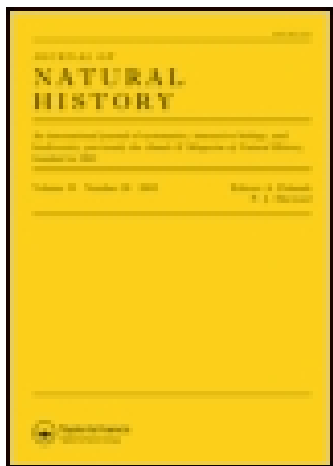


This article was downloaded by: [Cornell University Library]
On: 14 November 2014, At: 20:29
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number:
1072954 Registered office: Mortimer House, 37-41 Mortimer
Street, London W1T 3JH, UK



Annals and Magazine of Natural History: Series 5

Publication details, including instructions for authors and subscription information:
<http://www.tandfonline.com/loi/tnah11>

How orb-weaving spiders make the framework or foundations of webs

Rev. Dr. H. C. McCook

Published online: 07 Oct 2009.

To cite this article: Rev. Dr. H. C. McCook (1882) How orb-weaving spiders make the framework or foundations of webs , Annals and Magazine of Natural History: Series 5, 9:49, 68-72, DOI: [10.1080/00222938209458996](http://dx.doi.org/10.1080/00222938209458996)

To link to this article: <http://dx.doi.org/10.1080/00222938209458996>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever

caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

How Orb-weaving Spiders make the Framework or Foundations of Webs. By the Rev. Dr. H. C. McCook.

Rev. Dr. H. C. McCook said that he had given attention during the past summer to the mode of constructing webs prevailing among orb-weaving spiders. He had been led to make some special studies of the extent to which air-currents are utilized in laying the foundation-lines upon which the orbs are hung by a remark of Rev. O. Pickard Cambridge in his work on the Spiders of Dorset*. "Spider-lines," he says, "may frequently be observed strained across open spaces of many feet and even yards in extent. This has been explained by some naturalists to have been done by the help of a current of air carrying the thread across. I cannot, of course, say that it has never been thus effected, though I have certainly never myself witnessed it. I have, however, on several occasions seen a spider fix its line, then run down to the ground, across the intervening space, and so up the opposite side, trailing its line as it went; and then having hauled in the slack, it fixed the line to the desired spot. This I believe to be the usual mode of proceeding in such cases."

Dr. McCook was satisfied that on both the above points this distinguished araneologist had failed to possess himself of all the facts; but he took up the points in question anew during the summer, and made notes of his studies. His previous opinion was fully confirmed. He had in a great number of cases observed orb-weavers passing from point to point by means of lines emitted from their spinnerets and entangled upon adjacent foliage or other objects. These mimic "wire-bridges" were of various lengths, owing to the direction of the wind and the relative positions of the spider and the standing objects around it. Lines of two, three, and four feet were frequent; lines of from seven to ten occurred pretty often; he had measured one twenty-six feet long, and in several cases had seen them strung entirely across country roads of from thirty to forty feet. Many of these lines he had seen carried by the wind directly from the spiders' spinnerets, had observed the entanglement, had seen the animal draw the threads taut and then cross upon them. That all the lines were similarly formed and used he had no doubt.

It was more difficult to determine the other question, viz. whether the lines used for the foundations of orb-webs were formed in the same way. Undoubtedly such lines are often made precisely as asserted by Mr. Cambridge. Dr. McCook had many times observed this; he had seen an orb-weaver after traversing a considerable space by a series of successive bridge-lines settle upon a site between the forked twigs of a bush, and carry her foundation-lines around in the manner described. But, on the other hand, he was prepared to say that the air-laid bridge-lines were also used for the foundations or frames of orbs.

1. First, he had observed that the hours in the evening at which

* Vol. i., Introduction, p. xxi.

the greatest activity in web-weaving began were those in which also began the formation of the bridge-lines. The latter action quite invariably preceded the former.

2. Again, a study of the foundation-lines of many webs gave more or less conclusive evidence that they were laid by the aid of air-currents. For example, the webs of some species, as *Acrosoma mitrata*, *A. spinea*, and *A. rugosa*, were frequently found strung between young trees separated by two or three yards. That these builders might have dropped to the ground, crept over wood, grass, and dry leaves, carrying the thread in the free outstretched claw, is, perhaps, not impossible, but did not seem at all probable to the speaker, although short spaces over smooth surfaces might well be cleared in this way. One web he found spun upon lines stretched from the balustrade of a bridge that spans a deep glen in Fairmount Park to the foliage of a tree that springs out of the glen at least twenty-five feet below. Unless foundations were formed by line-bridging the interspace of a yard or more, it must be inferred that the spider had dropped from the balustrade to the glen, crossed the interval to the trunk of the tree, ascended it, and, having made the detour of nearly sixty feet to the point directly opposite that from which she started, drawn her long line taut, and so completed her foundation. Dr. McCook thought that such a supposition could not be entertained, and it was clear that a breeze carried the line across from the spider's spinnerets.

Even stronger examples of circumstantial evidence were noted. Very many webs of *Tetragnatha extensa* and *T. grallator* were seen spread upon bushes overhanging pools and streams of water; others were seen stretched between separated water-plants, or from such plants to the shore. Either the foundation-lines were borne by air-currents, or the spiders must have crossed upon the water, carrying their lines. The latter supposition is not wholly untenable, the speaker thought, but would hardly be raised by any one who had studied the spinning-habits of the creature.

One other example may be cited. At Cape May, by the Landing, where pleasure-boats used for sailing upon the inlet are stored, there is an immense colony of Epeiroids, chiefly *Epeira strix*, *E. vulgaris*, and *E. domiciliorum* (Hentz). Great numbers of these spiders had their lines strung between the opposite, exterior walls of the boat-houses, which are built upon piles driven into the water. These lines were about 9 feet long, stretched over the water at heights varying from 1 to 10 feet. Most of them passed from wall to wall; many were fastened at one end upon piles and sticks driven here and there between the houses. Even if one were to admit that *Tetragnatha* could carry a free line over the smooth surface of an inland pool, it is past belief that the above-named *Epeiras* performed the same act upon the rough waters of an inlet of the Atlantic Ocean. The only reasonable conclusion is, that bridge-lines were formed by air-currents.

3. It was greatly desired that to the above cases of circumstantial

proof might be added actual observations of the use for foundations of those lines stretched by air-currents. Three summer evenings were devoted to obtaining this result, without complete success. On one evening the observer was interrupted and called off at the very critical period of his observation; on the other two evenings the wind was unfavourable. But some valuable results were obtained, and the webs of three adult individuals of *Epeira strix*, one male and two females, were selected, the den or nest of each spider located, and the web entirely destroyed, including the foundation-lines. The latter precaution was made necessary by the fact that orb-weavers had been noticed to use the same foundation-lines, for many days, for the erection of their new webs. Young spiders had been seen on several occasions to utilize the radii and foundations of abandoned webs of adults as the frame-lines of their small orbs. The great value which may attach to these old foundations appeared strikingly in subsequent studies, and also the difficulty if not impossibility of procuring suitable foundations for the webs of large spiders without the aid of the wind.

Two of the webs (one of the females') were so situated that the prevailing air-currents so carried the lines that they could not possibly find an entanglement. In consequence, neither of these spiders succeeded, during two entire evenings, up to half-past ten o'clock, in making a web. They frequently attempted it in vain. One, which was more closely watched, was in motion during the whole period, passing up and down, from limb to limb, apparently desirous of fixing her orb in the former site, but completely confused and foiled. The site was one, moreover, which would have allowed her to carry around a thread with comparative ease, being a dead sapling that forked near the ground. The spider domiciled during the day on the ground, but had her orb at the top of the forks, a height of 6 feet. Thus the space to traverse in passing from the top of one of the forks to a similar point on the opposite one presented comparatively few difficulties. But no attempt was made to carry the line around; and as the wind had evidently not changed during the night, no web appeared upon the tree in the morning. During the next evening the same restless movement along the bare limbs of the sapling was repeated, and was terminated at a late hour by a rare accident. A large moth, attracted by the lantern, became entangled upon a single short thread strung between two small twigs, whereupon *E. strix* pounced upon it, swathed and fell to feeding on it. Next morning a tiny orb-web had been built around the shell of the moth at the point of capture.

During both evenings this spider at frequent intervals poised herself at the extremity of twigs, and emitted threads from her spinnerets which entangled upon some of the short twigs, but never upon the opposite fork, as the wind was steadily contrary. No other entanglement was secured, as there was no object in the direction of the wind for a great distance. However, Dr. McCook could at any time obtain an entanglement upon his hand by arresting the

thread. By imitating the motion of a swaying leaf or limb, the spider was caused to perceive the attachment and immediately ventured upon the line. Once the thread fastened upon the observer's face, and the animal was allowed to cross the line (4 or 5 feet) until within a few inches of the face, when she took in the situation, instantly cut the line and swung downward and backward over the long arc, and, after a few oscillations, climbed up the line to the point of departure. Her willingness to use the air-currents for making transit-lines was thus quite as manifest as her inability. The third spider exhibited a like behaviour.

4. The third individual, a male, did not attempt to spin an orb in the former site; the wind was unfavourable, but there would not have been much difficulty in carrying a cord around. He came out of his rolled-leaf den at 7.20 p.m., and for more than an hour laboured to secure a web foundation. He was located upon a dead end of a bough of a tree with many branching twigs. As with the former individual, so with this: many efforts were made to obtain foundations by sending out threads from the spinnerets; and to this end he tried most of the numerous points of the twigs covering the territory which he seemed to have chosen as his general range. One of these, a little pendant which hung in the centre of the group, was taken as the basis of a most interesting operation. The spider dropped from the pendant by a line 3 or 4 inches long, grasped the line by one of the second pair of feet, and rapidly formed a triangular basket of threads by connecting the point of seizure with lines reaching to the feet of the remaining second and the third and fourth pairs. In this basket he hung head upwards, the body held at an angle of about 45° , the two fore feet meanwhile stretched out and groping in the air, as though feeling for the presence of obstructions, of enemies, or of floating threads. At the same time he elevated his spinnerets and emitted a line, which was drawn out at great length by the air and secured no entanglement. The body of the spider had a gentle lateral oscillation, which appeared to the observer to result from a voluntary twisting of the central rope by the animal, but may have been caused by the air; the effect, in either case, was to give the line a wider swing and much increase the chances of entanglement.

However, there was no entanglement, and the spider dropped several inches further down, and repeated exactly the process as described above. This was repeated again and again; and when the observer allowed the line to attach to his person the spider at once proceeded to satisfy himself of the fact, and then to venture a crossing. In all these actions there was evidence of a habitual mode of securing transit by bridge-lines.

During the intervals of these attempts, and indeed preceding them, the spider passed back and forth along all the branching twigs, leaving behind him trailed threads or lines connecting the ends, many of which seemed to be purely tentative. At last a central point was taken, a short thread dropped therefrom and attached to

one of these tentative lines. The confused network of circumjacent lines was gathered together in a little flossy ball at the point of union, which was now made the centre of the orb, the first drop-line and the two divisions of the cross-line constituting the three original radii. From there the spider proceeded to lay in the radii and complete the orb. The speaker described this process in full, as illustrated by the industry of this and other individuals. The time occupied in constructing the orb proper was half an hour, while the work of prospecting for and obtaining a foundation consumed more than an hour. Even then the orb was very irregular, and showed decided traces of the want of the usual well and orderly laid foundations. An examination of a number of web-sites which had been marked upon the same grounds showed that, in every case where the surroundings had allowed an easy and good entanglement by the wind, the spider had made webs at an early hour, and with straight and regular foundations.

Dr. McCook concluded that the above observations, although not wholly conclusive in themselves, were sufficient warrant for the belief that air-currents have a large part in placing the original framework or foundation-lines of orb-webs, and that spiders habitually make use of them for that purpose. He doubted, however, whether there was any thing like a deliberate purpose to connect the point of occupancy with any special opposite point. It seemed to him that the spider acted in the matter very much at haphazard, but with a general instinct of the fact that such behaviour would somewhere secure available attachments. Many of her bridge-lines were evidently tentative and were chiefly at the mercy of the breeze, although some observations seemed to indicate a limited control of the thread by manipulation.

He added that on previous occasions he had actually observed the laying in, by air-currents, of lines which were immediately used for foundations. The above studies had been undertaken simply to verify such studies, and because he had retained but the briefest notes of former observations. While this use of air-currents is certainly placed beyond doubt, it is as certainly not the only mode of laying foundation-lines, and is dependent very much upon the site chosen, the condition of the wind, the abundance of prey, &c. Webs built in large open spaces are perhaps always laid out by bridge-lines; in more contracted sites the frame-lines are generally carried around, and often a foundation is the result of both methods*.—*Proc. Acad. Nat. Sci. Philad.*, Oct. 4, 1881.

* Since these notes were communicated, a copy of 'Nature' (Sept. 22, 1881) has been received, in which it is said that Mr. Cambridge, in the second volume of his 'Spiders of Dorset,' modifies the opinion above quoted concerning the influence of air-currents. I have not yet received that volume, but make this statement on the authority of the journal referred to.—H. C. McC.