the upper Jackson of Louisiana that the Indians used it as a source of material for their stone implements.[4]

Although no fossil species of *Attalea* have hitherto been recorded, the genus was in existence at this time, as is attested by quantities of fruits of a species of *Attalea* which I have from the late middle Eocene of northwestern Peru. The native genera of palms in the modern flora of Florida are *Thrinax*, *Coccothrinax*, *Sabal*, *Serenoa*, *Roystonea*, and *Pseudophoenix*, all of which have small drupaceous or berry-like fruits, entirely unlike the fossil form.

The present species should be readily recognized if encountered by future collectors, a contingency much to be hoped for, since it will enable sections to be cut, and thus verify or disprove the present identification based upon the external features.

ZOOLOGY.—*The ambulatory tubes and other features of the nema* Draconema cephalatum.[1] N. A. Cobb, U. S. Department of Agriculture.

There is no adequate published description of the locomotion of *Draconema* and its numerous marine relatives; very few persons have ever witnessed one of these nemas perambulating its natural substratum.

Draconema moves much after the manner of the ordinary inchworm, or measuring worm. The caterpillar called the "inchworm" has two bunches of feet, a bunch near each extremity. Standing on the bunch of hind feet, it stretches forward and takes hold with the front bunch. Then, releasing the hind bunch, it draws the body forward into a loop so that the posterior bunch may attach itself near the front one. Loosening the front bunch, the caterpillar again stretches forward, etc.

It is convenient to speak of the two attachment organs of the adult *Draconema* as "soles." The method of attachment of these soles to the substratum in *Draconema* is very different from that of the inchworm. The sole of *Draconema* is armed with projecting hollow setae connected with internal glands supplying a sticky and, presumably, non-water-soluble secretion, and it is by the aid of this secretion emerging from ends of the hollow setae that the sole is attached.

[4] Edward W. Berry. Pan-Amer. Geol., **45**: 273–276. 1926.

[1] Received May 2, 1929.

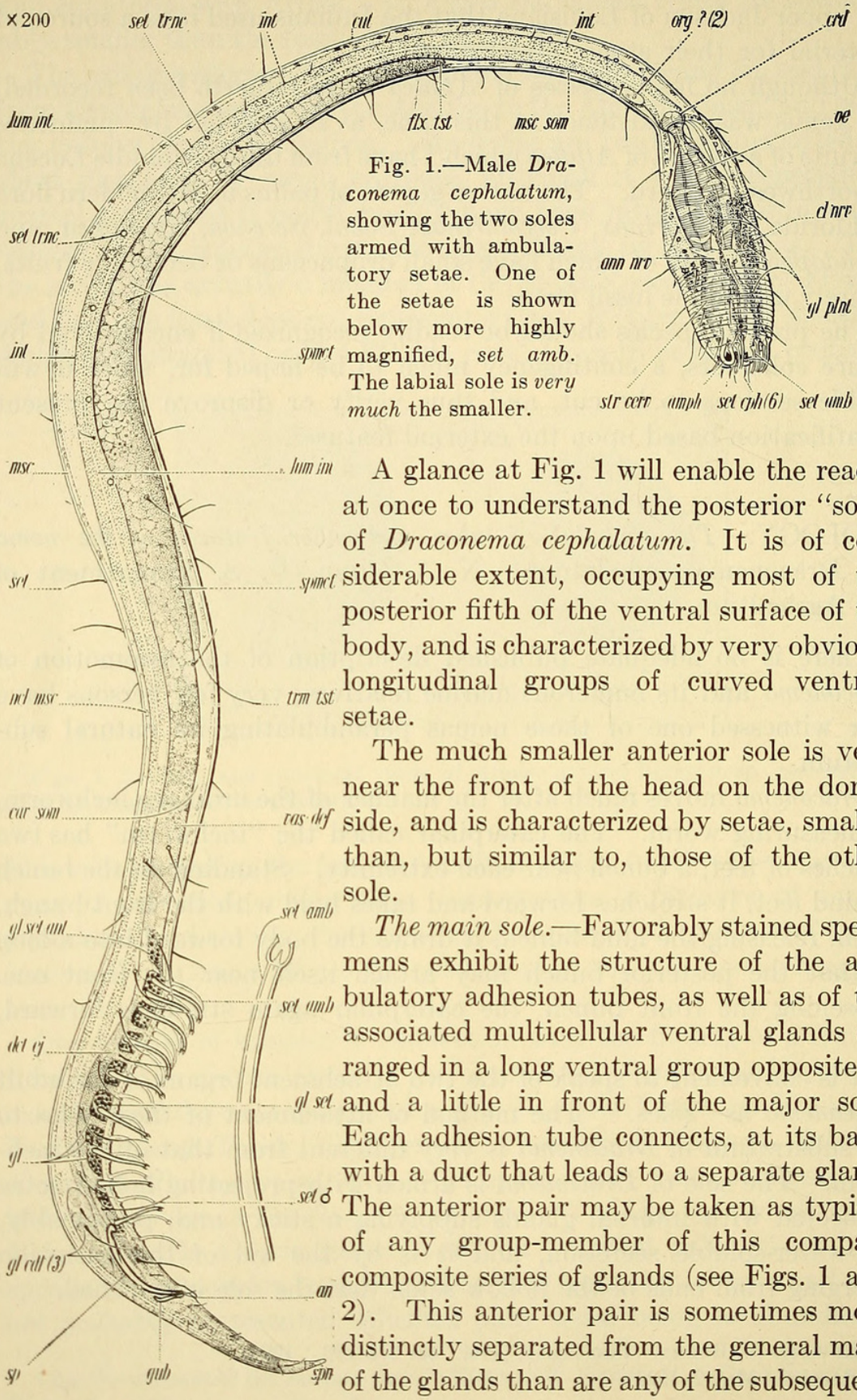

Fig. 1.—Male *Draconema cephalatum*, showing the two soles armed with ambulatory setae. One of the setae is shown below more highly magnified, *set amb*. The labial sole is *very much* the smaller.

A glance at Fig. 1 will enable the reader at once to understand the posterior "sole" of *Draconema cephalatum*. It is of considerable extent, occupying most of the posterior fifth of the ventral surface of the body, and is characterized by very obvious, longitudinal groups of curved ventrad setae.

The much smaller anterior sole is very near the front of the head on the dorsal side, and is characterized by setae, smaller than, but similar to, those of the other sole.

The main sole.—Favorably stained specimens exhibit the structure of the ambulatory adhesion tubes, as well as of the associated multicellular ventral glands arranged in a long ventral group opposite to and a little in front of the major sole. Each adhesion tube connects, at its base, with a duct that leads to a separate gland. The anterior pair may be taken as typical of any group-member of this compact composite series of glands (see Figs. 1 and 2). This anterior pair is sometimes more distinctly separated from the general mass of the glands than are any of the subsequent

pairs or groups; and each of these two glands proves to have three nuclei. (See Fig. 2.) The cells of each gland, as well as their spheroidal nuclei, increase in size from front to back, the anterior, i.e., distal, cell having less than one-eighth the volume of the posterior; the nucleus in the small anterior cell is also less conspicuous. This group (pair) of glands is more or less clavate in form and is nearly as long as the corresponding body diameter. Posteriorly, each gland diminishes suddenly in diameter to form a duct about half as wide as one of the adjacent annules of the cuticle. Near the gland the wall of the duct contains somewhat elongated nuclei of considerably smaller size than the nuclei of the glands. The duct also lacks the granular character of the glandular cells themselves. The two ducts, at first ventral, diverge backward to the two foremost adhesion tubes, and are one to two times as long as the glands. Near where a duct enters the somewhat swollen base of an adhesion tube, there is a small duplex enlargement or ampulla. In the specimens under examination, only in the very basal portion of the adhesion tube is there any indication of the staining action of the acid carmine.

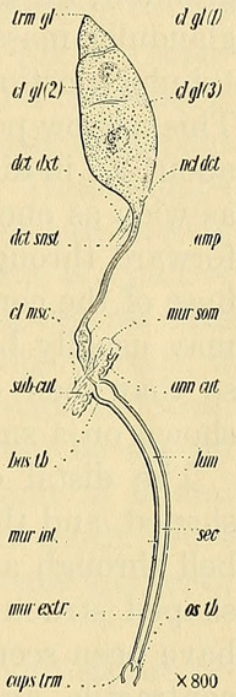

Fig. 2.—Anterior ambulatory seta of *D. cephalatum* with its 3-celled gland, its 3-celled mate concealed, though part of its duct shows,—*dct snst.; som*, body wall; *cl msc*, somatic muscle; *an cut*, cuticular annules; *mur ext* and *mur int*, outer and inner walls of ambulatory tube; *os tb*, secretory pore.

The numerous glands composing this ventral series are so closely packed together that, as a rule, it is difficult to distinguish the exact number of groups, but it is evident that throughout the series the glands are arranged in groups side by side, apparently mostly in pairs or quartets, the number of glands being commensurate with the number of adhesion tubes. On occasions when the entire group of glands is slightly separated from the body wall, and therefore from the bases of the adhesion tubes, the ducts leading to the tubes are distinctly visible, and have the appearance, when viewed laterally, of a rather complicated plexus.

The minor, or cephalic, sole.—The dozen or so adhesion tubes and glands of the cephalic sole have the same general plan as the sublateral and subventral ones of the posterior sole just described. The glands connected with the cephalic tubes (*gl. plnt*) are located mainly dorsad in the anterior two-fifths of the neck between the oesophagus and the body-wall; there are two dorsally

sublateral groups of glandular cells and four subdorsal groups, corresponding to a similar grouping of the six pairs of adhesion tubes. The glands of the cephalic sole are sometimes rather more strongly stained than those of the posterior sole in the same specimen, but present the same general anatomical and histological structure. Referring to the dorsally sublateral cervical glands as examples (see Fig. 1), these are distinctly granular in structure and apparently duplex, that is, have a well marked constriction near the middle, on opposite sides of which, fore and aft, is a considerable volume of nuclear (?) matter; the remaining portion of the cells is rather coarsely granular, the granules measuring nearly 1μ in diameter. This duplex glandular mass is half as long as the neck and anteriorly tapers to a tubular portion not much wider than one of the cervical annules. This narrow portion of the gland in turn tapers to a very narrow duct about 2μ in diameter, which swells to form a fusiform duplex ampulla as wide as one of the coarser cervical annules. The ampulla empties forward through a short narrow duct, 1 to 2 μ wide, directly into the base of the corresponding adhesion tube, where a little stained matter may usually be seen. The adhesion tubes reach exactly to the lips, so that their outpour is practically terminal. All these details are shown on a small scale in Fig. 1.

The distal extremity of the ambulatory tube is somewhat bell-shaped, and the lumen of the tube is prolonged into the cavity of the bell through a short conoid extension. The significance of this bell-shaped structure remains more or less problematical. No elements have been seen in the tube, or in the bell, that could be regarded as contractile, and one therefore seems obliged to assume that whatever changes of form are exhibited by this bell-shaped structure are due to such factors as its own elasticity, the pressure of the internal secretion and counter pressure of the external water. It would seem advantageous to the nema if the secretion which flows out through the bell-shaped organ could be "cut off" at will, and it is conceivable that this bell-shaped affair in some way accomplishes that end. Again, it is conceivable that the bell may mechanically give to the end of the tube a greater adhesiveness, conceivably through suction,—a suction that might be made to vary with the relationship of the distal end of the tube to the substratum, as in the familiar elastic concave rubber suction disc.

The facts that the setae of the inner rows are always the shorter, and that all the setae are incurved, suggest that a suitable substratum may be a microscopic filament, or a thin edge of something. This

thought arises from the fact that the main sole appears "bow-legged," as it were. Such apparently suitable thin and narrow forms of substratum occur on certain marine algae and, as a matter of fact, at least two observers—Cobb and Chambers—have seen *Draconema* perambulating the surface of algae.

In balsam specimens from Hudson Bay the body-wall tissues surrounding the mouth-opening have a golden yellow color and take on the form of a six-parted, but twelve-pointed, star.

Probably the excretory pore is at the lips. I formerly referred to a cell just behind the cardia as possibly representing the renette; this suggestion may not be well founded. In this region I observe two of these cells lying side by side in subventral position (see Fig. 1), separated by a small space. In the same latitude, just behind the minute cardiac cavity, on each side of the intestine, there is a rather compact group of granular cells containing about a dozen nuclei. These groups are as long as the corresponding body diameter, and about half as wide as long. Between the two groups, on the dorsal side, there is a pair of subdorsal granular cells rather closely resembling the subventral ones just described. As to the function of these lateral groups of cells, it seems not impossible,—as they are free at their posterior ends and seem connected with the intestine anteriorly,—that they may be special glands associated with digestion. There is a similar pair of lateral groups of cells in front of the cardia, emptying (?) backward. I do not think the possibility is excluded that some of these cells are nerve cells.

The intestine is composed of cells of such a size that about six are required to complete a circumference. The thin refractive lining is hardly 1 μ thick. The cardia, as usual, presents a distinct group of closely packed nuclei, indicating that it is composed of cells of rather small size, of which the number is probably about fifteen to twenty. Notable is the presence of *scattered cells in the wall of the intestine which stain differently* from their neighbors. These, no doubt, discharge some special function. Thus far they have been observed only in the anterior portion of the intestine.

The portion of the neck opposite, and adjacent to, the oesophageal constriction, except such portion as is occupied by the glands of the minor sole, is rather closely packed with nerve cells.

The lateral fields are one-third as wide as the body and contain a considerable number of nuclei rather irregularly arranged.

The cuticle in the posterior region of the tail is traversed by radial elements that give rise to a finely punctate appearance on the surface (see Fig. 1).

An interesting observation is the apparent connection of the tandem group of three caudal glands with the dorsal field by means of a narrow strand running forward, possibly of a nervous character, as is suggested: 1, by its form and position; 2, by its size and structure.

The internal extremity of the gubernaculum lies near the body axis and is connected fore and aft with the ventral body-wall by slender strands of muscular tissue. The testis is now believed to be reflexed, not outstretched as formerly figured.

The broad, rapidly tapering ovaries,—the anterior lying to the right, the posterior to the left,—are reflexed to nearly opposite the vulva and contain comparatively few ova, arranged in single file in the wider part, elsewhere irregularly. Hundreds of subspherical sperm cells may occur in the uterus. Usually there is one egg at a time in the uterus, thin shelled and smooth, and deposited before segmentation begins. The eggs are three-fourths as wide as long and about two-thirds as long as the corresponding body diameter.

Some of the results of the present investigation have been more or less definitely forecast by various observers on several occasions, notably by Steiner and Irwin-Smith, both of whom from inadequate material, have, with admirable insight, suggested the probable connection of the adhesion tubes with internal structures and also the possibility of the glandular nature of these latter.

While no doubt now remains that both the major and minor soles are glandular and are organs of locomotion, it still seems to me quite doubtful whether we fully understand the bodily structure of *Draconema*. The form of the head and neck and other parts do not seem to be explained merely on the basis of the use of these two "sticky" soles in locomotion. There probably are other unknown factors playing a part in the activities of *Draconema* that will further explain its highly peculiar and interesting structure.[2]

[2] *Nomenclature.* The proposal of the genus *Draconema* in 1913 appears reasonable in view of the fact that at that time the published descriptions of the species belonging to its family, though in no case as complete as desirable, indicated the existence of two (or more) genera, the type species of one of which should be that originally named by Claparède *Chaetosoma ophiocephalum* 1863 (not *Chaetosoma* Westwood, 1851, Coleoptera). *Draconema cephalatum*, was then, and continues to be, thought generically different from Claparède's *ophiocephalum*. The name *Chaetosoma*, being preëmpted, should be replaced by its synonym *Notochaetosoma* Irwin-Smith 1917. Should the opinion prevail that all the described forms of the family belong to one genus, then the oldest synonym for *Chaetosoma* would be *Draconema*, and should be substituted. In that event, the family name would naturally become *Draconematidae;* in any case, it seems likely that *Draconema* is a better representative of the group than the only other genus so far proposed, *Notochaetosoma*.

Draconema cephalatum is cosmopolitan, and seems to have been described by several different authors under as many different specific names, e.g., *annulatum* Ditlev., *haswelli* Irwin-Smith, *hibernicum* Southern.