AN ACCOUNT OF THE CRUSTACEA COLLECTED BY THE WALKER EXPEDITION TO SANTA MARTA, COLOMBIA.

By A. S. Pearse,

Honorary Curator of Crustacea, University of Michigan.

INTRODUCTION.

The Crustacea of Colombia have been studied now and then, and some species have been described which are not known to occur elsewhere, but no one has ever visited the country for the express purpose of studying its carcinological fauna. It was with great pleasure, therefore, that the writer accepted an invitation to accompany the Walker Expedition, sent during the summer of 1913 by the Museum of Zoology, University of Michigan, to investigate the region about Santa Marta, on the southern shore of the Caribbean Sea. A general account of the country has been published elsewhere (Pearse, '14).

This part of South America offers an admirable variety of habitats. The map (fig. 1) gives the general features of the country. Along the coast there is a strip of desert about 7 miles wide, the flora of which consists largely of acacias and great cacti. Beyond this the mountains rise abruptly to the snow peaks of the Sierras. From July 1 to 26 the party made its headquarters on the Cincinnati Coffee Plantation, at an altitude of 4,500 feet, whence it was possible in a single day to tramp to the top of San Lorenzo (8,300 feet) and return, or to go down to Minca (2,000 feet). The mountains were covered with a luxuriant forest and it rained every afternoon. From July 28 to August 4 we studied the fauna about "La Rosa," an irrigated tract of land in the midst of a desert, the aridity of which was relieved somewhat by swift streams originating in the mountains above. From the desert we went to Fundacion, a village on the bank of a good-sized river which flowed rapidly over a sandy bottom. Here it was extremely hot and there was rain only twice during the two weeks of our stay. The surrounding country was rather dry and sandy; the forest being less dense than in the mountains above. Two days, August 22 and 23, were spent in the mangrove swamps along the Cienaga Grande on Tasajera Isla. After that (August 25 to 30) headquarters were made in Santa Marta and the sluggish rivers in that vicinity were explored. A trip was also made to Gaira, a village down the coast near the mouth of a river.

Through the indulgence of the chief of the expedition the writer was able to devote his whole time to the collection and study of crustaceans, and, as a thorough search was made in each locality visited, the list of species is believed to be representative. My thanks are due to Dr. A. G. Ruthven, who led the expedition, and to Mr. F. M. Gaige, who completed the party. Both were constantly on the alert for crustaceans and helped very materially in securing specimens and notes. My thanks are also due to Miss Mary J. Rathbun, who read the manuscript of this paper, gave many valuable suggestions, and furnished photographs for the figures of the crabs appearing in this paper.

CRUSTACEAN HABITATS.

The crustaceans of Colombia live in a variety of habitats. The aquatic representatives may dwell in the cool swift torrents on the tops of mountains, in the sluggish meandering streams of the lowlands, or among the luxuriant vegetation in the swamps. Terrestrial crustaceans may live in bromeliads, in the rough bark of trees, among fallen leaves, under logs, in rotting tree trunks, in the ground or on its surface. Some crabs and isopods are amphibious, wandering from land to water and back again as suits their convenience. The habitats in the vicinity of Santa Marta may be grouped under the following headings: Ocean, mangrove swamps, streams, forest, desert.

No attempt is made in this paper to consider the marine Crustacea, but it is impossible to study those of land or fresh water without discussing many marine crabs, such as the Gecarcinidae, Ocypodidae, Grapsidae, and Coenobitidae, which wander about on the banks of estuaries (*Uca*, *Gecarcinus*), climb among the mangroves (*Sesarma*), or migrate far inland along the banks of rivers (*Cardisoma*).

The mangrove swamps along the Cienaga Grande swarmed with fiddler crabs (*Uca mordax* and *U. minax*), which live in holes in the mud among the thickly crowded aerial roots. Sesarmas (*S. roberti*) climbed about over the mangroves, dodging beneath roots or into their holes when disturbed. These mangrove crabs have a habitat which furnishes them an abundance of food, but they often fall a prey to the herons and raccoons, which are extremely common.

The streams near Santa Marta are of two sorts: (1) Swift mountain torrents flowing over solid rock or bowlders, and (2) the slow-flowing rivers of the flat country along the coast. The rapid-flowing mountain streams contain no proper crustacean fauna, though the amphibious crabs, *Pseudothelphusa*, and isopod, *Philoscia nitida*, are often found there. Both these crustaceans are also of frequent occurrence on land at considerable distances from water. As soon as the streams lose the impetus of their descent from the mountains, however, they are invaded by a horde of shrimps and prawns. The favorite resort of the strange *Atya scabra* is among the collections of leaves and other

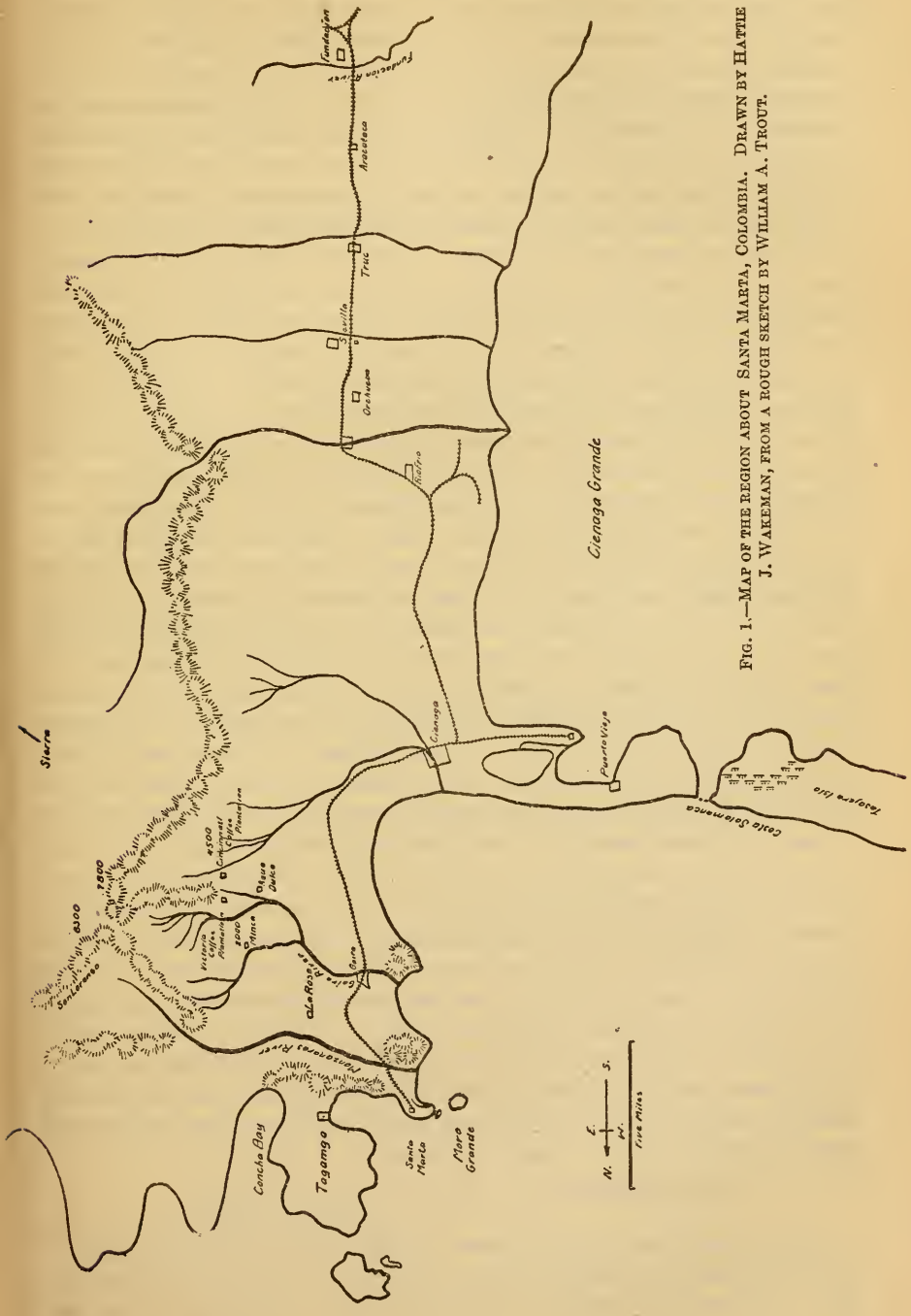


FIG. 1.—MAP OF THE REGION ABOUT SANTA MARTA, COLOMBIA. DRAWN BY HATTIE J. WAKEMAN, FROM A ROUGH SKETCH BY WILLIAM A. TROUT.

débris which catch on logs or sticks. Here they spread the nets on their claws and scrape up the organic sustenance which the surrounding water contains. Prawns, great and small, lurk under stones or logs or secrete themselves in the vegetation along the shores.

Swamps supported an abundance of entomostracans, but with the exception of an occasional fresh-water crab (*Trichodactylus quinquedentatus* or *T. dentatus*), no higher Crustacea were found. Ostracods crawled over the floating vegetation, copepods and cladocerans often swarmed in the water. Around the margins of swamps land crabs were often abundant, living in short burrows beneath logs.

The rain forest had a greater variety of crustacean inhabitants than any other region. This was to be expected if the variety of habitats and the abundance of food were considered. The most widely distributed genus was *Philoscia, P. nitida,* being the most abundant species. This isopod was usually found in rather damp places—under stones in brooks; along the edges of streams; on the ground under leaves, sticks, logs, or stones; in bromeliads; and on trees. When the foraging ants invaded the forest it could be seen fleeing over the ground or up the trunks of trees. *P. walkeri* and *P. culebrae* were less abundant. They were found under logs or leaves. *Ligyda richardsonae* was very common and resembled *Philoscia nitida* in its habits. The usual haunt of *Cubaris brevispinis* was under the scaly bark of a certain tree with an extremely rough trunk, though it was sometimes found on the ground under leaves or logs. Other species of isopods frequented rotten logs or the ground under fallen leaves. *Minca ruthveni* was extremely abundant in such situations. The forest crabs in the region about Santa Marta were *Pseudothelphusa pearsei* and *P. clausa,* which were common everywhere at the Cincinnati Coffee Plantation—under logs far from water, in streams, walking over the ground during showers.

In the desert along the coast there were no characteristic crustaceans except *Coenobita diogenes* which wandered about among the sparse vegetation in rocky situations. Nevertheless, there were a number of crustaceans in the desert. Along the streams where the forest crept down into the lowlands some characteristic species from above were found (*Philoscia culebrae, Cubaris brevispinis,* etc.). Some crabs (*Trichodactylus dentatus, T. pictus, T. quinquedentatus*) which were not met in the forest at higher altitudes were also found along these streams. In the water itself there were the shrimps and prawns characteristic of larger streams.

REMARKS ON THE ECOLOGY OF CRUSTACEA.

It is interesting to observe how in their habits different types of animals cling to racial traditions. Many of the Amphibia, such as the toads and tree frogs, are truly terrestrial, yet most of them go back to the water during the breeding season. On the other hand.

the Reptilia all breed on land; even the marine turtles and sea snakes which spend their lives in the open ocean come back to the shore to lay their eggs. Among invertebrates representatives of but two phyla have taken generally to terrestrial habitats—the arthropods and the mollusks, both provided with a strong exoskeleton. In the Arthropoda the Crustacea hold a position like the Amphibia among the vertebrates, for they are in the midst of a transition from aquatic to terrestrial habitats. In fact this class shows every gradation in mode of life—marine, fresh-water, terrestrial, arboreal. Everything indicates that crustaceans had their origin in the ocean and subsequently invaded other habitats. What are the factors, then, which have been influential in enabling these animals to take up new modes of existence or have prevented them from doing so? How have they left the ocean and become adjusted to new habitats?

Crustaceans have two peculiarities which are of considerable ecological importance. They carry their eggs about with them so that the distribution of the various species is not closely limited by breeding conditions, as is the case with many animals which deposit eggs; as, for example, insects whose larvae require particular food plants, fishes which can nest only on certain kinds of bottom, etc. Furthermore, the class as a whole is strongly committed structurally to respiration by means of gills and this fact has apparently offered the most serious obstacle to the invasion of the land.

The lessened salinity of fresh water has apparently not been important in limiting crustaceans in their migration in streams, swamps, or lakes. Several orders are now confined almost exclusively to fresh water. Yet some species which live on land or in fresh water always go back to the ocean to breed (*Coenobita*, *Birgus*). On the other hand, there are many which pass their whole life cycle away from the sea (many Entomostraca, Isopoda, Potamonidae, Potamobiidae).

The food habits of Crustacea permit them to live almost everywhere. Most species are omnivorous, and they frequently do much good as scavengers. If feeding habits alone were considered, it would seem remarkable that more crustaceans have not left the ocean.

Admirable protection is afforded by the exoskeleton which not only serves as an armor but prevents desiccation. Most species lurk in holes or crevices during the day and are active at night. Those which feed in daylight have very keen vision and are quick to react to any moving object, retreating to some appropriate hiding place when threatened with danger.

In changing from salt to fresh water or from water to land respiration must undergo marked changes, and this process is therefore of great importance in considering the ecology of Crustacea. The simpler crustaceans breathe through the general body surface but

the Malacostraca have generally developed special gills in branchial chambers on the thorax or in connection with the appendages. The Crustacea have clung to the gills with great tenacity and instead of acquiring some other method of respiration have in many cases evolved elaborate accessory structures to facilitate the proper operation of the gills, as in *Calappa*, *Emerita*, etc. It is interesting to note that none of the primitive crustaceans have become terrestrial. Those which have taken up their abode on land have usually been able to do so through the further modification of already specialized respiratory organs. Some terrestrial Malacostraca fill the branchial cavity with water before going on land, others have labyrinthine cavities which serve as lungs developed from the walls of the branchial chambers (*Birgus*, *Thalassina*); the land amphipods have lost the thoracic appendicular gills and breathe through the general body surface; the isopods breathe through their flattened pleopods and some have even developed tracheal tubes like those of insects on these appendages. It would have made a great difference in the racial history of the Crustacea if they had hit upon tracheae early, instead of recently in one of the groups already adjusted to a terrestrial existence. Here as everywhere in the course of organic evolution success has brought its penalty. Branchial respiration made crustaceans so successful in aquatic habitats that the race got in a rut and became so set that it could not easily adjust itself to land. This limits crustaceans to water or to moist situations; comparatively few have been able to adjust their respiratory processes so as to take their oxygen directly from the air. They are also thus exposed to the dangers which accompany the fouling or drying up of water.

In their reproductive activities the Crustacea have one peculiarity, which has already been mentioned, the habit of carrying the eggs and young during part of their development. This, with the fact that most eggs or embryos within the eggshell are quite resistant to dessication, makes possible adjustment of reproductive habits to fresh water or land. The prawns in fresh water (*Macrobrachium*) differ little from their relatives in the ocean (*Palaemon*). Many fresh-water crustaceans, however, carry the young longer than marine species of the same type (*Astacidae*), and in some the young leave the parent in practically the adult form (Potamonidae). Yet some of the most truly terrestrial species go back to the ocean to hatch their larvae (*Coenobita*, *Birgus*). When we consider the remarkable powers which the eggs of many marsh and pool inhabiting species have of resisting extreme temperature and dessication (*Branchipus*, *Diaptomus*, *Cypris*), it seems strange that no entomostracans live on land. In general there appears to be nothing about the reproductive activities of Crustacea which would prevent ready adjustment to land habitats.

The behavior of crustaceans is such that life in any sort of a habitat might be possible. As a rule the reactions of different species are rather stereotyped and are suited to a particular habitat. Those species which are closely related taxonomically may have widely different types of behavior. Fiddler crabs are diurnal, while *Ocypode* hunts at night, yet both live in burrows along the seashore and have close systematic relationship. Isopods live in burrows in wood, cling to aquatic vegetation, run over the ground, live as parasites, or have other habitats, each involving a different *set* of reactions. *Balanus* and *Polyonyx* both get their food by net fishing, yet one is a Cirriped and the other a Porcellanid. The behavior of crustaceans shows great specificity in relation to particular habitats which indicates that the class as a whole is plastic and has been able to become adjusted to a great variety of conditions.

Summarizing the last few paragraphs, it may be said that respiration appears to be the chief factor which has kept crustaceans in aquatic habitats. Reproduction, salinity of water, protection, food, and behavior may also be of more or less importance but their influence is, as a rule, distinctly secondary.

The next point to be considered is the routes which crustaceans have followed in their migration from the ocean to other regions. I think we may assume three such highways: (1) Through the rivers to the land, (2) from ocean directly to land, (3) from marshes to swamp habitats in fresh water.

At the mouths of rivers there is a mingling of fresh and salt water and a variety of crustaceans live there, some wandering from sea to river and back. The prawns, so characteristic of the rivers in the Tropics, doubtless came originally from the ocean, for they are closely related to marine species; in fact, some species now live in both places. The crayfishes and river crabs probably followed the same route. *Cardisoma* still remains near the mouths of rivers, but other genera of river crabs (*Trichodactylus*, etc.) never enter the ocean and are found far inland. The prawns and shrimps never wander from rivers over the land, but crayfishes commonly do so and some live in holes far from water. Some crabs pass most of their time on land even when they are carrying eggs (*Pseudothelphusa*).

Along the ocean there are many crabs, isopods, and amphipods which feed between the tide marks (*Chiridotea*) or above (*Orchestia, Uca, Ocypode*, etc.), or even climb shrubs or trees in search of food (*Sesarma*), yet all of them remain near the seashore. Doubtless the terrestrial hermit crabs (*Birgus* and *Coenobita*) started in this way, but now do not return to the ocean except to breed. Calman ('11) points out that the more primitive land isopods are found nearer the sea and most of the terrestrial representatives of that group appear to have taken their way from sea directly to land. The terrestrial amphipods (*Orchestia, Talitrus*) took the same route.

Along the marsh-to-swamp-to-land route a number of crustaceans have traveled. Most entomostracans in fresh water probably came this way but have never attained as far as the land. Possibly some shrimps (*Palaemonetes*) and crabs (*Trichodactylus*) have also taken this route, the latter reaching the land.

The seclusive habits of crustaceans have been a great help to them in their landward migration. Most terrestrial species are burrowers

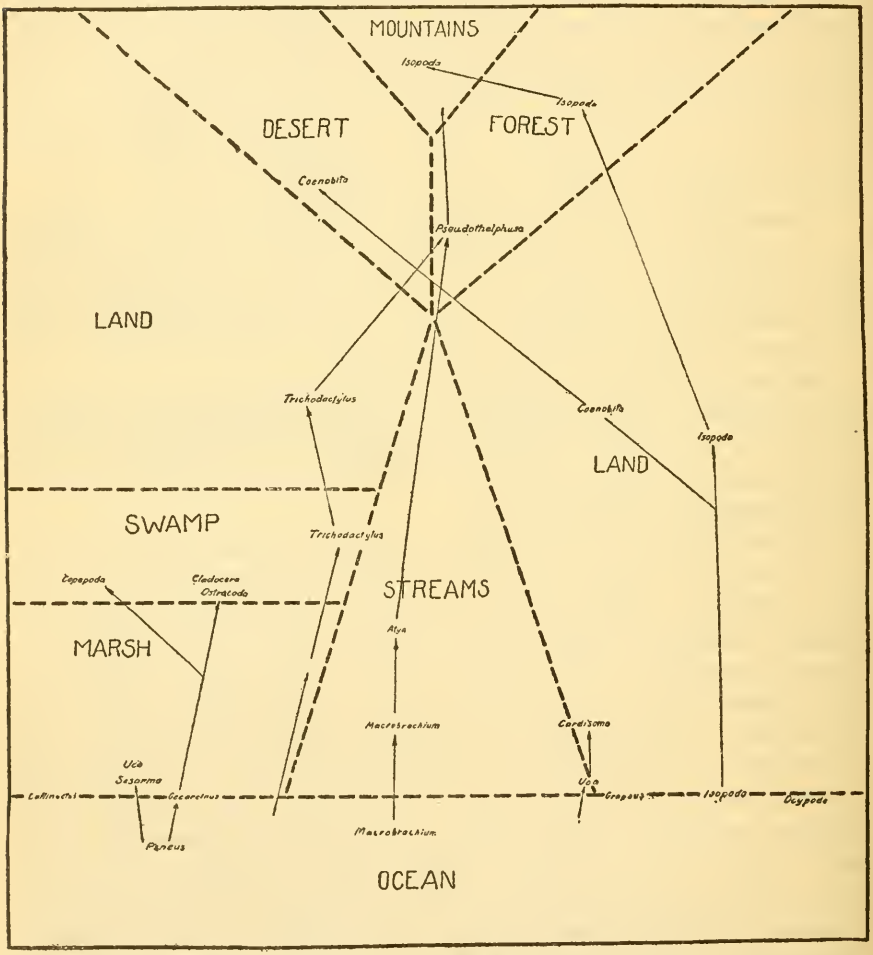


FIG. 2.—DIAGRAM TO SHOW THE CRUSTACEANS IN VARIOUS HABITATS IN COLOMBIA AND THEIR MIGRATION ROUTES.

or live under leaves or fallen logs during the day. They are thus better protected from their predaceous enemies and are less exposed to dessication. Starting on the wet beaches along the shores of the ocean or of rivers, there has been a gradual migration to damp places under stumps, stones, and leaves, and from such situations even to arboreal habitats, under bark or among foliage. In figure 2 the chief routes of travel are shown.

In Colombia there is a gradual decrease in the number of species of crustaceans in going from the shore inland. In the present paper 14 species are recorded from Santa Marta on the coast, 16 at Fundacion in the low country a little way back, 10 at "La Rosa," which is about 7 miles from Santa Marta, 12 at the Cincinnati Coffee Plantation at an altitude of 4,500 feet, and 4 (all isopods) on San Lorenzo (a mountain which reaches an altitude of 8,300 feet). The distribution of species in local habitats was as follows:

Forest, 15—on ground, 12; under logs, 10; near streams, 9; in trees, 3; in bromeliads, 2.

Streams, 12—larger rivers, 8; mountain brooks, 5 (7); in pools in brooks, 6.

Swamp, 11—in puddles, 8; open water, 5; land about margin, 2.

Desert, 1—(*Coenobita*).

GEOGRAPHICAL AFFINITIES OF THE CRUSTACEANS OF THE SANTA MARTA REGION.

Of the Entomostraca collected, five of the cladocerans and the ostracod are species which have previously been taken in the southeastern United States. They will doubtless be found to have a wide distribution when their range is known. *Diaptomus marshi* has been recorded from Guatemala and Panama. *Cyclops leuckarti* and *Macrothrix laticornis* are cosmopolitan.

The shrimps and prawns are for the most part species which range from the southern United States to Brazil. *Peneus brasiliensis* ranges north to Massachusetts, and *Atya scabra* is found in Africa. *Coenobita diogenes* occurs in the West Indies, Africa, and some of the Pacific Islands.

Two genera of land crabs (Potamonidae) were collected near Santa Marta. Of the three species of *Trichodactylus,* two range east and south to Brazil, the other northwest to Nicaragua. The four species of Pseudothelphusa described by Miss Rathbun are related to species which are found south and west. The different species therefore have relations in every direction. The marine crabs are all species which have a wide range on the Atlantic coast of both Americas, some even extending to Africa and other continents.

The isopods which are not new range through Central America and the West Indies, one extending to Bermuda and the Mediterranean. Doubtless many of them reach farther to the south, but their distribution in that direction is unknown.

The crustaceans treated in this paper add nothing of great importance to what is known concerning the distribution of the carcinological fauna of South America and the West Indies. The land crabs mostly range southward, the entomostracans and isopods northward, but the latter premise may be found to be erroneous when the

central and western parts of South America are better known. No amphipods were found, although a careful search was made in every locality visited. No Entomostraca were found at the Cincinnati Coffee Plantation. This was doubtless due to the fact that there was very little swampy land or standing water.

LIST OF SPECIES.

COPEPODA.

DIAPTOMUS MARSHI Juday.

Quite common in a Birge-net collection from some pools at the edge of a marsh at Fundacion, August 15. Previously recorded from Guatemala and Panama (Marsh, '13).

ACARTIA TONSA Dana.

Collected at surface of Cienaga Grande at Tasajera Isla in a tow net at 9 o'clock in the evening on August 22. Previous records from Australia, South Pacific, and Massachusetts.

CYCLOPS LEUCKARTI Claus, var. EDAX Forbes.

A common species on the lowlands. Collected in Birge-net as follows: Artificial pond, Fundacion, August 9, 11; pools along railroad, Fundacion, August 11; swamp, La Rosa, July 31; pools along railroad, Santa Marta, August 29; pool covered with duckweed in bed of Gaira River, Gaira, August 27; marsh, Gaira, August 27. Cosmopolitan.

CLADOCERA.

MOINODAPHNIA MACLEAYII Sars.

In swamps, at Fundacion, August 11, and at Gaira, August 27. Previously reported from Louisiana.

EURYALONA OCCIDENTALIS Sars.

In pools at edge of swamp, Fundacion, August 15. Previously reported from Florida, Texas, and Arkansas.

ALONELLA KARUA (King).

In pools at edge of marsh, Fundacion, August 15. Previously reported from Louisiana, Texas, and Arkansas.

MOINA BRACHIATA Jurine.

Abundant in an artificial pool, Fundacion, August 9. Previously reported from Wisconsin, Nebraska, and Missouri.

MACROTHRIX LATICORNIS (Jurine).

In the marsh at Fundacion, August 11, and in pools along the railroad at Santa Marta, August 29. Cosmopolitan.

PSEUDOSIDA BIDENTATA Herrick.

In pools at border of swamp, Fundacion, August 15. Previously reported from southern United States.

OSTRACODA.

PARACYPRIS PERELEGANS Herrick.

Common among roots of floating plants in a swamp near "La Rosa" on July 30; in a *Lemna*-filled pool in the woods near the same place, August 2; and in the marsh at Fundacion, August 11, among floating aquatic vegetation. My thanks are due to Mr. R. W. Sharpe for the identification of this species, which was originally described from Alabama.

ISOPODA.

TYLOS LATREILLI Audouin and Savigny.

A single specimen was captured on the sandy ocean beach at Santa Marta. Range: Odessa, Tunis, Algeria, Bermudas, Florida, and (now) Colombia.

PHILOSCIA CULEBRAE Moore.

Below the Cincinnati Coffee Plantation this species was abundant under leaves and logs in the forest down as far as Minca. It was also found in smaller numbers at "La Rosa," where five specimens were taken in a cane field and one in the bark of a rough-trunked tree.

This species has previously been reported only from Porto Rico (Moore, '01). The uropods were broken off the type-specimens, hence are shown here (fig. 3).

FIG. 3.—PHILOSCIA CULEBRAE. LEFT UROPOD AND TELSON.

PHILOSCIA WALKERI, new species.

Cotypes.—Cat. No. 45931, Museum of Zoology, University of Michigan. Cat. No. 47949, U.S.N.M. Collected at the top of San Lorenzo, Sierra Nevada de Santa Marta, Colombia, 8,300 feet elevation, under stones in grass, by F. M. Gaige, July 10, 1913. Orig. No. 130.

Body very slender; 4 by 1.1 mm. Head nearly one and one-half times as long as broad; front somewhat recurved between sides and middle; sides and posterior margin rounded. First segment of thorax little longer than those following, its anterior margin curved, the posterior margin nearly straight; anterior angles rounded and projecting laterally somewhat beyond the sides of the head. Next six

segments about equal in length; last three with posterolateral angles produced but rounded, angles of last reaching to end of third abdominal segment. First three abdominal segments about equal in length and shorter than either the fourth or fifth; lateral parts of the first concealed by the last thoracic segment. Telson short, about as long as preceding segment, apex triangular, rounded at tip.

Eyes rather small, with 10 facets. Second antenna extending to end of third thoracic segment, spinulose; first segment short, second

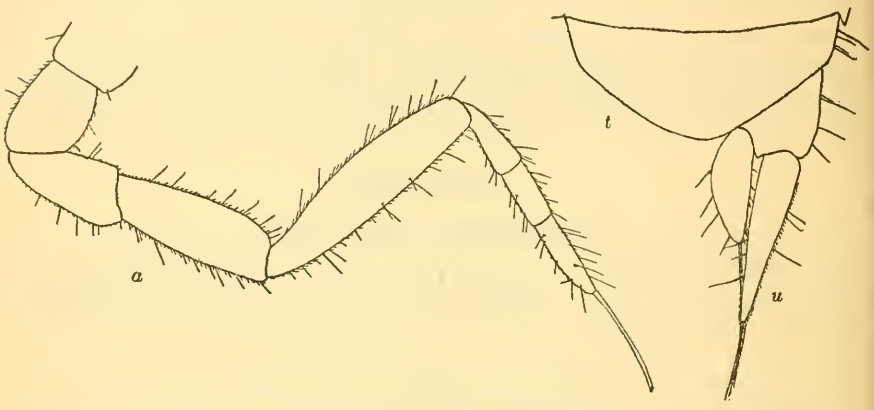


FIG. 4.—PHILOSCIA WALKERI. *a*, ANTENNA; *t*, TELSON; *u*, UROPOD.

and third subequal in length; fourth one-fourth longer than third; fifth one-third longer than fourth; flagellum 3-segmented, without the slender terminal seta about as long as preceding segment. Mandible with 4-toothed tip; below tip are two plumose setae; lower down a brush; no palp. First maxilla with inner plate armed with two plumose processes; outer plate with eight curved spines.

Legs slightly increasing in length from before backward. Uropods with basal segment broad; outer ramus one-third longer than inner one, tapering; inner ramus broad, oval (fig. 4).

Color, deep brown; a broad white band across the anterior margin of each thoracic segment (these bands give the isopod a striped appearance); a patch of irregular longitudinal bands extends back from the anterior band on each side of the thoracic segments; head with many small elongated white markings. Ventral surface white. Legs white, mottled with delicate brown markings.

This species was fairly common under stones, grass, and logs, and in bromeliads at the top of San Lorenzo (8,300 feet) on July 19 and 23. Two specimens were also taken in the forest below at an altitude of about 4,500 feet.

PHILOSCIA NITIDA Miers.

This was an abundant species in the forest from "La Rosa" (fig. 1) to the top of San Lorenzo. It was usually found on the ground among leaves or under logs but was also taken on tree trunks,

in brooks, and in bromeliads. At the top of San Lorenzo it was found in the ground under leaves and in a little brook that started there. Those taken at high altitudes are darker in color in alcohol.

LEPTOTRICHUS GRANULATUS Richardson.

Thirty specimens of this interesting isopod were collected—under some bricks in the patio of our house in Santa Marta; in a log in an ant's nest and under leaves in the forest at Fundacion; under the bark of a rough tree near "La Rosa." It has previously been reported only from the Bermudas, where it was found in dead coral.

CUBARIS CINCTA (Dollfus)?

A small specimen, probably referable to this species, was taken in the forest under leaves on the ground near the Cincinnati Coffee Plantation. Previously recorded from Layon, West Indies.

CUBARIS BREVISPINIS, new species.

Holotype.—Cat. No. 45981, Museum of Zoology, University of Michigan. Collected on trail above Minca, Sierra Nevada de Santa Marta, Colombia, 2,200 feet elevation, by A. S. Pearse, July 15, 1913. Orig. No. 91.

Paratypes.—Cat. No. 47944, U.S.N.M.

Body contractile, capable of being rolled into a ball; dorsal surface covered with strong spines; color brown with a narrow horn-colored

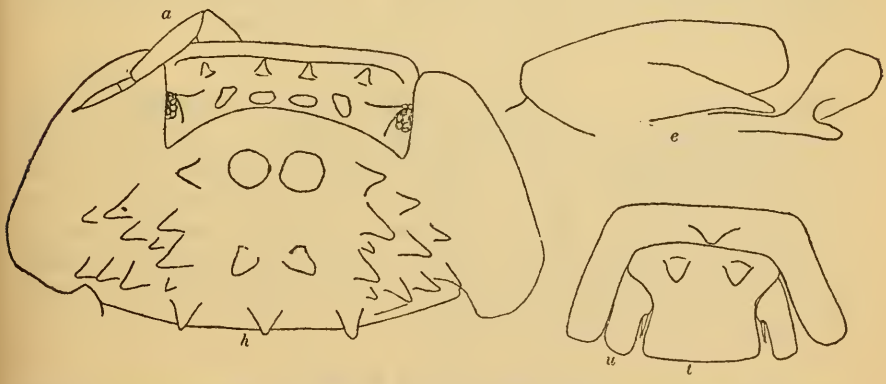


FIG. 5.—CUBARIS BREVISPINIS. *a*, ANTENNA; *e*, VENTRAL SURFACE OF FIRST TWO EPIMERA; *h*, HEAD; *t*, TELSON; *u*, UROPOD.

margin along the lateral and posterior borders of all free somites, and with some irregular white spots. Length 9, width 4.3 mm.

Head wider than long; front straight; anterolateral angles rounded. A transverse row of four small spines in front; six larger spines behind. Eyes small, rounded, with 16 facets. First antenna small and inconspicuous; second having flagellum composed of two articles, the second of which is twice as long as the first (fig. 5).

First thoracic segment with lateral parts large and laminar; anterior and posterior angles rounded; dorsal surface of epimera concave; bearing 29 spines. Near to the anterior margin are two large spines followed by a clear space, then two smaller spines and a single median spine projecting beyond the posterior border of the segment. On either side of the last are two other spines of similar size. The remaining spines are on the sides of the segment but do not come from the epimera. Each of the following six segments has 17 spines: eight across the anterior borders, three near the middle of the posterior border, two on either side of the posterior border (the inner one smaller), and two beyond all the others near the epimera on either side. All thoracic epimera produced and flattened, rectangular with rounded angles. Coxopodites distinct on first and second segments, tapering with rounded tips.

First somite of abdomen barely visible; second segment short, covered laterally by last thoracic somite, unarmed; third, fourth, and fifth somites each with a single stout median spine; sixth somite with a pair of lateral spines near base. Uropoda rather slender; outer rami small, reaching halfway to posterior margin; inner rami minute only reaching a little beyond the median constriction in the sixth abdominal somite.

The usual haunt of this little isopod was beneath the scales of a tree with extremely rough bark. Once two specimens were found under some stones in a dry creek bed. It was found at Fundacion, La Rosa, and below the Cincinnati Coffee Plantation.

CUBARIS GIGAS Miers.

Nine specimens were collected under stones at Fundacion. The color of this species is rather striking. There is a salmon-colored band along each side of the body, extending through all the thoracic epimera; dorsum with the usual lateral markings; distal half of uropoda salmon-colored. The coxopodite of the first somite is free for one-third of its length and does not reach as far back as the epimerite. There is a well-developed coxopodite on the second somite. Previously reported from Nicaragua.

MINCA, new genus.

First pair of antennae minute, triarticulate. Second pair of antennae short; flagellum biarticulate. Eyes small, composite. First maxilla with two plumose processes. First three thoracic somites with coxopodites distinct from epimera. Terminal abdominal segment triangular. Uropoda vary broad and flat, extending beyond tip of abdomen; basal segment large; entire, tetragonal; outer ramus minute, inserted near center of dorsal surface of basal segment; inner branch small, linear, not reaching to tip of basal article.

Type of genus.—*Minca ruthveni* Pearse.

This genus differs from the others in the family *Armadillididae*, (*Cubaris*, *Pseudarmadillo*) in (1) the shape of the telson, (2) the

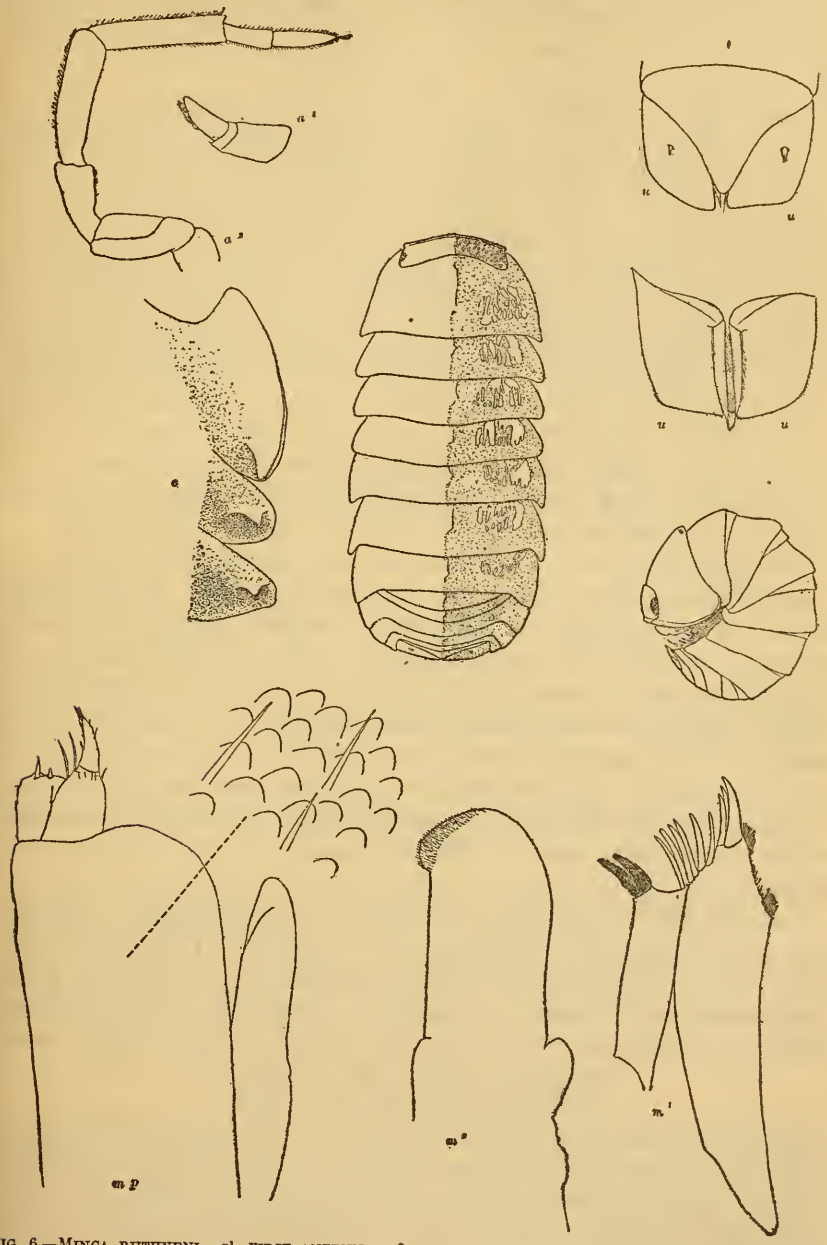


FIG. 6.—MINCA RUTHVENI. a^1, FIRST ANTENNA; a^2, SECOND ANTENNA; *e*, VENTRAL SURFACE OF FIRST THREE EPIMERA; m^1, FIRST MAXILLA; m^2, SECOND MAXILLA; *mp*, MAXILLIPED; *t*, TELSON; *u*, UROPOD.

structure of the uropoda, and (3) the presence of free coxopodites on three somites. It is named for a station at the base of the foothills near Santa Marta.

MINCA RUTHVENI, new species.

Cotype.—Cat. No. 45949, Museum of Zoology, University of Michigan. Cat. No. 47945, U.S.N.M. Collected under logs on Cincinnati Coffee Plantation, Sierra Nevada de Santa Marta, Colombia, 4,500 feet elevation, July 17, 1913. Orig. No. 111.

Body finely tuberculate, pubescent toward posterior end; length 16 mm., width 7.4 mm. Head not produced into lobes; very short, less than one-third first thoracic segment; more than four times wider than long. Eyes small oval, with about 12 facets, close to lateral margins. First pair of antennae inconspicuous; second pair with the basal segment short, second article two and a half times as long as first; third one-fifth shorter than second; fourth nearly twice third and subequal to fifth; flagellum 2-segmented, with the second segment slightly longer. First maxilla with two plumose processes.

First thoracic somite longer than any other, twice as long as second, which is subequal to the six following. Coxopodites distinct on the first three segments; on the first in the form of a long carina extending the whole length of the segment but diverging more posteriorly; on the second and third as short triangular processes.

Abdomen composed of six somites; first two covered laterally by last thoracic segment. First five somites about equal in length when measured on median line. Terminal segment triangular, obtuse, pointed; posterolateral margins slightly concave. Basal segment of uropoda laminar, tetragonal, extending beyond tip of terminal segment; external ramus minute, conical, inserted near center of dorsal surface of basal segment; inner ramus linear, acute, reaching beyond tip of sixth abdominal segment and equaling basal segment (fig. 6).

Color chocolate-brown with median spots and lateral yellowish-white markings, as shown; often the epimera on thorax have white spots.

One hundred and eighty-one specimens were collected. This species was abundant under logs on and about the Cincinnati Coffee Plantation. The contents of the stomachs of several individuals were examined through a compound microscope. The food consisted of minute bits of rotten wood and some vascular plant tissue.

SPHAERONISCUS GAIGEI, new species.

Holotype.—Cat. No. 45908, Museum of Zoology, University of Michigan. *Paratype.*—Cat. No. 47946, U.S.N.M. Collected in highest timber on San Lorenzo, Sierra Nevada de Santa Marta, Colombia, 7,800 feet elevation, under leaves in ground, July 23, 1913. Orig. No. 161.

Body oblong, convex, contour rounded posteriorly; contractile into a somewhat flattened ball; length 4.4 mm., width 1.8 mm. Head set in first thoracic segment; front sinuous, with a slight concavity

on either side; lateral angles prominent. Eyes small, with 14 facets. Second antenna robust, with 3-segmented flagellum; covered with many minute setae; ultimate segment nearly as long as the two preceding together, terminal seta very long. First maxilla with two plumose processes (fig. 7.)

First segment of thorax not twice as long as head, with two transverse rows of large tubercles; longer than other segments, each of which has a row of tubercles along its posterior margin. Coxopodites not distinct. First two abdominal segments without epimera; epimera of succeeding segments continuing contour of body. Terminal segment nearly twice as broad as long, slightly concave on posterolateral margins; tip rounded. Uropoda with basal segments square but deeply notched on posterior border near median angle; external rami longer than basal segment, inner rami extending to middle of outer.

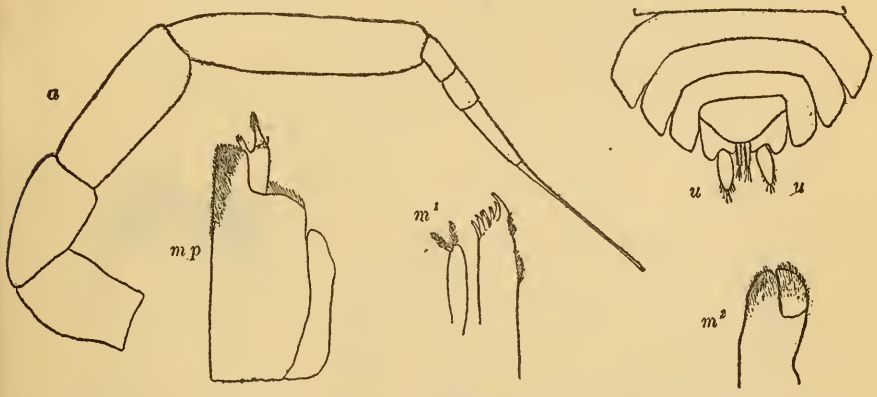


FIG. 7.—SPHAERONISCUS GAIGEI. *a*, ANTENNA; m^1, FIRST MAXILLA; m^2, SECOND MAXILLA; *mp*, MAXILLIPED *u*, UROPOD.

Color, reddish-brown with irregular bilaterally symmetrical markings of yellowish-white.

Seven specimens were taken in the highest timber on San Lorenzo, at an altitude of about 7,800 feet, in the ground under leaves, by Mr. F. M. Gaige, on July 23.

SPHAERONISCUS COLOMBIENSIS, new species.

Holotype.—Cat. No. 45957, Museum of Zoology, University of Michigan. *Paratype.*—Cat. No. 47947, U.S.N.M. Collected under leaves and logs in forest south of Cincinnati Coffee Plantation, Sierra Nevada de Santa Marta, Colombia, 4,800 feet, by A. S. Pearse, July 12, 1913. Orig. No. 82.

Body oblong, very convex, contractile into a ball; length 16 mm., width 5.8 mm. Dorsal surface marked with very minute pearly granules arranged in irregular anastomosing lines. Head set in first thoracic segment; front nearly straight; epistoma rhomboidal.

Eyes small. Flagellum of second antenna 3-segmented. Inner lobe of first maxilliped armed with two plumose processes (fig. 8).

First thoracic segment twice as long as head, and longer than any other segment. Coxopodites not distinct. First abdominal segment with lateral parts concealed; second without epimera but not concealed; the epimera of the next three segments continuing the general

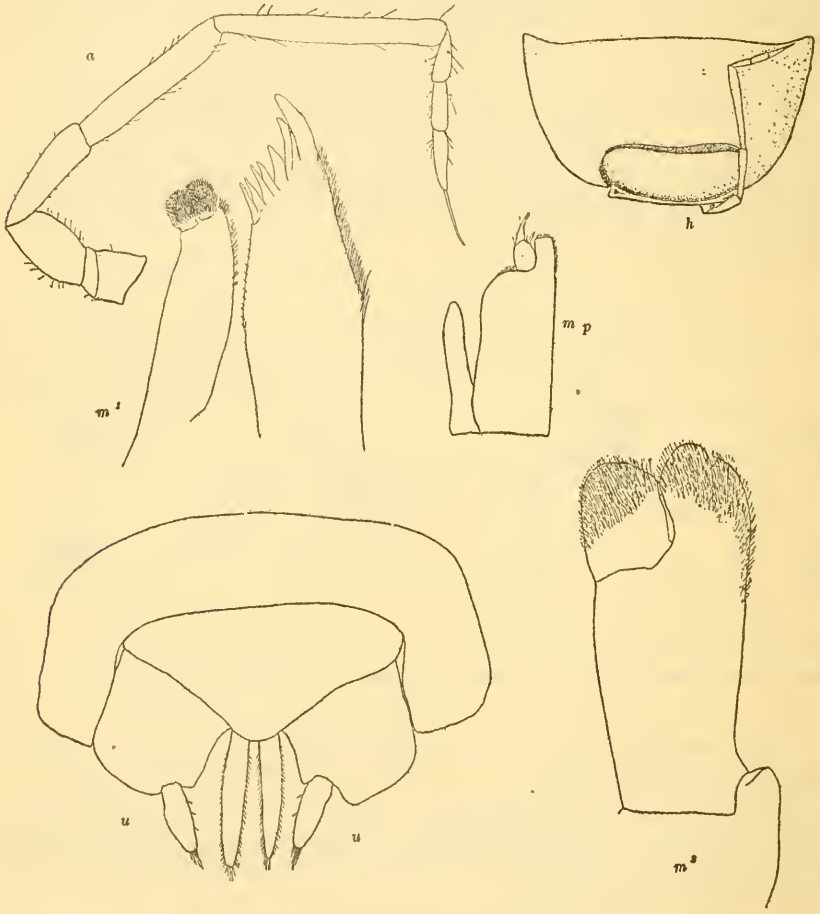


FIG. 8.—SPAERONISCUS COLOMBIENSIS. *a*, ANTENNA; *h*, HEAD AND FIRST THORACIC SEGMENT; m^1, FIRST MAXILLA; m^2, SECOND MAXILLA; *mp*, MAXILLIPED; *u*, UROPOD.

contour of the lateral margin. Telson broadly triangular, twice as broad as long, obtuse, slightly concave on posterolateral margins. Basal segments of uropoda large, square, with a notch at the mediodistal angle for the exopodite, which extends downward. The internal ramus of the uropoda slender, reaching about as far as outer ramus, longer than basal segment.

Color, brown, with paired lateral areas which contain irregular yellowish-white lines.

This isopod was found under stones and logs in the forest about the Cincinnati Coffee Plantation, but was not common. Females carrying young were collected on July 3 and 12.

LIGYDA RICHARDSONAE, new species.

Cotype.—Cat. No. 45721, Museum of Zoology, University of Michigan. Cat. No. 47948, U.S.N.M. Collected at Cincinnati Coffee Plantation, Sierra Nevada de Santa Marta, Colombia, 3,800 feet elevation, by A. S. Pearse, July 3, 1913. Orig. No. 18.

Body oblong-ovate, nearly three times as long as wide, 5.5 by 18.3 mm. Specimens measured vary in length from 13.3 to 18.3 mm.

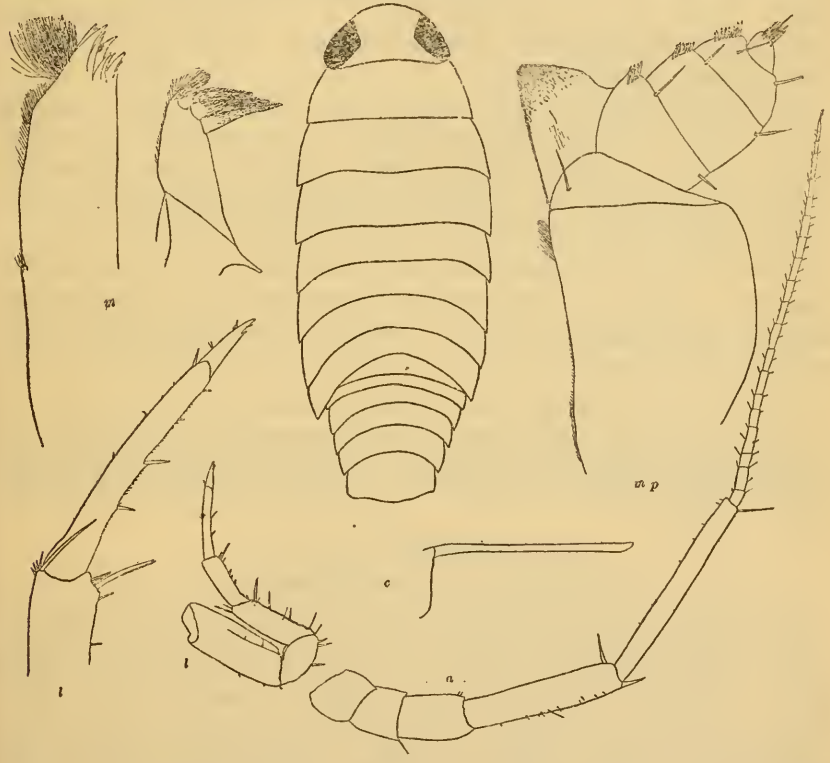


FIG. 9.—LIGYDA RICHARDSONAE. *a*, ANTENNA; *c*, COPULATORY ORGAN; *l*, FIRST LEG OF MALE; *m*, FIRST MAXILLA; *mp*, MAXILLIPED.

Color, mostly gray with a broad light band at the sides of the thorax; sometimes a few white spots along the posterior borders of thoracic segments; usually a broad rather indistinct darker band along median dorsal line. Uropoda 6.2+ mm. long (broken), slender. Dorsal surface of body smooth with a few scattered minute hairs. Head twice as wide as long, 4 by 1.7 mm.; anterior margin arcuate. Eyes elliptical; truncate on median margin; space between eyes in front more than greatest diameter of one eye; length of one eye, 1.2 mm.

First pair of antennae small and inconspicuous. Second pair of antennae with first two segments short and subequal; third segment hardly as long as first two combined; fourth segment twice as long as third; fifth one-third longer than fourth; flagellum contains about 20 segments, and reaches to end of fourth thoracic segment. Maxilliped has a palp of five articles (fig. 9).

Segments of thorax subequal, with lateral margins smooth. Epimera coalesced with segments, usually lighter in color than terga. All six segments of abdomen distinct; the first two shorter than the three following and with their lateral parts covered by seventh thoracic segment; third, fourth, and fifth segments successively larger. Sixth or last abdominal segment with lateral margins parallel; posterior margin not produced but somewhat arcuate. Abdomen narrower than thorax.

First pair of legs in male slender, with ventral border of merus finely serrate. Copulatory appendage of male slender, linear, and nearly straight. All legs ambulatory; with biunguiculate dactyli. This species resembles *L. baudiniana*, but the first legs of the male lack the armature characteristic of that species.

It was abundant in the forest from above Minca to the top of San Lorenzo. It lives in damp places, under leaves, logs, and stones, and was often found in brooks. Females carrying young were taken on July 15, 18, and 25.

PROBOPYRUS BITHYNIS Richardson.

A female of this species was found in the branchial chamber of a *Macrobrachium olfersii* (Wiegmann) collected July 29 in a stream near "La Rosa."

DECAPODA.

MACROBRACHIUM OLFERSII (Wiegmann).

This species was very common in the streams near "La Rosa" (fig. 1), in the Manzanares River at Santa Marta, and in the Gaira River. On July 29 and 31 and on August 1 large (54, 45.5, 46.3, 42.5, 47, 66.7 mm.) females carrying eggs were taken in the rivers and irrigating ditches near "La Rosa." The largest specimen captured, a male measuring 73 mm. in length, was found in a ditch at the same place. About 300 specimens of all sizes were collected.

This prawn usually rested under stones, among fallen leaves or aquatic vegetation in the larger streams. It is widely distributed through the West Indies, Mexico, Central America, Venezuela, Brazil, and West Africa.

MACROBRACHIUM ACANTHURUS (Wiegmann),

This was the only prawn collected at Fundacion, where it was common in the small sluggish streams; it was not found at any of the other localities visited. Eighteen specimens were collected. Females

(46, 30, 42.3 mm. in length) carrying eggs taken on August 8 and 14. This species ranges from Texas to Brazil. Its distribution in Colombia is apparently different from other shrimps and prawns.

MACROBRACHIUM JAMAICENSE (Herbst).

This species was quite common in the streams near "La Rosa" (fig. 1). The 20 specimens collected were secured in the streams along the margins under leaves, among vegetation, and under stones. Two females carrying eggs were taken June 30. They measured 143 and 130.5 mm. in length. This species ranges from Texas to Rio de Janeiro and is also found on the Pacific slope.

ATYA SCABRA Leach.

This peculiar shrimp was quite common in the swift streams flowing among bowlders over sandy bottoms near "La Rosa." It was found among or under bunches of dead leaves which had accumulated against sticks or stones. Females carrying eggs were often met during the first week in August. The largest of these measured 62 mm. in length; the smallest, 26 mm. Of the 79 specimens collected, the largest was 64.5 mm. long. This species is widely distributed, being found from Mexico to Venezuela and in West Africa.

PENEUS BRASILIENSIS Latreille.

A shrimp which is abundant in the Cienaga Grande. A number were purchased from a fisherman at Puerto Viejo. Most of them measured about 80 cm. long. They have 10 (9) rostral spines and the antennular peduncle slightly exceeds the tip of the rostrum. This species is found from Massachusetts to Brazil and has also been reported from West Africa.

COENOBITA DIOGENES Milne-Edwards.

On August 29 Doctor Ruthven came upon a great drove of these hermit crabs apparently migrating away from the ocean through the desert near Santa Marta. His attention was first attracted by the noise they made as they scratched along among the loose bowlders, sticks, and dry leaves. It was estimated that about 500 individuals were moving over an area about 200 meters square. Eleven specimens were preserved. All were females and eight were carrying eggs. The range of this crab extends from West Africa, through the West Indies to the Pacific Islands. Three specimens brought back alive have lived in the vivarium at the University of Wisconsin for a year.

TRICHODACTYLUS (DILOCARCINUS) DENTATUS (Randall).

This crab was common around the edge of swamps and in pools and intermittent streams at Fundacion. Near swamps they were often found in burrows under logs. These holes sometimes reached a depth of 20 cm. and often had no water in them. In the creeks the crabs were usually found under sticks or loose stones. The largest

male collected measured 24.2 mm. long and 30.5 mm. wide; the largest female, 27 by 33 mm. Sixty-eight specimens were taken. This species ranges southward from Colombia through Venezuela and Guiana into Brazil.

TRICHODACTYLUS (DILOCARCINUS) PICTUS (Milne Edwards).

A single male was collected under a pile of leaves in the Fundacion River August 12. It measured 10.4 mm. long by 11 mm. wide. This species is found in Colombia, Guiana, Brazil, Paraguay, and on the upper Amazon; Young ('00) says also in Peru.

TRICHODACTYLUS (TRICHODACTYLUS) QUINQUEDENTATUS Rathbun.

This crab was abundant in little pools along the margins of the streams near "La Rosa." It also was common with *T. dentatus* at Fundacion around swamps and in small streams. Females carrying eggs were taken at Fundacion August 8 (1) and on August 11 (4). On the latter date a male and female were found together in a hole under a log. The largest female measured 19.8 by 23.5 mm. One hundred specimens were collected, the largest being a male measuring 20.9 by 25.5 mm. The range of this species is from Colombia to Nicaragua.

PSEUDOTHELPHUSA PEARSEI Rathbun.

Plate 70.

Pseudothelphusa pearsei RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 95.

This land crab was abundant on and near the Cincinnati Coffee Plantation. It was collected in the forest at altitudes from 3,500 to 5,000 feet in a great variety of habitats—walking over the ground during rains, on land under logs or stones, in brooks under stones, in burrows under stones along streams.

Paratypes.—Cat. Nos. 47950, 47952, 47953.

PSEUDOTHELPHUSA CLAUSA Rathbun.

Plate 71.

Pseudothelphusa clausa RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 98.

Quite a common species at the Cincinnati Coffee Plantation. Its altitudinal range was from 4,000 to 4,800 feet, and its habits similar to *P. pearsei.*

Paratypes.—Cat. No. 47951, U.S.N.M.

PSEUDOTHELPHUSA ANGULATA Rathbun.

Plate 72.

Pseudothelphusa angulata RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 98.

This species was collected only once under stones at the edge of a brooklet in the forest above Minca; altitude, 2,900 feet.

PSEUDOTHELPHUSA RUTHVENI Rathbun.

Plate 73.

Pseudothelphusa ruthveni RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 100.

An adult female of this species was collected at the south end of the Cincinnati Coffee Plantation (2,500 feet).

CALLINECTES ORNATUS Ordway.

Parts of shells left by raccoons or herons were common in the mangrove swamps at Punta Gruesa along the Cienaga Grande. This species ranges from South Carolina to Brazil and is also found in the Bermudas.

SESARMA ROBERTI Milne Edwards.

These crabs had burrows among the mangroves at Punta Gruesa. They walked about over the roots or climbed in the trees. Three specimens were taken which show the following measurements in millimeters:

	Length.	Breadth ant.	Breadth post.	Front.
Male	16.6	20.2	16.3	14.3
Male	14.9	18.5	15.3	12.3
Female	14.0	17.8	15.2	12.2

This species is found throughout the West Indies and in Africa.

GRAPSUS GRAPSUS (Linnaeus).

Common on the rocks along the ocean at Santa Marta. Range, throughout the Tropics.

CARDISOMA GUANHUMI Latreille.

The holes of these great crabs were abundant on the clay flats at the mouth of the Manzanares River at Santa Marta. They were also common in holes about the roots of trees along the Gaira River at Gaira. Shells and claws from crabs of this species were picked up in the mangrove swamp at Punta Gruesa.

At the mouth of the Manzanares a careful study was made of the habits of *Cardisoma*. At night the crabs came forth in hordes, walked about everywhere over the flats, and climbed into the trees. One was seen in a tree 10 feet from the ground. In feeding the females and smaller males go about sifting the mud between both chelae, but do not pass every "handful" they grasp up to the mouth. The big males use only the smaller claw. Several times crabs were seen to eat fallen leaves from trees. One would take a leaf in his claw and start nibbling at one end, and this was continued until the whole leaf had disappeared.

When a *Cardisoma* digs he makes frequent use of his great claws, and in this respect differs from the fiddler crabs (Pearse, '12) which live on the same mud flats with him. He may dig up a lump of dirt with his chelipeds or gouge it out of the ground with the walking legs of one side, like a fiddler. Dirt while being carried from a burrow is hugged against the body by either chela and the walking leg next to it or held in both chelae, like a washerwoman carrying an armful of clothes. Burrows were closed by pushing up soft mud from the inside, thus shutting the owner in.

The holes were often dug at the bases of trees or under stumps, but many were scattered over the open flats. They went down to water or soft mud.

Cardisomas keep themselves clean. After carrying a load they rub their chelae together and scrape themselves with the legs. The eyestalks are wiped with the maxillipeds.

In fighting the males use the great claws after the manner of fiddler crabs. Combats were often seen.

Cardisoma guanhumi is found in the Bahamas, and from Florida Keys to Brazil.

GECARCINUS LATERALIS (Freminville).

Loose carapaces and claws were found at Punta Gruesa, but the only living specimens were seen on the ocean beach at the mouth of the Manzanares River. A male and a female were collected on the night of August 27. One of these was at the bottom of a burrow 6 inches deep on the sandy beach. Another female was taken two days later about 500 meters from the river at the edge of a rock slide in the cactus brush. This individual had established herself under a rock, where she had made a shallow excavation. The male measured 37.2 mm. long by 49.2 mm. wide; the larger female, 34.5 by 44 mm. This species ranges from the Bermudas, Bahamas, and Florida Keys to Colombia and Venezuela.

UCA MORDAX (Smith).

Common in holes in the clay flat at the mouth of the Manzanares River, where it associated with *Cardisoma guanhumi*, and at Punta Gruesa in holes in sand, under logs, and among mangrove roots. On August 29 a female carrying eggs was captured at the first locality mentioned. Thirty-five specimens were preserved. The largest male measures 12.5 by 18.8 mm.; the largest female, 10.2 by 14 mm. Range, from the Bahamas and West Indies to Rio de Janeiro.

UCA MINAX (Le Conte).

Abundant in the mangroves at Punta Gruesa. Eighteen specimens were taken. Size of largest male, 20.5 by 29.8 mm.; female, 16.1 by 22.8 mm. Range (Smith, '70), Connecticut to Florida, and (now) Colombia.

OCYPODE ALBICANS Bosc.

Common on the sandy beaches at Santa Marta and 1 mile north of Punta Gruesa; burrowing in holes along the ocean. Range, New York to Brazil.

BIBLIOGRAPHY.

BENEDICT, J. E.

1901. The Anomuran Collections made by the *Fish Hawk* Expedition to Porto Rico. U. S. Fish Com. Bull. (1900), vol. 2, pp. 129–148, pls. 3–36.

BUDDE-LUND, G.

1885. Crustacea Isopoda Terrestria. Hauniae, 320 pp. 1899. A Revision of "Crustacea Isopoda Terrestria," with additions and illustrations. 31 pp., pls. 1–5.

CALMAN, W. T.

1910. The Researches of Bouvier and Bordage on Mutations in Crustacea of the Family Atyidae. Quart. Journ. Micr. Sci., vol. 55, pp. 785–797.

1911. The Life of Crustacea. New York, pp. xvi–289.

DOLLFUS, A.

1896. On West Indian Terrestrial Isopod Crustaceans. Proc. Zool. Soc. London, (1896), pp. 388–400.

MARSH, C. D.

1913. Report on Fresh-Water Copepoda from Panama. Smithsonian Misc. Col., vol. 61, pp. 1–31.

MÜLLER, F.

1881. Atyoida potimirim, eine schlammfressende Susswassergarneele. Kosmos, vol. 9, pp. 117–124.

NOBILI, G.

1896. Di un nuovo genere di Crostacei decapodi raccoloto nel Darien dal dott. E. Festa. Boll. Mus. Zool. et Anat. comp. Torino, vol. 11, (p. 238) pp. 1, 2.

1897. Decapodi e Stomatopodi raccolti dal Dr. Enrico Festa nel Darien, a Curacao, La Guira, Porto Cabello, Colon, Panama, ecc. Boll. Mus. Zool. et Anat. comp. Torino, vol. 12 (p. 280), pp. 1–8.

ORTMANN, A. E.

1894. A Study of the Systematic and Geographical Distribution of the Decapod Family Atyidae. Proc. Acad. Sci. Philadelphia (1895), pp. 397–416.

1902. The Geographical Distribution of Fresh-Water Decapods, and its Bearing upon Ancient Geography. Proc. Amer. Philos. Soc., vol. 41, pp. 267–400.

PEARSE, A. S.

1911. Report on the Crustacea Collected by the University of Michigan Walker Expedition in the State of Vera Cruz, Mexico. Rept. Mich. Acad. Sci., vol. 13, pp. 108–114.

1912. The Habits of Fiddler Crabs. Philippine Journ. Sci., vol. 7 (D), pp. 113–133.

1914. Tropical Nature in Colombia. Pop. Sci. Monthly, vol. 86, pp. 290–305.

RATHBUN, M. J.

1897. Synopsis of the American Sesarmae, with Description of a New Species. Proc. Biol. Soc. Washington, vol. 11, pp. 89–92.

1901. The Brachyura and Macrura of Porto Rico. U. S. Fish Com. Bull. (1900), vol. 2, pp. 1–127, 129–137, pls. 1–2.

1906. Les crabes d'eau douce. Nouv. Arch. d. Mus., ser. 4, vol. 6, pp. 225–312, pls. 9–11; vol. 7, pp. 159–321, pls. 13–22; vol. 8, pp. 33–122.

1915. New Fresh-Water Crabs (Pseudothelphusa) from Colombia. Proc. Biol. Soc. Washington, vol. 27, pp. 95–100.

RICHARDSON, H.
1905. Monograph of the Isopods of North America. Bull. U. S. Nat. Mus., 54, pp. liii+727.
SHARPE, R. W.
1908. A Further Report on the Ostracoda of the United States National Museum. Proc. U. S. Nat. Mus., vol. 25, pp. 399–430, pls. 50–65.
SMITH, S. I.
1870. Notes on American Crustacea. No. 1 Ocypodoidea. Trans. Conn. Acad. Arts and Sci., vol. 2, pp. 113–176, pls. 2–5.
WHEELER, W. M.
1900. The Free-Swimming Copepods of the Woods Hole Region. U. S. Fish Com. Bull., 1889, pp. 157–192.
YOUNG, C. G.
1900. The Stalk Eyed Crustacea of British Guiana, West Indies, and Bermuda. London, pp. xix–514.

EXPLANATION OF PLATES.

(From photographs furnished by Mary G. Rathbun.)

PLATE 70.

Pseudothelphusa pearsei, male.

FIG. 1. Paratype (45865); right first abdominal appendage; dorsal view, × 3.
2. Same specimen; abdomen, × 3.
3. Same specimen; left outer maxilliped, × 3.
4. Holotype; dorsal view, × 1½.
5. Same specimen; front view, × 1½.

PLATE 71.

Pseudothelphusa clausa, male.

FIG. 1. Paratype (45878); left first abdominal appendage; inner view, × 3.
2. Same specimen; abdomen, × 3.
3. Same specimen; left outer maxilliped, × 3.
4. Holotype; dorsal view, × 1½.
5. Same specimen; front view, × 1½.

PLATE 72.

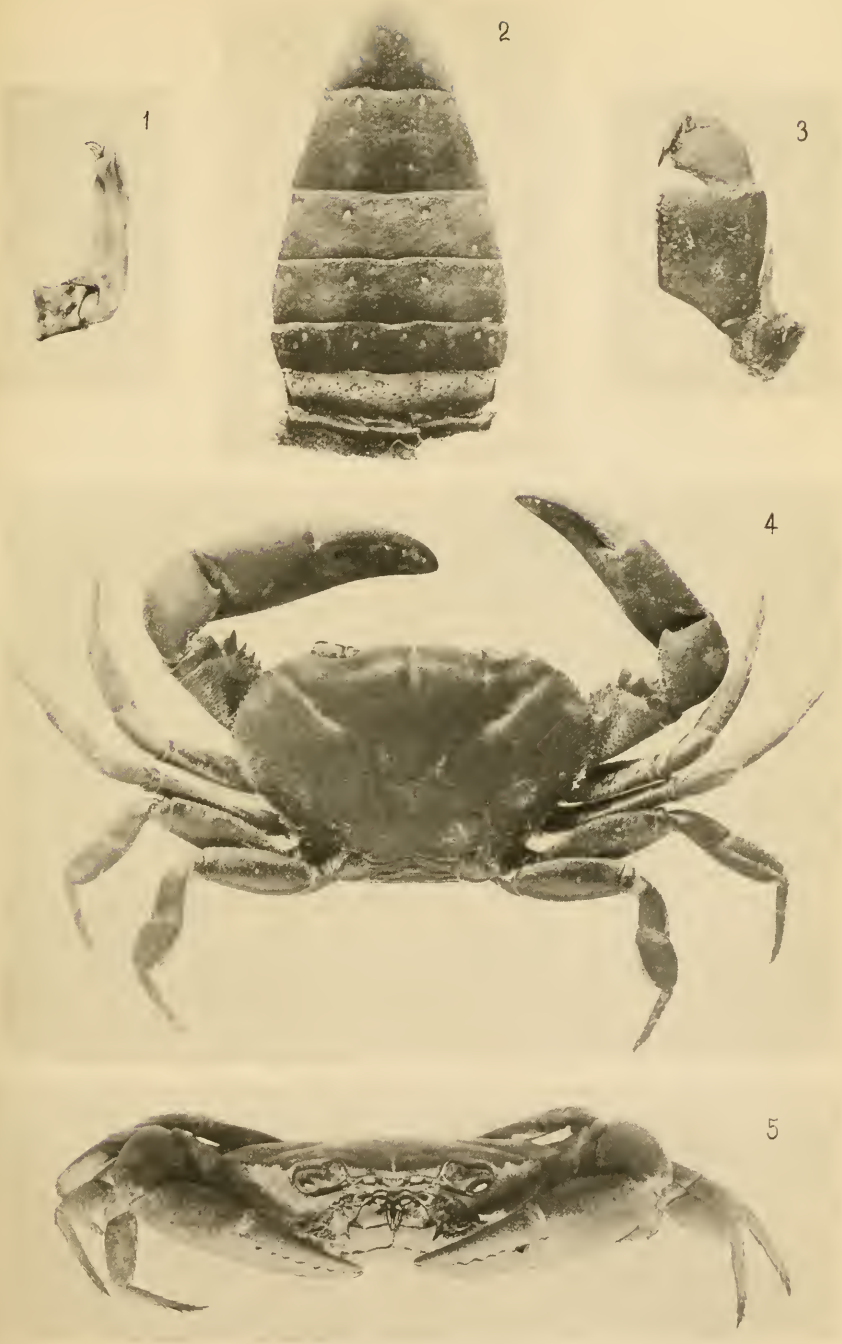
Pseudothelphusa angulata, male, holotype.

FIG. 1. Left first abdominal appendage; inner view, × 3.
2. Abdomen, × 3.
3. Left outer maxilliped, × 3.
4. Dorsal view, × 1.
5. Front view, × 1.

PLATE 73.

Pseudothelphusa ruthveni, female, holotype.

FIG. 1. Left outer maxilliped, × 3.
2. Dorsal view, × 1½.
3. Front view, × 1½.

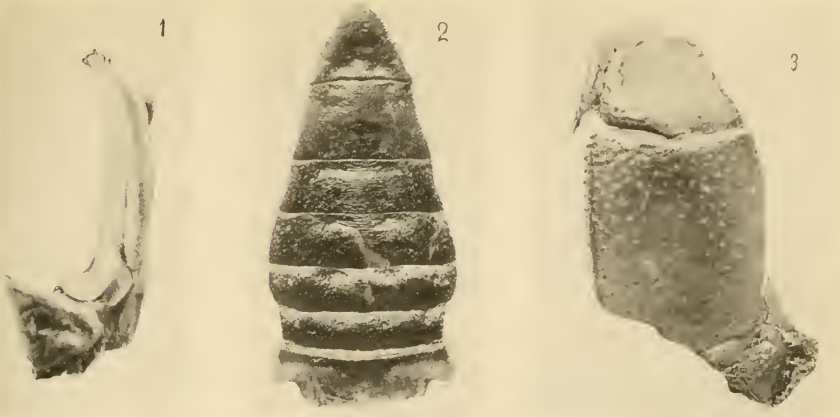


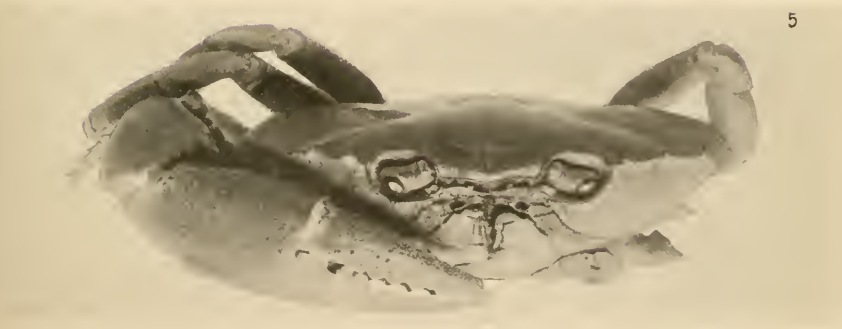
PSEUDOTHELPHUSA PEARSEI.

FOR EXPLANATION OF PLATE SEE PAGE 556.

PSEUDOTHELPHUSA CLAUSA.

FOR EXPLANATION OF PLATE SEE PAGE 556.





PSEUDOTHELPHUSA ANGULATA.

FOR EXPLANATION OF PLATE SEE PAGE 556.

PSEUDOTHELPHUSA RUTHVENI.

FOR EXPLANATION OF PLATE SEE PAGE 556.