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FOUR BURROWING LYCOSA (*GEOLYCOSA* MONTG. *SCAPTOCOSA* BANKS) INCLUDING ONE NEW SPECIES.

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In *PSYCHE*, Vol. 2, 1877, S. H. Scudder described the burrowing spider of the Atlantic seacoast under the name *Lycosa arenicola*, which was preoccupied by Cambridge in the "Spiders of Dorset" in 1875. It was again described by George Marx in the *American Naturalist* in 1881 as *Lycosa pikei*. The upland species of

Fig. 1. First and second legs; a, *pikei*, b, *nidifex*, c, *missouriensis*, d, *wrightii*.

the Eastern States was described by Marx at the same time with the name *Lycosa nidifex*. *Lycosa missouriensis* was described by Nathan Banks in *Entomological News*, 1895, and again under the name *domifex* by J. L. Hancock in *Entomological News*, 1899. The fourth species which is described here, *Lycosa wrightii*, has long been known without any name or description being published.

This group is distinguished, as mentioned by Banks in his description of *Scaptocosa* in Journ. N. Y. Ent. Soc., 1904, by the absence, in females only, of spines on the upper side of tibia III and IV and by definite black markings on the under side of legs I and II in both sexes. In *pikei* the black extends the whole length of legs I and II including the coxæ. In *nidifex* it covers four terminal joints. In *missouriensis* it covers three terminal joints and in *wrightii* three joints of leg I and two and part of the third of leg II. Fig 1. In this group the first leg is proportionally thicker in both sexes than in the other Lycosidæ. In the

Fig. 2. *Lycosa pikei* sitting in the mouth of its burrow waiting for insects to come within reach.

males the first leg is three times as long as the cephalothorax in *nidifex* and *wrightii* and two and three-fourths times as long in *missouriensis* and *pikei*. In females it is two and a half times as long in *nidifex*, two and a quarter in *wrightii*, two and a fifth in *pikei* and twice in *missouriensis*.

L. pikei lives in sandy country near the seashore from Maine to New Jersey; *L. nidifex* along the eastern coast from Maine to Georgia and westward as far as Albany, N. Y., and Atlanta, Ga.; *missouriensis* along the Great Lakes in Ohio, Indiana and Illinois and south to Missouri and North Carolina; *L. wrightii* in sandy country along the Lakes from the eastern end

of Lake Erie near Buffalo to Chicago, Ill., and south to the middle of Illinois, along the Illinois River.

In this group the burrowing habit is so far developed that, excepting adult males during the mating season, their whole life is passed under ground or within a short distance of the mouth of the burrow. As soon as the young leave their mother they make burrows of their own proportioned to their size. The digging is done by covering the sand with silk enough to hold the grains together and it is then gathered into pellets of convenient size and carried in the mandibles to the mouth of the burrow, where

Fig. 3. *Lycosa nidifex* sitting in the mouth of its burrow.

it is thrown outward by the ends of the front feet and on open sand the pellets may be seen in a circle of three or four inches radius around the hole. When watching for prey, they sit with the front half of the body out over the edge of the hole and the legs turned under. Fig. 2. They are sensitive to the slightest movements on the ground, and when down in their burrows will notice the walking of an insect within an inch or two of the hole and come quickly to the top. The movement of a straw on the surface will sometimes deceive them and bring them to the mouth of the hole.

Lycosa nidifex digs often in sod and makes a "turret" around

the mouth of the burrow, sometimes only a narrow ring of dead grass, but often rising an inch or more above the surface of the ground and covered with straw, chips or any fine, loose material within reach. When watching, the spider sits in the top of the turret. Fig. 3. *L. missouriensis* also habitually makes a turret, low or high, according to the material and surroundings. Fig 4. *L. pikei* makes no turret except a slight ring where there is much loose material blowing near the hole. Fig. 2. In open sand it

Fig. 4. Mouth of burrow of *Lycosa missouriensis* surrounded by grass and leaves of bearberry, Buffington, Indiana.

sometimes makes a flat collar of silk over the surface an inch wide around the hole. *L. wrightii* also prefers to dig in open sand and makes no turret or only a rudiment of one.

L. nidifex matures in May, the other species in August and September. The males all die before winter. Both sexes of all the species pass the winter half grown. In *nidifex* they mature early enough to lay their eggs the next summer but the other species do not mature until late and the fertilized females live over a sec-

ond winter and lay eggs in May or June. The burrows are not closed during the winter except as the weather accidentally flattens the lining around their mouths and makes the opening smaller. The spiders remain torpid at the bottom, unhurt by the freezing of the soil around them

***Lycosa pikei* Marx.**

Pl. 4, Figs. 1, 1a, 1b, 1c.

Lycosa arenicola, Scudder, ПСИЧЕ, Vol. II, 1877.

Lycosa pikei, Marx, American Naturalist, 1881.

Lycosa nidifex, Emerton, N. E. Lycosidæ, Trans. Conn. Acad., 1885.

Lycosa pikei, Emerton, Supplement to N. E. Spiders, Trans. Conn. Acad., 1909.

The name *arenicola* was preoccupied by O. P. Cambridge in the "Spiders of Dorset," 1875. In Trans. Conn. Acad., 1885, I have confounded this species with *L. nidifex* and the description given there applies in part to both species. This mistake has been continued by T. H. Montgomery in Proc. Acad. Nat. Sci., Philadelphia, 1904, and by R. V. Chamberlin in Proc. Acad. Nat. Sci., Philadelphia, 1908. The differences between this species and *nidifex* are described in my supplement to N. E. Spiders, Trans. Conn. Acad., 1909. *Lycosa arenicola* McCook refers to this species in his accounts of habits on the Massachusetts coast, but he also applies the name *arenicola* to "the turret spider," and so probably includes *nidifex* and perhaps other species.

Lycosa pikei is distinguished from *nidifex* by its color, which is darker toward the front, and the distinct middle stripe on the abdomen. The legs are also slightly shorter. These differences are more distinct in the males and less so in old females and young. The cephalothorax in females is dark gray with a lighter middle stripe. The first and second legs are colored like the cephalothorax with the first pair a little the darker. The third and fourth legs are lighter gray more like the light stripe of the cephalothorax. The abdomen is light gray with a slightly darker middle band extending its whole length, the front end following the outline of the dorsal vessel and the hinder half a little wider with the sides notched. On the under side the legs I and II are black their whole length, and the sternum is black, at least at the front end. The abdomen is pale with usually, but not always, a gray stripe in the middle for the whole or part of its length. The sides of

the abdomen are black and sometimes in young individuals the middle and side stripes unite and the whole under surface is as black as in *wrightii*.

In males the upper side is all light gray, the front legs only a little darker than the third and fourth. The front of the mandibles is more brightly orange, with sometimes a little orange around the eyes, and there is a bright orange marking bordered with black in the middle of the abdomen. The light middle stripe of the cephalothorax is bordered by black markings radiating toward the sides, the most conspicuous marks ending at the two upper eyes. On the under side the markings are like those of the female, with still stronger contrast between the light and dark parts.

The length of the cephalothorax of the female is 9 mm., of the male 8 mm. Leg I of female 20 mm., of male 22 mm.

The holes are usually in clear sand, but where the spiders are numerous they dig on high land among low plants, and sometimes even in pastures where there is a thick sod. They make no "turret" around the mouth of the hole, but where they dig among loose rubbish, a few pieces may be sometimes fastened to the lining around the mouth. A flat collar on the sand is sometimes made around the hole. The spider sits out on the edge of its hole when looking for prey with feet I and II turned under the thorax, as shown in Fig. 2. Insects are noticed within six or eight inches and the spider rushes for them, returning quickly to the hole.

Freshly molted males and females are found in their holes in August and the males wander about on the surface through that month and September. The pairing was once seen at the mouth of the hole. The female sat out of the hole with her feet under her as usual, while the male approached very slowly, holding his first legs above his head and alternately moving them slowly forward and drawing them quickly back until he was within the female's reach, when she came out toward him and after a show of defence, allowed him to step over her and grasp her around the cephalothorax as usual in the *Lycosidæ*. The eggs are laid the next spring in May and June. The young remain a long time with the mother, in one case as late as September.

This species lives from Old Orchard Beach, Maine, to Sandy Hook, New Jersey, but never far from the seashore. It is espe-

cially abundant in the sandy hills of Cape Cod, Mass., and in the dunes from Cape Ann north to Plum Island. The spiders described by Marx were from Long Island, New York, where it is abundant.

***Lycosa nidifex* Marx**

Pl. 4, Figs. 2, 2a, 2b, 2c.

American Naturalist, 1881.

This species has for the most part been confounded with *L. pikei*. In 1870 I described in the American Naturalist the holes of this spider with their large turrets at the mouth covered with grass and leaves, but found at that time only immature spiders which I did not distinguish from *L. pikei*, which I afterward found at the seashore. In my own writings and in those of McCook, Montgomery and Chamberlin, *Lycosa arenicola* or *nidifex* has included both species. Marx left no type specimens, but in his collection now at the U. S. National Museum are spiders of this species taken in the neighborhood of Washington and no doubt the ones used by Marx at the time he described *Lycosa nidifex*.

The color of the female is dark gray modified by lighter hairs, with very little difference between the front and hind legs and anterior and posterior parts of the body. The cephalothorax has a lighter middle stripe and the abdomen has a dark middle stripe following at the front end the shape of the dorsal vessel, at the sides of which the abdomen is lightened by paler or yellowish hairs. On the under side the legs I and II have the four terminal joints black, the femora and the other legs gray with light hairs. The coxæ, sternum and maxillæ are also gray, a little darker than the legs. The under side of the abdomen is pale with a dark middle band and dark sides and spinnerets, the width of the dark band is variable and in some individuals appears to cover the whole abdomen with dark color.

The male is light gray, when freshly molted varying from bluish gray to flesh color. The middle stripe of the cephalothorax is bordered with black, broken into radiating dark lines extending forward beyond the upper eyes. On the abdomen there is a distinct dark mark over the dorsal vessel and a less distinct and wider stripe extending back to the spinnerets. The mandibles have more orange hairs than in the female and in some individuals the

markings of the back are partly outlined with orange yellow hairs. The under side has the same light gray color with black markings like those of the female.

This species is longer legged in both sexes than *L. pikei*. The cephalothorax of a female and of a large male measures 9 mm. Leg I of female 24 mm. and Leg I of male 27 mm.

L. nidifex digs its holes in open fields, often through sod several inches thick and covered with growing grass and other low plants. It is most abundant in sandy regions but sometimes digs in hard gravel. It makes usually a so-called "turret" around the mouth

Fig. 5. Mouth of burrow of *L. nidifex* surrounded by pieces of decayed wood, Waltham, Mass.

of its hole, sometimes a low ring of straw or chips attached to the edge of the lining of the burrow and sometimes rising an inch or more above the ground and covered with dead leaves, straw, chips or whatever loose material may be at hand. Figs. 5 and 6. The spider watches for insects sitting in the top of the turret with the head above the edge and the feet turned under the thorax. Fig. 3.

Unlike the other species of this group, *nidifex* matures in the spring and freshly molted males and females may be found in Massachusetts from the tenth to twentieth of May. A half-grown male taken from its hole near Albany, N. Y., on May 16 matured and molted May 27.

This species is common in eastern Massachusetts in sandy soil at least partly covered with sod. At Plymouth it lives in the sandy hills within quarter of a mile of the seashore where pikei lives in the sand fields. At Tyngsboro it lives in similar places along the Merrimack River and in Wellesley and Waltham in open pastures with gravelly soil and thick sod. At the railroad station Karner, west of Albany, N. Y., it is abundant in the barren sandy fields. Southward it is common around Washington and at Atlanta, Ga.

This is probably *L. fatifera* Hentz, Boston Journ. Nat. Hist.,

Fig. 6. Mouth of burrow of *L. nidifex* surrounded by pieces of dry cow-dung, Waltham, Mass.

1841, though this name has been applied to several other species of large Lycosidæ.

***Lycosa missouriensis* Banks.**

Pl. 4, Figs. 3, 3a, 3b, 3c.

Entomological News, 1895.

L. domifex, J. L. Hancock, Ent. News, 1899.

Female from Buffington, Indiana, has the cephalothorax 10 mm. long and the first leg 20 mm. Male from Havana, Ill., has the cephalothorax 8 mm. long and first leg 22 mm. The color is dull yellow brown, the femora lighter and brighter orange. The under side is pale without much variety in color except the distinct black of the three last joints of legs I and II. The spinnerets are brown

and the maxillæ and labium are darker than the sternum and coxæ, the tarsus and metatarsus of legs III and IV are also a little darkened. On the upper side the cephalothorax is lighter in the middle without any distinct middle stripe. The abdomen is faintly marked with a series of dark and light transverse stripes. The mandibles are dark brown, black at the ends with orange hairs on the front. In young the femora are brighter yellow and the tibia and metatarsus of legs I and II are black above as well as below and in the adult male these joints are dark above though not as black as on the under side.

The burrowing habits of this species have been well described by Hancock in his account of *L. domifex*. The holes are made usually in sand but are sometimes dug in soil of any kind. I found two at Durham, North Carolina, in hard clay soil. There is usually a turret of some kind unless in open sand where there is no material for one. Fig. 4 shows the top of a hole at Buffington, Indiana, with a turret partly covered with leaves of the bearberry. The species matures in August and September and I have a male taken by Mr. A. G. Vestal at Havana, Ill., among litter on the ground as late as October 10. The eggs are laid in May, rather later than those of *wrightii*. One dug at Durham, North Carolina, early in July had young on its back.

This species is very abundant in the sand dune country along the Great Lakes. I found them at Sandusky, Ohio, near the summer laboratory of the University of Ohio, and they are common all through northern Indiana and Illinois. It does not mix its burrows with those of *wrightii* but each species lives in colonies of its own. R. V. Chamberlin reports it from Utah and *L. latifrons* Montgomery, Proc. Acad. Nat. Sci., 1904, from Texas, is said by Banks to be the same species.

In his account of *L. fatifera*, Hentz, in Boston Journ. Nat. Hist., 1841, mentions "a piceous variety" pale on the under side, which is probably this species.

***Lycosa wrightii* sp. nov.**

Pl. 4, Figs. 4, 4a, 4b, 4c, 4d.

Although no description of it has been published, this species has long been known. J. L. Hancock in his account of *L. domifex* mentions several species of burrowing spiders in the neighbor-

hood of Chicago, of which this is no doubt one. I received a specimen from C. B. Davenport, then Professor in the University of Chicago, in 1904 and the last few years its habits have been studied by Mr. W. H. Wright, a teacher in Chicago from whom I have received specimens of both sexes.

This spider is a little smaller than *missouriensis* and lighter in color, the whole upper surface a light yellowish gray. The cephalothorax is lighter in the middle than at the sides but has no definite middle stripe. The abdomen has a dark mark in the middle over the dorsal vessel, around which may be a few bright yellow scales. At the sides of the abdomen in front the black edges of the ventral black spot extend far enough to be seen from above. On the under side the color is more varied. The tarsus, metatarsus and tibia of leg I are black, and the tarsus, metatarsus and part of the tibia of leg II are also black. The whole under side of the abdomen except around the epigynum and around the spinnerets is black and the spinnerets are also black at the ends. The ends of the mandibles are black and the maxillæ and labium are a darker gray than the rest of the body. The front of the mandibles is thinly covered with orange hairs and there is a little orange on the front of the head about the eyes.

In the male (Pl. 4, 4, 4a) the color is the same, but the legs are longer and more slender and the whole body smaller. The cephalothorax of an adult female measures 8 mm., that of a male 7 mm. Leg I of the female 18 mm., leg I of male 21 mm., a little longer legged in both sexes than *missouriensis*.

The burrows are like those of *piketi* without a turret or with only a few chips attached to the lining around the mouth. They are usually in clear sand and extend down 12 to 18 inches, enlarged at the bottom.

The spiders mature in August and September and the eggs are laid in the following May in light blue cocoons. Pl. 4, 4d. After laying eggs the females become darker in color and resemble more *L. missouriensis*.

This species is found at the eastern end of Lake Erie, opposite Buffalo, N. Y., at various places along the southern end of Lake Michigan (W. H. Wright), as far as Chicago and at Havana, Ill., in sand dunes along the Illinois river (A. G. Vestal).

DESCRIPTION OF PLATE 4.

Lycosa pikei, male 1, 1a, female 1b, 1c.

Lycosa nidifex, male 2, 2a, female 2b, 2c.

Lycosa missouriensis, male 3, 3a, female 3b, 3c.

Lycosa wrightii, male 4, 4a, female 4b, 4c, old female with cocoon of eggs, 4d.

THE STANFORD EXPEDITION TO BRAZIL, 1911.

J. C. BRANNER, *Chief*.

PARABIOSIS IN BRAZILIAN ANTS.¹

BY WILLIAM M. MANN.

During the different visits of the members of the Stanford Expedition at Pará, the suburb Souza was found to be the best collecting ground, and much of their time was spent there. The combination of forest and good trails, quickly reached by electric cars, made the locality quite ideal for collectors having only a limited time at their disposal.

Here, as elsewhere in Brazil, ants abounded, and of these the small, black *Dolichoderus bispinosus* Oliv. was most in evidence. This species lives in carton nests, built on the branches of trees, though often a colony is found in a deserted termitarium. After a couple of attempts I gave up investigating the larger nests, for when these were disturbed myriads of ants swarmed out, literally tumbling over one another to the ground, where they scattered in all directions in search of the disturber. On hurriedly leaving the vicinity of one nest, I happened to leave my net lying on the ground. On my return, a few minutes later, it was covered with ants, each gripping so tightly that when I pulled it away its head often remained attached to the net. In young trees along the trails there were numerous small nests, four or five inches in diameter, and several of these were opened. Each contained, besides the *Dolichoderus*, a colony of a small black *Cremastogaster*. The smaller ants were not scattered throughout the nest, but were grouped in certain of the chambers.

Forel² has recorded observations which he made in Columbia

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 54.

² La Parabiose chez les Fourmis. Bull. Soc. Vaud. Sc. Nat. XXXIV, 130, p. 380-385.

EMERTON—*LYCOSA*