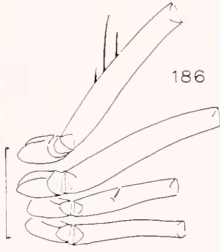
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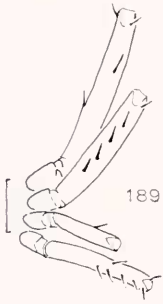
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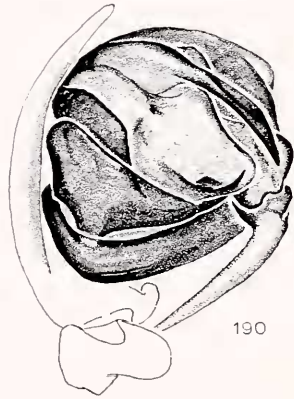
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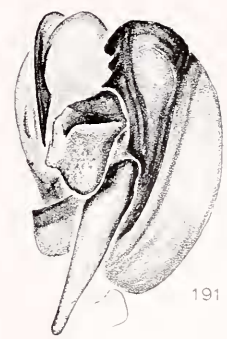
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191

male. Total length 6.3 mm. Carapace 3.4 mm long, 2.8 wide. First femur, 4.5 mm; patella and tibia, 5.5; metatarsus, 3.7. Third patella and tibia, 2.2; fourth, 3.9.

The illustrated specimens came from Costa Rica except Fig. 175 from Panama.

Diagnosis. The venter of the abdomen of females is more contrastingly colored than that of other species; it has a white mark framed by black (Fig. 173). Unlike all other species north of Mexico, *E. bifida* has the middle piece of epigynum bulging in both ventral and posterior view (Figs. 167, 168); the lateral areas are about as long as wide (Fig. 168). Unlike all other species north of Mexico, *E. bifida* has the embolus of the male palpus different; it is twisted (Fig. 174) and the terminal apophysis is a long prong widest near the tip and extending to the outer edge of the conductor (Fig. 174).

Distribution. Southern Texas to Costa Rica (Map 4).

Records. *Texas.* Cameron Co.: most southern Palm Grove, 16 Feb. 1941, ♀ (L. I. Davis). *Veracruz.* Río Blanco, 6 Nov. 1957, ♀ (R. Dreisbach). *Costa Rica.* La Verbena, ♀♀ (Tristan).

Eustala eleuthera new species

Figures 179–188, Map 4

Holotype. Male from Cape Sable, Monroe County, Florida, 4 April 1958, H. V. Weems, collector, in the Museum of Comparative Zoology. The specific name is a noun in apposition after the Bahamian Island Eleuthera.

Description. Female from South Bimini: Carapace yellow with white hairs in cephalic region. Sternum, legs yellow. Dorsum of abdomen speckled with black marks.

There is an outline of folium, sometimes a black line (Fig. 183). Venter with a central white spot, longer than wide, black on each side; spinnerets dark brown (Fig. 185). Posterior median eyes 1.2 diameters of anterior medians, laterals 0.6 diameter of anterior median eyes. Anterior median eyes 1.8 diameters apart, posterior medians their diameter apart. The abdomen is triangular with a pointed posterior dorsal hump, and a second smaller hump between the dorsal hump and spinnerets (Figs. 183, 184). Total length 6.3 mm. Carapace 2.2 mm long, 2.0 wide. First femur, 2.7 mm; patella and tibia, 3.4; metatarsus, 2.0; tarsus, 0.9. Second patella and tibia, 2.7 mm; third, 1.5; fourth, 2.5.

Male: Coloration slightly darker than in female. Posterior median eyes 0.8 diameter of anterior medians, anterior laterals 0.7, posterior laterals 0.6 diameters. Anterior median eyes 1.3 diameters apart, posterior median eyes their diameter apart. Total length 3.4 mm. Carapace 1.9 mm long, 1.6 wide. First femur, 2.5 mm; patella and tibia, 3.0; metatarsus, 2.0; tarsus, 0.7. Second patella and tibia, 2.2 mm; third, 1.2; fourth, 1.9.

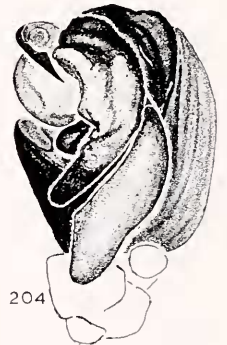
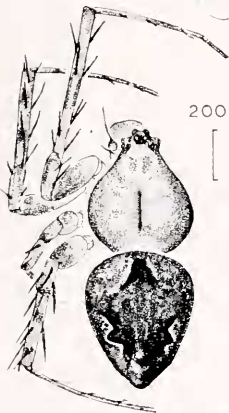
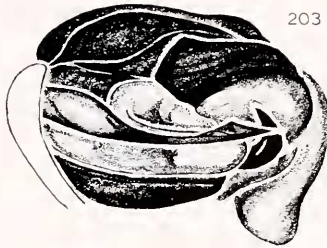
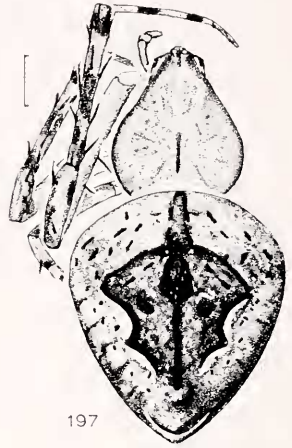
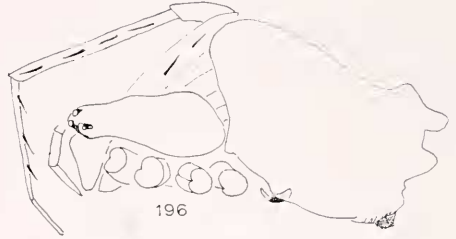
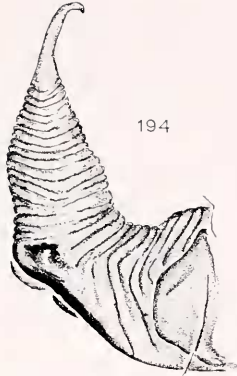
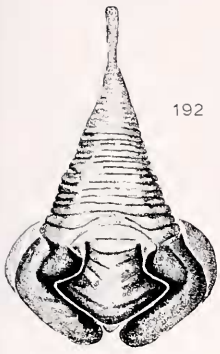
Specimens illustrated came from South Bimini.

Variation. Some individual females are much darker than others. Total length of females 4.1 to 6.3 mm, carapace 1.7 to 2.2 long, 1.5 to 2.0 wide. Total length of males 2.7 to 4.0 mm, carapace 1.5 to 2.1 long, 1.2 to 1.6 wide.

Diagnosis. Many females can be separated from other species by the speckled abdomen (Fig. 183) and by the short, finger-shaped scape of the epigynum (Fig. 179). Unlike that of *E. brevispina*, the epigynum

Figures 192–204. *Eustala rosae* Chamberlin and Ivie: 192–198. Female: 192–195. Epigynum: 192. Ventral. 193. Posterior. 194. Lateral. 195. Posterior, cleared. 196. Lateral. 197. Dorsal. 198. Abdomen, ventral. 199–204. Male: 199. Lateral, legs removed. 200. Dorsal. 201. Ventral macrosetae on left femora. 202–204. Left palpus: 202. Mesal. 203. Apical. 204. Ventral.

Scale lines. 0.1 mm except Figs. 196–201, 1.0 mm.



of *E. cleuthera* lacks a constriction in posterior view (Fig. 180), and the median piece is relatively small (Fig. 180). The male has a unique, bent, half-spear-shaped terminal apophysis (Fig. 187) and a very small conductor with a proximally facing pocket in lateral view (Fig. 188).

Distribution. Southern Florida, Bahamas, Jamaica (Map 4).

Records. *Florida.* Monroe Co.: 2 mi. north of Flamingo; Cape Sable. *Bahama Islands.* South Bimini; Long Island; Crooked Island; New Providence. *Jamaica.* St. Andrew Parish: Hope Gardens. St. Thomas Parish: Holland Bay. St. Ann Parish: Claremont.

Eustala cameronensis Gertsch and Davis

Figures 189–191, Map 4

Eustala cameronensis Gertsch and Davis, 1936, Amer. Mus. Novitates, 881: 13, fig. 13, ♂. Male holotype from Cameron Co., Texas in the American Museum of Natural History, examined.

Description. Male holotype: Carapace yellow-brown with dark patches and some tiny black pigment spots posteriorly. Sternum with black pigment spots. Legs yellow-brown. Third and fourth legs banded, the first two unbanded. Dorsum of abdomen with a black-bordered folium. Abdomen is oval with posterior hump indistinct. Total length 4.0 mm. Carapace 2.0 mm long, 1.7 wide. First femur, 3.4 mm; patella and tibia, 3.6; metatarsus, 2.1; tarsus, 0.8. Second patella and tibia, 2.4; third, 1.2; fourth, 2.1.

Diagnosis. The male palpus (Figs. 190, 191) resembles that of *E. clavispina*. As in *E. clavispina* the embolus is partly hidden by the transparent subterminal apophysis (Fig. 190), the terminal apophysis has a

wider neck, and the conductor is of very different shape (Figs. 190, 191). The female is unknown.

Record. *Texas.* Hidalgo Co.: 7 mi. E. Edinburg, 3 Sept. 1953, ♂ (S. Mulaik).

Eustala rosae Chamberlin and Ivie Figures 192–204, 297, 313, Map 5

Eustala rosae Chamberlin and Ivie, 1935, Bull. Univ. Utah, biol. ser., 2(8): 22, fig. 124, abdomen. Juvenile female holotype from Roosevelt Dam, Arizona, lost.

Description. Female from Trinity County, California: Carapace yellow-brown with tiny dark dots. Sternum brown with black spots and some irregular white spots. Legs contrastingly banded, black on brown. Dorsum of abdomen white, brown and black with a distinct folium and a median longitudinal dark line from anterior to posterior (Fig. 197). Sides with thin longitudinal black lines. The abdomen is triangular, pointed behind, with a hump in front of the point and a hump halfway between the point and spinnerets; three humps in a row (Figs. 196, 197). Total length 7.5 mm. Carapace 3.2 mm long, 2.7 wide. First femur, 4.5 mm; patella and tibia, 5.2; metatarsus, 3.2; tarsus, 1.4. Second patella and tibia, 4.5 mm; third, 2.5; fourth, 3.7.

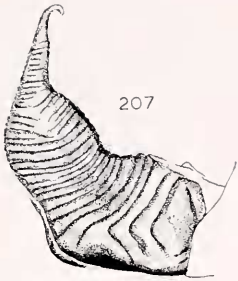
Male from San Diego Co., California: Carapace, legs and sternum much darker than in female. Legs with indistinct light spots. Venter of abdomen black with transverse colorless area behind genital groove (Fig. 198). Abdominal humps as in female (Figs. 199, 200). Dorsum of abdomen has scattered macrosetae. Total length 4.3 mm. Carapace 2.5 mm long, 1.9 wide. First femur, 3.4 mm; patella and tibia, 4.0; metatarsus, 2.6; tarsus, 1.0. Second patella and tibia, 3.0; third, 1.7; fourth, 2.7.

Figures 205–217. *Eustala anastera* (Walckenaer): 205–211. Female (Pennsylvania): 205–208. Epigynum: 205. Ventral. 206. Posterior. 207. Lateral. 208. Posterior, cleared. 209. Lateral. 210. Dorsal. 211. Abdomen, ventral. 212–217. Male (Pennsylvania): 212. Lateral, legs removed. 213. Dorsal. 214. Ventral macrosetae on left femora. 215–217. Left palpus: 215. Mesal. 216. Apical. 217. Ventral.

Scale lines. 0.1 mm except Figs. 209–214, 1.0 mm.



205



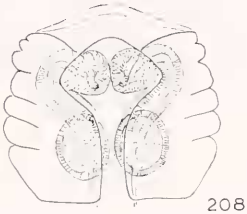
207



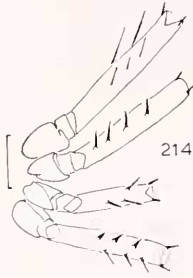
209



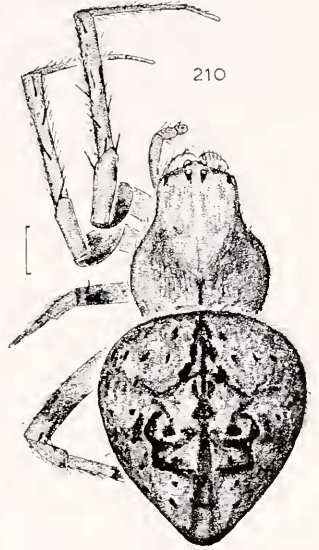
206



208



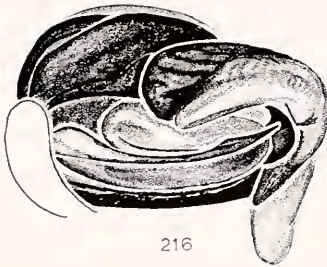
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212



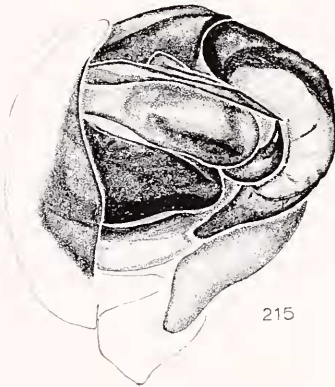
216



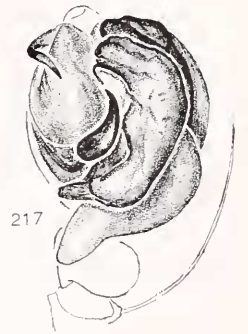
211



213



215



217

Variation. Total length of females 6.8 to 9.0 mm, carapace 2.3 to 3.6 long, 1.9 to 3.1 wide. Total length of males 5.0 to 5.9 mm, carapace 2.6 to 3.0 long, 2.2 to 2.7 wide.

Diagnosis. Females differ from those of related species by having three posterior tubercles in a row on the abdomen (Fig. 196), and by the extra lateral lobe on the base of the epigynum (Figs. 193, 195) in posterior view. Males differ from most related *Eustala* species by the half-spear-shaped tip of the terminal apophysis of the palpus, much wider than its stalk (Figs. 202, 203, 297, 313). Males differ from *E. anastera*, which have a similar terminal apophysis, by lacking macrosetae on the venter of the second femur (Fig. 201).

Natural History. Specimens have been collected from montane forest and juniper woodland, and creosote brush scrub in California. Most mature individuals were collected from April to August.

Distribution. Oregon, Utah to Baja California, New Mexico and Chihuahua (Map 5).

Eustala anastera (Walckenaer)

Plate 7, Figures 205–232, 280–285,
298–302, 314, 315, Map 5

Epeira anastera Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 33. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, drawing no. 381. Copy of manuscript in the Museum of Comparative Zoology, examined.¹ McCook, 1893, *American Spiders*, 3: 172, pl. 8, figs. 1–4, ♀, ♂.

Epeira eustala Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 37. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, drawing no. 119. Copy of manuscript in the Museum of Comparative Zoology, examined.

Epeira apotroga Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 43. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, drawing no. 371. Copy of manuscript in the Museum of Comparative Zoology, examined.

Epeira spatulata Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 44. Type,

Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, drawing no. 366. Copy of manuscript in the Museum of Comparative Zoology, examined.

Epeira illustrata Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 45. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, drawing no. 186. Copy of manuscript in the Museum of Comparative Zoology, examined.

Epeira decolorata Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 49. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, drawing no. 345. Copy of manuscript in the Museum of Comparative Zoology, examined.

Epeira triflex Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 60. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, illustration no. 112. Copy of original in the Museum of Comparative Zoology, examined.

Epeira trinotata Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 75. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, illustration no. 272. Copy of original in the Museum of Comparative Zoology, examined.

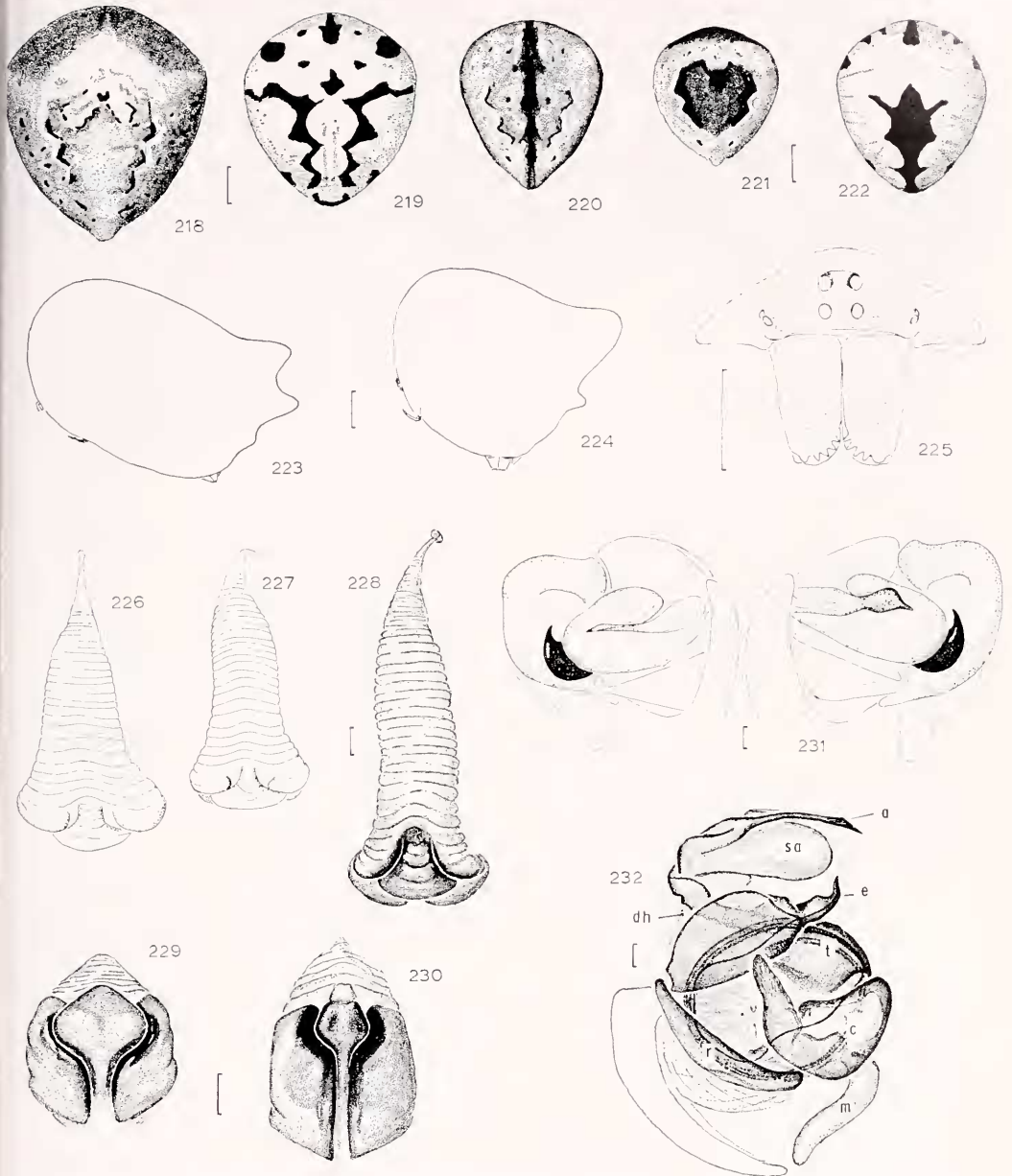
Eustala anastera.—Chamberlin and Ivie, 1944, *Bull. Univ. Utah, biol. ser.*, 7(5): 102, fig. 4. Kaston, 1948, *Bull. Connect. Geol. Nat. Hist. Surv.*, 70: 233, figs. 706–709, 727, ♀. Bonnet, 1956, *Bibliographia Araneorum*, 2(2): 1837 (in part only).

Note. I have listed only the first Abbot figure cited by Walckenaer for each name. *Epeira circulata* Walckenaer, 1841, p. 79, may have been an *Eriophora*, probably not *Eustala* as indicated by Chamberlin and Ivie (1944).

Description. Female from Pennsylvania: Carapace brown, sides of thorax darker. Thorax covered with white hairs and down. Legs dark, banded. Dorsum of abdomen with folium or longitudinal dark line. Abdomen triangular, longer than wide with a distinct posterior dorsal hump (Figs. 209, 210). Total length 7.5 mm, carapace 2.7 mm long, 2.4 wide. First femur, 3.4 mm; patella and tibia, 4.2; metatarsus, 2.4; tarsus, 0.9. Second patella and tibia, 3.6 mm; third, 1.7; fourth, 3.2.

Male from Pennsylvania: Coloration as in female. Total length 4.8 mm. Carapace

¹ See footnote under *Cyclosa turbinata*.



Figures 218-232. *Eustala anastera* (Walckenaer): 218-222. Dorsal patterns of female abdomen. 218. (Pennsylvania). 219. (West Virginia). 220. (Michigan). 221, 222. (Florida). 223, 224. Female abdomen, lateral. 223. (Georgia). 224. (southern Texas). 225. Female eye region and chelicerae. 226-228. Epigynum. 226-228: Ventral. 229, 230. Posterior. 226, 227. (Kerr Co., Texas). 228. (Goliad Co., Texas). 229. (Nova Scotia, Canada). 230. (Cimarron Co., Oklahoma). 231. Left and right palpi from same individual (Grant Par., Louisiana). 232. Left palpus expanded.

Scale lines. 0.1 mm except Figs. 218-225, 1.0 mm.

Abbreviations. a, terminal apophysis; c, conductor; dh, distal hematodocha; e, embolus; m, median apophysis; r, radix; sa, subterminal apophysis; t, tegulum.

2.5 mm long, 2.2 wide. First femur, 3.6 mm; patella and tibia, 4.3; metatarsus, 2.9; tarsus, 1.2. Second patella and tibia, 3.0 mm; third, 1.8; fourth, 2.8.

Variation. The pattern is variable although most specimens are dark. Some specimens have a folium on the abdomen (Figs. 210, 218, 221), some have black patches on white (Figs. 219, 222), others only a longitudinal median line (Fig. 220). Females from Texas have two humps in a line (Fig. 224), as do occasional females from other areas (Fig. 223); one from Cimarron, Oklahoma, had three. The hump is smaller in the northeastern part of the range, where *E. emertoni* is not found, and the epigynum has a larger middle piece in posterior view (Fig. 229) and resembles that of *E. emertoni*.

Males sometimes have a short and pointed terminal apophysis (Fig. 315). Such males included those collected and determined by W. Ivie from eastern Pennsylvania, one each from Alabama (Mobile), Mississippi (Jefferson City), West Virginia, Virginia, South Dakota, Idaho, Texas, Oklahoma, Mississippi, Ontario, Connecticut (New Canaan), and all males from Michigan. The smaller males in Florida may have only one macroseta on the second femur, sometimes only on one side. But several very large males lacked these macrosetae entirely: one from Calhoun Co., Arkansas, one from Boston, Mass., one from Lebanon State Forest, New Jersey and one from Center Harbor, New York. Most males from the northeastern part of the range, where *E. emertoni* and *E. cepina* are not found, lack these macrosetae and the outer, "upper," bulge of the conductor is smaller (Fig. 298).

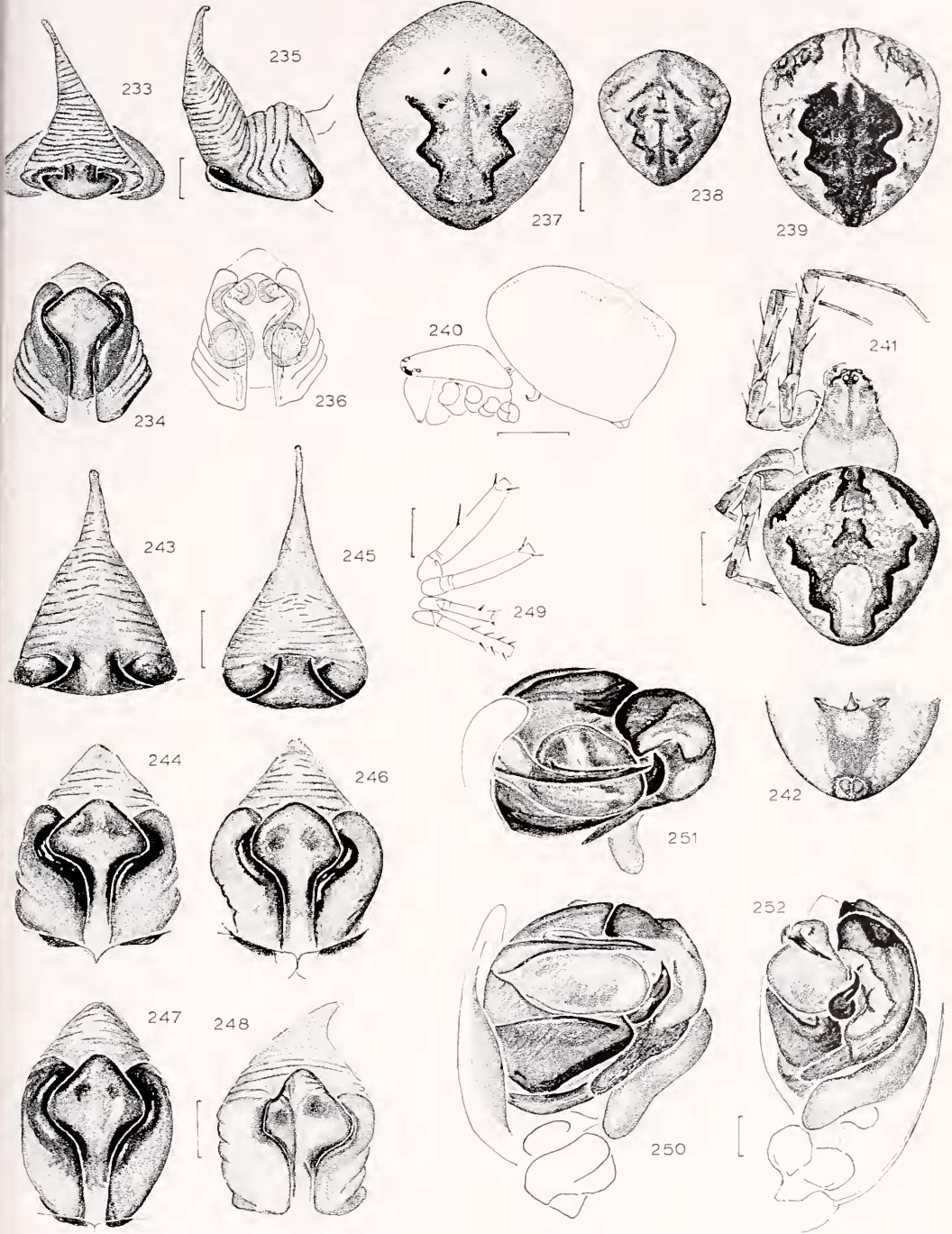
Total length of females 5.4 to 10.0 mm, carapace 2.5 to 3.3 long, 2.3 to 2.6 wide. Total length of males 3.9 to 9.5 mm, carapace 2.2 to 4.8 long, 1.8 to 4.0 wide. The smallest specimens all came from central and southern Florida.

Diagnosis. The species differs from the related *E. emertoni* and *E. cepina* by being darker and larger. Females differ from *E. cepina* by size, color and shape of the abdomen (Figs. 209, 210), from *E. emertoni* by having the median area of the base in posterior view smaller than each lateral area (Figs. 280–285) (but in eastern Canada where *emertoni* is absent, the epigynum may resemble that of *E. emertoni*). The abdomen is longer than wide with a distinct posterior hump (unlike *E. emertoni*). The epigyna are larger, 0.36 (Florida), to 0.58 mm wide (the smallest from south central Florida) than those of *E. cepina*. Females differ from the western *E. rosae* and *E. conchlea* by the shape of the epigynum in posterior view. The contrasting black and white pattern (Figs. 219, 222) found in some individuals is diagnostic; it is not found in related species.

Males differ from *E. rosae*, *E. emertoni* and *E. cepina* by having a row of three to five short macrosetae on the venter of the second femur (Fig. 214); rarely, in small Florida specimens, there is only one. (These macrosetae may be absent in individual males and always absent in those from eastern Canada.) The conductor is smaller and its tail shorter than that of *E. triflex* and *E. cepina* (Figs. 298–302). Most of the conductor is "above" the embolus, the portion "below" the embolus is less in length than the embolus height. The terminal apophysis

→
 Figures 233–252. *Eustala cepina* (Walckenaer): 233–236. Epigynum. (Pennsylvania): 233. Ventral. 234. Posterior. 235. Lateral. 236. Posterior, cleared. 237–239. Dorsal patterns of female abdomen (all Texas): 240–242. Female (Pennsylvania): 240. Lateral, legs removed. 241. Dorsal. 242. Abdomen, ventral. 243–248. Epigynum: 243, 245. Ventral. 244–248. Posterior. 243, 244. (New Jersey). 245, 246. (Missouri). 247. (Kansas). 248. (Emmet Co., Michigan). 249–252. Male (Pennsylvania): 249. Ventral macrosetae of left femora. 250–252. Left palpus: 250. Mesal. 251. Apical. 252. Ventral.

Scale lines. 0.1 mm except Figs. 237–242, 249, 1.0 mm.



tip is usually (but not always) "half-spear-shaped" and wider than its neck (Figs. 215, 314), but not so wide as that of *E. rosae*. In both *E. triflex* and *E. cepina*, the terminal apophysis tip is only rarely wider than its neck. In *E. rosae* it is wider but, as in the other two species, lacks the line of ventral macrosetae on the second femur. The conductor of the palpus, unlike that of *E. cepina*, has an "upper, outer" lobe (seen upper right in Figs. 299, 302); the palpus is much larger (0.91 to 1.6 mm wide in mesal view) than that of *E. cepina*.

Natural History. *Eustala anastera* is commonly found as prey in *Trypoxylon* and *Trypargilum* mud-dauber wasp nests. The species is found in diverse habitats. Collecting sites are goldenrod (*Solidago*) fields, chokeberry, an apple tree in Ontario, a tamarack bog (*Larix occidentalis*) in Manitoba, a balsam fir tree (*Abies balsamea*) in New Brunswick, a white spruce (*Picea glauca*) in New Brunswick, maple woods in Wisconsin, and tamarack (*Larix occidentalis*). Specimens have also been collected by sweeping a marsh, in xeromesic woods, by beating dead oak branches, by sweeping *Poa pratense*, in a web in dead twig in Michigan, in loblolly pine (*Pinus taeda*) in Arkansas; in oak-pine flatwoods, by sweeping turkey oak (*Quercus laevis*) scrub, by sweeping cypress (*Taxodium*) swamp edge, in palm-cypress (*Taxodium*), in red mangrove (*Rhizophora*) hammock, along a road, in a web in Spanish moss (*Tillandsia usneoides*), on *Pinus clausa*, and near scrub oak in Florida. I think one requirement for *Eustala anastera* is dead branches in a relatively open wooded area or along wood borders. Comstock (1940) reports vertical webs from low bushes. The spider does not make a retreat but sits on bark or dead branches to the side of the web, "the spider closely resembling the bark of the tree or other plant on which it rests; and they act as if conscious of this protection, running only a short distance when disturbed and then crouching down close to the bark." Kaston (1948) reports *Eustala anastera* as

being one of the few orb-weavers overwintering in the penultimate instar. Males are found throughout the season but, even in Florida, are more common in spring. The web illustrated by Plate 7 is described in the introduction as belonging to *Eustala*.

Distribution. Throughout southern Canada and the United States, except perhaps within the range of the similar *E. rosae* in California. The southern limits are unknown but are believed to be Central America (Map 5).

Eustala cepina (Walckenaer)

Figures 233–252, 286–290, 303–308, 316, Map 5

Epeira cepina Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 37. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, *Natural History*, drawings no. 173 and 175. Copy of original in Museum of Comparative Zoology, examined.

Epeira parvula Keyserling, 1863, *Sitzungsber. Naturf. Gesellsch. Isis, Dresden*, p. 131, pl. 6, figs. 9, 10, ♀. Female lectotype here designated from Baltimore in the British Museum, *Natural History*. One female, one male paralectotypes are *E. cepina*, another female *E. anastera*; one juvenile female paralectotype from Peoria is *E. anastera*. NEW SYNONYMY.

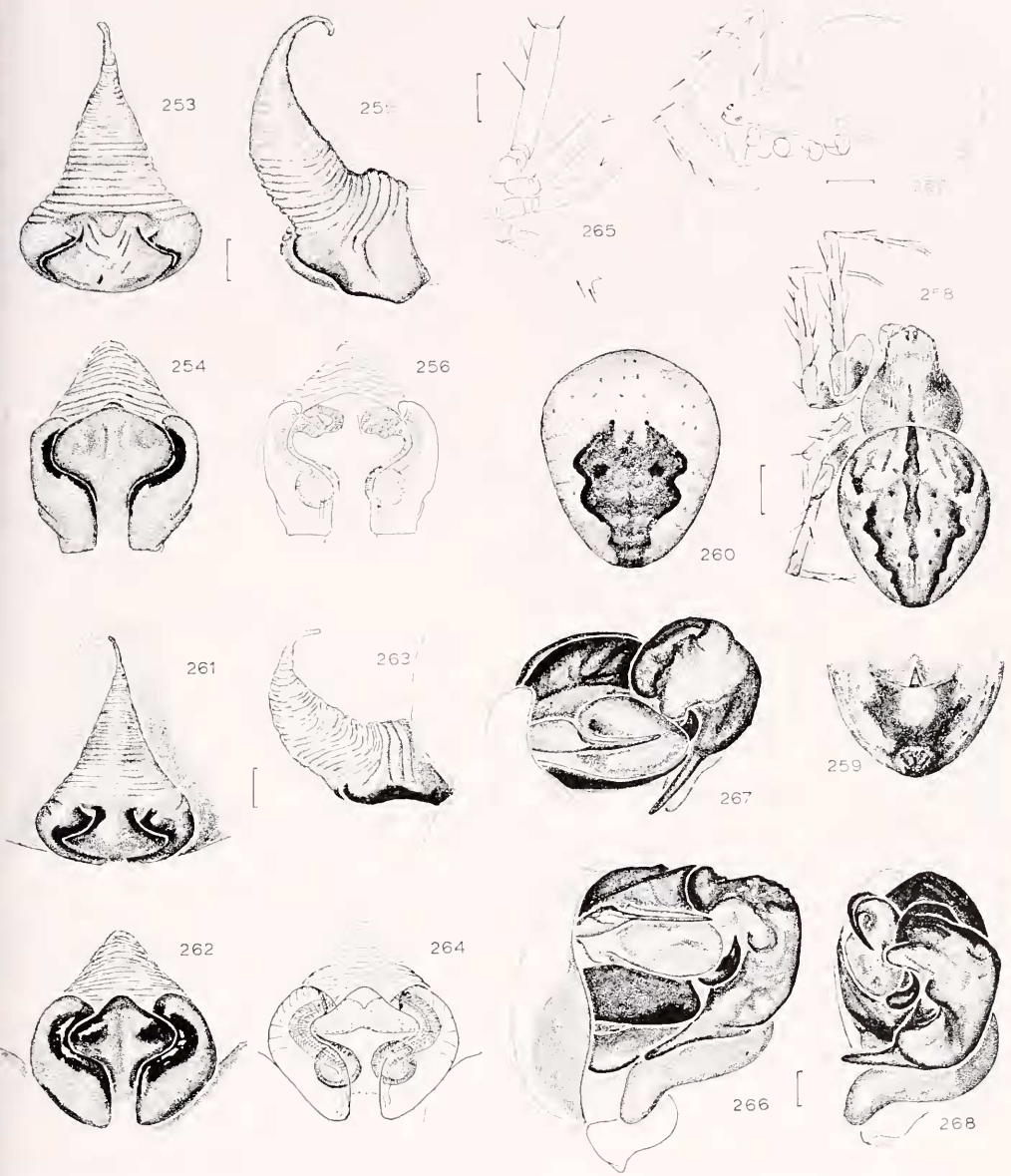
Eustala cepina.—Chamberlin and Ivie, 1944, *Bull. Univ. Utah, biol. ser.*, 7(5): 103.

Eustala arkansana.—Archer, 1951, *Amer. Mus. Novitates*, no. 1487: 19, fig. 47, ♀. Female allotype not male holotype.

Note. Most specimens in collections had been labeled *E. anastera*, but A. F. Archer called this species *A. triflex*.

Description. Female from Pennsylvania: Carapace orange-brown. Sternum orange-brown with some white spots. Legs orange-brown, slightly banded. Dorsum of abdomen with a folium. The abdomen is triangular, almost as wide as long (Figs. 237–241). Total length 5.5 mm. Carapace 2.3 mm long, 1.7 wide. First femur, 3.2 mm; patella and tibia, 3.6; metatarsus, 1.9; tarsus, 0.8. Second patella and tibia, 2.6 mm; third, 1.4; fourth, 2.2.

Male: Coloration as in female. The abdomen is oval, triangular. Total length 3.3



Figures 253-268. *Eustala emertoni* (Banks): 253-259. Female (Pennsylvania): 253-256. Epigynum: 253. Ventral. 254. Posterior. 255. Lateral. 256. Posterior, cleared. 257. Lateral. 258. Dorsal. 259. Female abdomen, ventral. 260. Dorsal pattern of female abdomen (Texas). 261-264. Epigynum (Connecticut): 261. Ventral. 262. Posterior. 263. Lateral. 264. Posterior, cleared. 265-268. Male (Pennsylvania): 265. Ventral macrosetae of left femora. 266-268. Left palpus: 266. Mesal. 267. Apical. 268. Ventral.

Scale lines. 0.1 mm except Figs. 257-260, 265, 1.0 mm.

mm. Carapace 1.7 mm long, 1.5 wide. First femur, 2.2 mm; patella and tibia, 2.7; metatarsus, 1.8; tarsus, 0.8. Second patella and tibia, 2.3 mm; third, 1.0; fourth, 1.8.

Variation. The color variation of the abdomen is less than that of *E. anastera*, a black median longitudinal line is common (Figs. 237–241). Total length of females 3.4 to 7.9 mm, carapace 1.4 to 2.9 long, 1.3 to 2.2 wide. Total length of males 2.5 to 4.3 mm, carapace 1.5 to 2.4 long, 1.2 to 2.0 wide. The smallest specimens, females measuring total length 3.4 to 4.5 mm, epigynum less than 0.38 mm wide, all came from southern Florida. Some specimens appear intermediate with *E. emertoni* and perhaps *E. anastera*.

Diagnosis. The abdomen is triangular (Figs. 237–241), almost as wide as long, and may lack a dorsal pattern. The middle area of the epigynum in posterior view is larger or subequal to the lateral (unlike *E. emertoni*) (Figs. 236, 244, 247, 286–290). The epigynum is much smaller in size (0.28 to 0.38 mm wide) than that of *E. anastera*. The male differs from *E. emertoni* in that the longer terminal apophysis overhangs the bubble-like subterminal apophysis (Figs. 303–308, 316). The conductor lacks the lobe (to the upper right in Figs. 303–308) present in both *E. anastera* and *E. emertoni*. The conductor is smaller (Figs. 303–308) than that of *E. emertoni* and *E. anastera*. The embolus sits in the middle of the conductor, not in the “lower” half as is common in *E. anastera*. The palpus is also always smaller in size (about 0.65 to 0.72 mm wide) than in *E. anastera* and *E. emertoni*.

Natural History. *Eustala cepina* is commonly found as prey in mud-dauber wasp nests, of *Chalybina* wasps in Oklahoma. It has been found on lake shores in Michigan and Wisconsin, in dune grass and mixed forest in Wisconsin, by sweeping weeds in Illinois, in pine dunes in Indiana, by sweeping around a pond in Pennsylvania, in a garden in North Carolina, on pecan trees in

South Carolina, in low grass and an urban area in Alabama, in pond vegetation, on wheat and cotton in Arkansas, on weeds beside a road in Mississippi, by beating cedar (*Taxodium*) branches on a slope near a stream in Georgia; in oaks along a beach, in grasslands, and on a small oak in an open area in mesic hammock in Florida. The spiders also probably rest on dead branches next to the web without retreat. It seems to prefer wetter areas than does *E. anastera*.

Distribution. New England south to Florida, Ontario, Wisconsin, Colorado, central Texas to Mexico (Map 5).

Eustala emertoni (Banks)

Figures 253–268, 291–295, 309–311, 317, Map 5

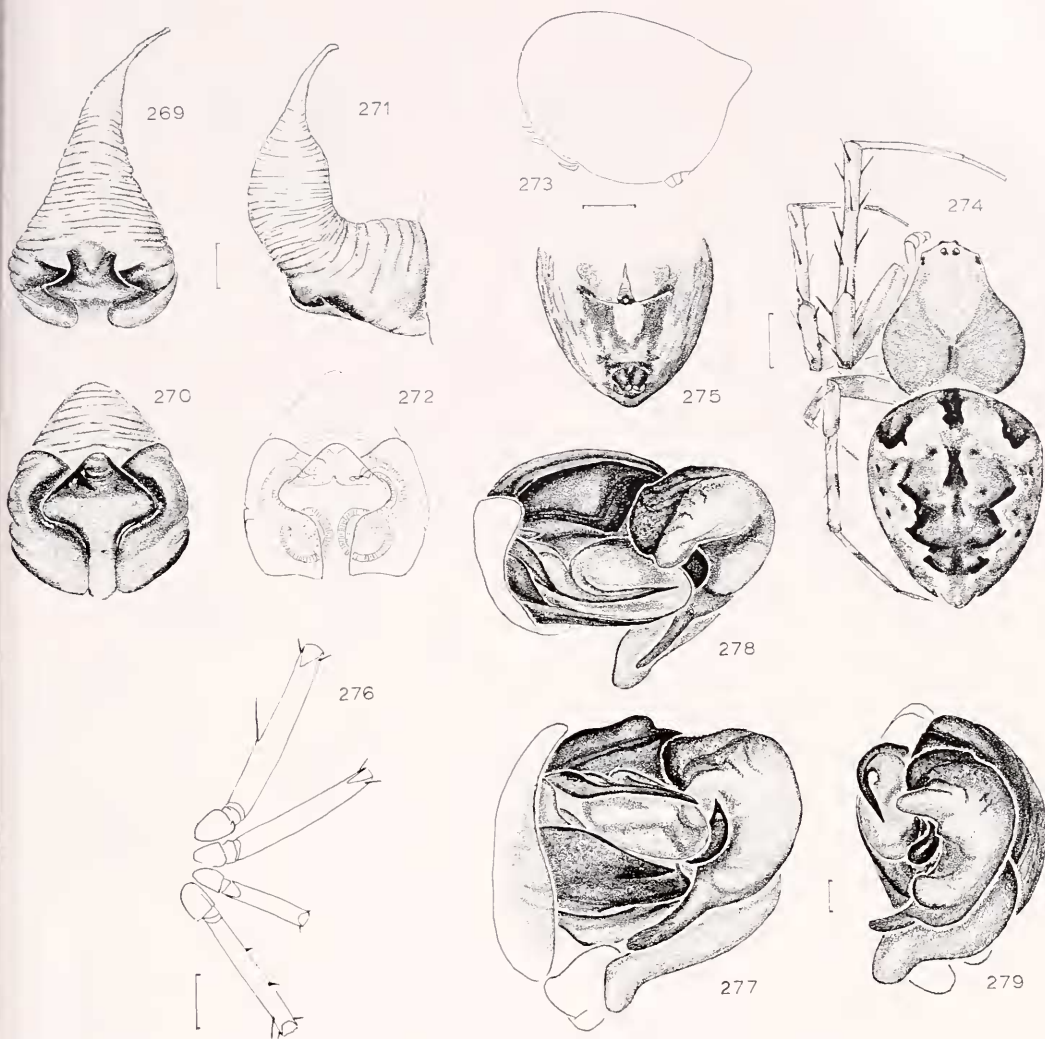
? *Epeira petasata* Walckenaer, 1841, *Histoire Naturelle des Insectes Aptères*, 2: 70. Type, Abbot manuscript, Spiders of Georgia, in the British Museum, Natural History, illustration no. 135. Copy of original in Museum of Comparative Zoology, examined. Doubtful name.

Epeira emertoni Banks, 1904, *J. New York Entomol. Soc.*, 12: 111. Female syntypes from Sea Cliff, N.Y., Washington, D.C., and Auburn, Alabama, lost.

Eustala triflex.—Chamberlin and Ivie, 1944, *Bull. Univ. Utah, biol. ser.*, 8(5): 103 (not *E. triflex* Walckenaer).

Eustala arkansana Archer, 1951, *Amer. Mus. Novitates*, no. 1487: 19, fig. 44, ♂, not ♀. Male holotype from Berryville, Carroll Co., Arkansas, in the American Museum of Natural History, examined. NEW SYNONYMY.

Note. This species, called *Eustala triflex* by Chamberlin and Ivie (1944), is not *E. triflex* Walckenaer. *Eustala triflex*, fig. no. 112 of Abbot's manuscript, Spiders of Georgia, is contrastingly white and black as in Figures 219, 222, a coloration not found in this species. The same comment applies to the name *E. trinotata* Walckenaer, Abbot's fig. no. 272. Chamberlin and Ivie believed Hentz's *bombycinaria* to be this species. The light shoulder spots of *bombycinaria* Hentz are found, as in fig. 16, plate 31, but they are not white as shown by Hentz in the figures and in a colored manu-



Figures 269–279. *Eustala conchlea* (McCook): 269–275. Female: 269–272. Epigynum: 269. Ventral. 270. Posterior. 271. Lateral. 272. Posterior, cleared. 273. Abdomen, lateral. 274. Dorsal. 275. Abdomen, ventral. 276. Male ventral macrosetae on left femora. 277–279. Male left palpus: 277. Mesal. 278. Apical. 279. Ventral.

Scale lines. 0.1 mm, except Figs. 273–276, 1.0 mm.

script illustration at Harvard University. Banks was the first to describe the species and give diagnostic characters.

Description. Female from Pennsylvania: Head region much lighter than sides of thorax. Carapace with white down. Sternum with some black pigment marks. Legs with only femora banded. Dorsum of ab-

domen with very distinct contrasting folium (Fig. 258). The abdomen is oval without hump (Figs. 257, 258). Total length 5.6 mm. Carapace 2.3 mm long, 2.0 wide. First femur, 3.0 mm; patella and tibia, 3.6; metatarsus, 1.9; tarsus, 0.7. Second patella and tibia, 2.9 mm; third, 1.5; fourth, 2.5.

Male from Pennsylvania: Coloration and

shape as in female. Total length 4.3 mm. Carapace 2.3 mm long, 1.7 wide. First femur, 3.0 mm; patella and tibia, 3.4; metatarsus, 2.0; tarsus, 0.8. Second patella and tibia, 2.4; third, 1.4; fourth, 1.9.

Variation. The abdominal pattern is similar in most specimens (Fig. 258), some have a dark triangle on the dorsum (Fig. 260). Total length of females 3.4 to 7.6 mm, carapace 1.7 to 3.5 long, 1.5 to 2.9 wide. Total length of males 3.8 to 5.0 mm, carapace 2.4 to 2.6 long, 1.8 to 2.2 wide. Southern Florida females measure 5.0 to 6.1 mm total length, carapace 2.0 to 2.3 long, 1.7 to 2.0 wide.

Diagnosis. The abdomen of females is egg-shaped, widest anteriorly, the posterior hump absent; the median area of the epigynum in posterior view is distinctly larger than the small posterior lateral areas (Figs. 254, 262, 291–295), unlike that of *E. anastera* and, usually, of the smaller *E. cepina*. The epigynum is 0.4 to 0.5 mm wide, larger than that of *E. cepina*. It is similar to the epigynum of *E. conchlea* in the west, but the abdominal hump of *E. conchlea* is lacking in *E. emertoni*.

Males lack macrosetae on the venter of the second leg femora (Fig. 265). The tip of the terminal apophysis of the palpus is shorter than the bubble-like subterminal apophysis, unlike that of *E. cepina*. The conductor is much larger than that of *E. cepina* and *E. anastera* and, unlike that of *E. cepina*, is bulging "on top" and has a thin tail, about five times as long as wide (Figs.

266, 309–311, 317). The palpus is 0.8 to 1.2 mm wide.

Natural History. Specimens have been collected as prey by *Chalybion* wasps in Oklahoma and other mud-dauber wasps, in button woods (*Platanus* sp.) in Rhode Island (the northernmost locality), in wheat and in alfalfa in Arkansas, in a broom-sedge (*Andropogon virginicus*) field and bottomland pine-hardwood forest in North Carolina, in pinewoods and salt marsh in Georgia, in roadside low weeds and grass in Mississippi, in a wooded area in Texas, in pine-flatwoods, bottomland, palmetto flatwoods, and around a swamp in Florida.

Distribution. Rhode Island, Michigan to Florida, Kansas, central Texas and north-eastern Mexico (Map 5).

Eustala conchlea (McCook)

Figures 269–279, 296, 312, 318,
Map 5

Epeira parvula var. *conchlea* McCook, 1888, Proc. Acad. Sci. Philadelphia, p. 199, fig. 6, ♀. Specimens from Wisconsin and California. Female lectotype from California, here designated, and numerous female and male paralectotypes of the same species and one female paralectotype which is *E. californiensis*, all in the Academy of Natural Sciences, Philadelphia, examined. Wisconsin specimens do not survive.

Epeira anastera var. *conchlea* McCook, 1893, American Spiders, 3: 174, pl. 8, fig. 1n.

Eustala anastera buliafera Chamberlin, 1924, Proc. Calif. Acad. Sci., 4 ser., 12: 650. Female holotype from Isla Partida, Gulf of California in the California Academy of Sciences, examined.
NEW SYNONYMY.

Figures 280–296. Epigyna of the *E. anastera* group.

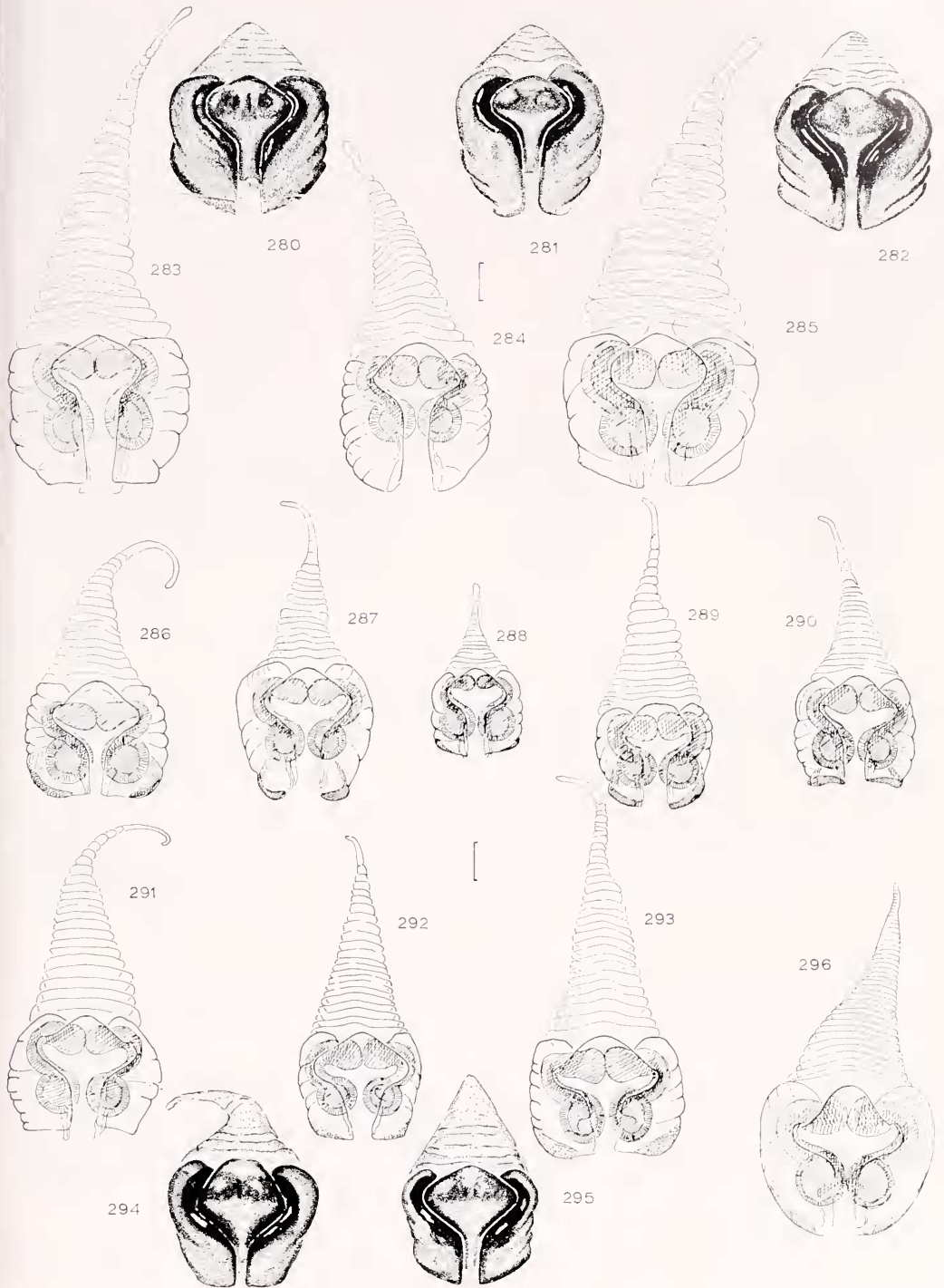
Figures 280–285. *Eustala anastera* (Walckenaer): 280–282. Posterior: 283–285. Mounted and cleared on a microscope slide: 280. (Michigan). 281. (northern Florida). 282. (Texas). 283. (Pennsylvania). 284. (Highland Co., Florida). 285. (Texas).

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Figure 296. *Eustala conchlea* (McCook).

Scale line. 0.1 mm.



Eustala anastera leuca Chamberlin, 1924, Proc. Calif. Acad. Sci., 4 ser., 12: 650. Female holotype in poor physical condition from Santa Inez Island, Gulf of California in the Academy of Sciences, examined, NEW SYNONYMY.

Note. In 1935 (p. 22), Chamberlin and Ivie compared the new *E. rosae* to *E. conchlea*, presumably considering them sympatric. In 1944, however, they consider "*Epeira anastera* var. *conchlea* McCook, *Ibid.*, 173 (in part, including type)" a synonym of *E. anastera*.

Description. Female from Laguna Beach, California: Head region yellow-brown, thoracic region darker. Black rings around posterior median eyes. Sternum with black pigment. Legs banded. Dorsum of abdomen with folium and median longitudinal dark line (Fig. 274). The abdomen has one posterior dorsal hump. Total length 5.3 mm. Carapace 2.4 mm long, 1.9 wide. First femur, 3.3 mm; patella and tibia, 3.9; metatarsus, 1.9; tarsus, 0.9. Second patella and tibia, 3.0 mm; third, 1.6; fourth, 2.6.

Male from Los Angeles, California: Carapace more evenly brown than in female and legs less banded. The posterior dorsal tubercle of the abdomen is distinct. Total length 5.2 mm. Carapace 2.7 mm long, 2.2 wide. First femur, 4.1 mm; patella and tibia, 4.5; metatarsus, 2.9; tarsus, 1.1. Second patella and tibia, 3.5 mm; third, 1.9; fourth, 3.0.

Variation. The variation is less than in other species. One female had a second tubercle below the posterior dorsal hump. Females measure total length 4.6 to 7.9 mm, carapace 2.2 to 3.2 mm long, 1.8 to 2.6 wide. Males, total length 4.3 to 5.0 mm, carapace 2.2 to 2.6 long, 1.9 to 2.2 wide. Specimens from Baja California and Arizona tend to be larger; a male from Tucson, Arizona, 6.4 mm long, carapace 3.4 long, 2.7 wide.

Diagnosis. The shorter, pointed terminal apophysis of the palpus (Figs. 277, 278, 312, 318), the posterior view of the epigynum (Fig. 270), and the single posterior dorsal hump (Fig. 273) separate *E. conchlea* from the sympatric *E. rosae*. *Eustala conchlea* is very similar to the eastern North American *E. emertoni*. Specimens differ from *E. emertoni* by having a posterior dorsal hump on the abdomen, while the abdomen of *E. emertoni* is egg-shaped, narrow behind without hump.

Natural History. This species has been collected from grassy fields, from tall weeds, and from reeds along a lagoon.

Distribution. Central California coast, Arizona, Baja California and Sinaloa.

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Figures 297-312. Conductor (stippled), embolus and terminal apophysis tip (black) and median apophysis (white) of left palpus of *E. anastera* group. (Note different enlargements.)

Figure 297. *Eustala rosae* Chamberlin and Ivie.

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Figure 312. *Eustala conchlea* (McCook).

Figures 313-318. Distal parts of palpus of the *E. anastera* group. (Note different enlargements.) 313. *Eustala rosae*. 314, 315. *Eustala anastera*. 314. (New Jersey). 315. (Pennsylvania). 316. *Eustala cepina* (Pennsylvania). 317. *Eustala emertoni* (Florida). 318. *Eustala conchlea*.

Scale lines. 0.1 mm.



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