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Host-induced morphological variations in the strigeoid trematode *Posthodiplostomum minimum* (Trematoda: Diplostomatidae). III. Organs of attachment

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HOST-INDUCED MORPHOLOGICAL VARIATIONS IN THE STRIGEOID TREMATODE *POSTHODIPLOSTOMUM MINIMUM* (TREMATODA: DIPLOSTOMATIDAE). III. ORGANS OF ATTACHMENT

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Abstract.— A variety of amphibian, reptilian, avian, and mammalian hosts were used in experimental development of *Posthodiplostomum minimum*. As a result of this study much host-induced morphological variation was noted in several organs of attachment. Variations in the oral sucker ranged from a well-developed muscular organ to a weakly developed oral slit. Acetabular development ranged from well-developed to reduced forms lacking apical musculature, tegumental spines, and sensory structures. The holdfast organ showed marked reduction in most poikilothermic hosts.

Members of the family Diplostomatidae Poirier, 1886, constitute a group of trematodes characterized by a distinct flat or spoon-shaped forebody containing an oral sucker, acetabulum, and bulbous tribocytic or holdfast organ. Throughout the literature, when investigators describe strigeoid trematodes, measurements of the oral sucker, acetabulum, and holdfast organ are characteristically given. Little emphasis has been placed on the effects of the definitive host upon the development of these organs.

A variety of amphibian, reptilian, avian, and mammalian hosts were experimentally employed in the development of adult *Postodiplostomum minimum*, a strigeoid trematode characteristically found in a variety of piscivorous avian hosts (Palmieri 1975). As a result of these experimental studies, great variations in the size, shape, and complexity of the oral sucker, acetabulum, and holdfast organ were recorded and are subsequently described in this paper.

Material and Methods

The experimental hosts employed and the techniques used in experimental infections of *P. minimum* to these hosts, as well as specimen preparation for examination by scanning electron microscopy, are explained in detail in part II of this study.

Results and Discussion

Oral sucker.— Five variables were analyzed for the oral sucker of *P. minimum*. (length, width, cross sectional area, ratio of length to width, and ratio of oral sucker-acetabulum cross sectional areas) and are listed in Table 1. Various morphological modifications of the oral sucker are compared according to hosts (Fig. 1-6).

Of all the morphological features of the adult worm examined during this investigation, the oral sucker shows the greatest amount of morphological variation.

In ecologically normal definitive hosts (piscivorous birds), as well as mammalian hosts, the oral sucker is well developed, muscular, and situated in the anteromost portion of the forebody (Figs. 5-8, 14). In certain avian and mammalian hosts, however, it appears to lie below the surface of the anterior end of the forebody (Figs. 3-4, 9-11, 15). In such instances, the cavity of the oral sucker appears collapsed, although the musculature retains its identity. In amphibian and reptilian definitive hosts, an oral sucker appears to be lacking or may be so markedly reduced that only an oral slit appears (Figs. 1-2, 11-13). In cases where the oral slit is present, it does lead into the pharynx. In other than avian hosts, it is not atypical to find some specimens with well-

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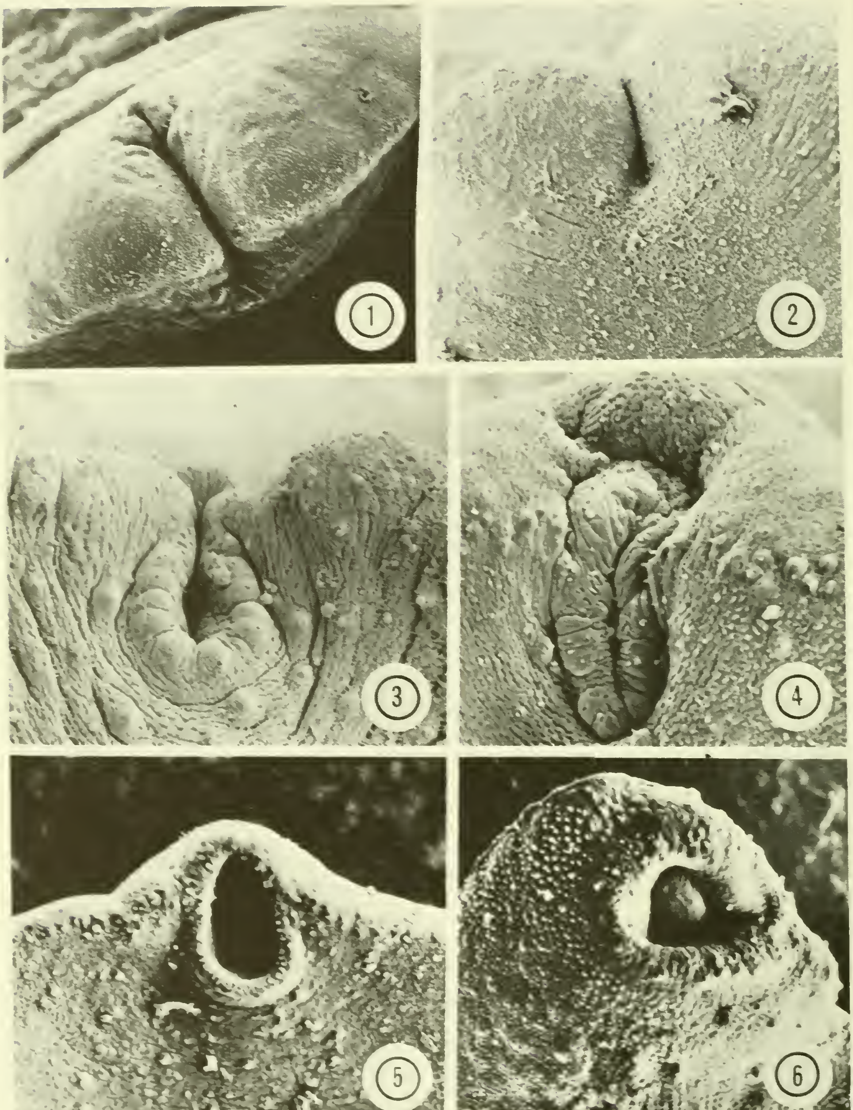


Figs. 1-6. Morphological variations of the oral sucker of adult *P. minimum* from vertebrate hosts. All specimens 72 hours old. Scale 1 inch = .030 mm. 1, Host: *Bufo americanus*, note presence of an oral slit; 2, Host: *Rana pipiens*, note presence of an oral slit; 3-4, Host: *Iguana iguana*, note the infolding of the oral sucker; 5, Host: *Columba livia*, note the well-developed oral sucker; 6, Host. *Felis catus*, note the well-developed oral sucker.

developed oral suckers and others with oral slits, even among worms recovered from a single definitive host.

Acetabulum.— Six variables were analyzed in studying the acetabulum (length, width, cross sectional area, ratio of the length to width, acetabular index, ratio of the acetabulum length to the body length, and the acetabulum width to the body width). Length and width were measured along the major axes of the body.

An analysis of the above data appears in Table 2. Morphological variations of the acetabulum are illustrated in Figures 16-21.

Throughout the four classes of definitive hosts experimentally used for development of adult *P. minimum*, complexity in structure and overall size of the acetabulum vary greatly depending on the group of definitive host used. Within some hosts (especially avian) the acetabulum is large, consisting of a full base well endowed with tegumental spines and an expanded muscular surface region covered with two rows of presumed sensory structures. Two views of the acetabulum recovered from the avian host *Larus argentatus* clearly show the above structures (Figs. 18-19). In other hosts, the acetabulum is reduced in size (Fig. 21) and neither the base nor the apical region are fully developed (Figs. 17-25). In one specimen of *P. minimum* recovered from a frog (*Rana pipiens*) (Fig. 16), the base of the acetabulum is not distinguishable, and there is no evidence of apical musculature, well-developed tegumental spination, or sensory structures. In a few abnormally developed worms recovered from *Ambystoma tigrinum*, the acetabulum has apparently degenerated to a point where it is no longer present.

Holdfast or tribocytic organ.— Four variables (length, width, cross sectional area, and ratio of length to width) were analyzed in studying the holdfast organ of *P. minimum*. An evaluation of the above data is presented in Table 3. Structure of the holdfast organ is shown on Figures 22-27.

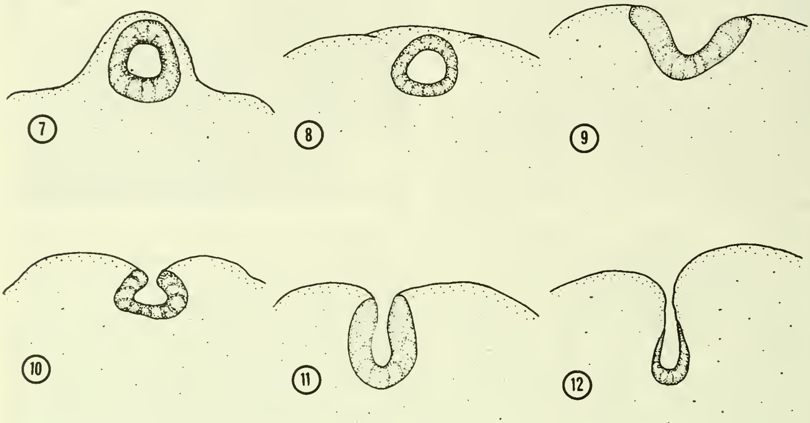
The holdfast or tribocytic organ of *P. minimum* occupies a large portion of the

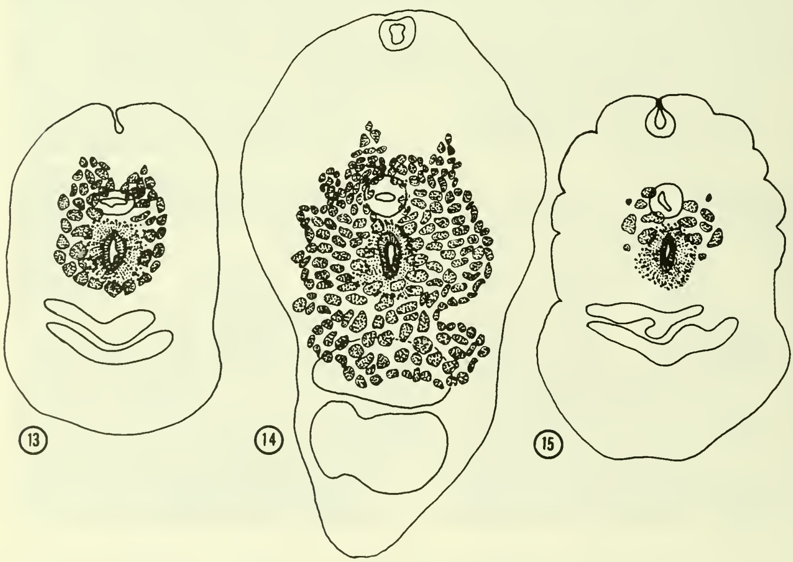
Table 1. Statistical analysis of oral sucker measurements of *P. Minimum* from experimental definitive hosts.*

Variable	Mean of Combined Host Class	Standard Deviation	Means			
			Amphibian	Reptilian	Aves	Mammalia
Oral Sucker Length (OSL)	0.033	0.010	0.029	0.049	0.038	0.036
Oral Sucker Width (OSW)	0.028	0.009	0.026	0.025	0.031	0.029
Cross-sectional Area of Oral Sucker (AOSLYOSW)	0.001	0.001	0.001	0.001	0.001	0.001
Ratio of Oral Sucker Length to Width (ROSLOSW)	1.109	0.393	1.045	0.946	1.232	1.244
Ratio of Oral Sucker to Acetabulum Cross-sectional Area (ROSXXA)	0.524	1.552	0.684	0.388	0.429	0.371

*All measurements in mm.

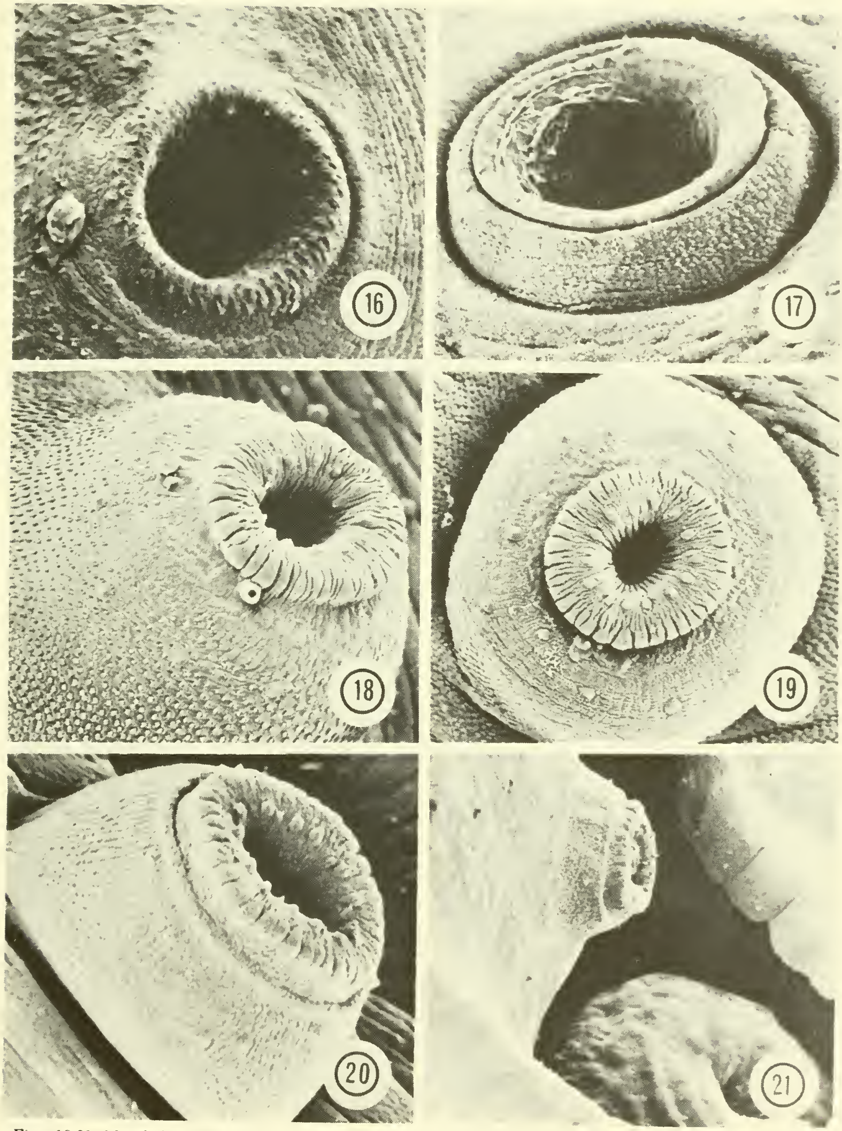
posterior region of the forebody. Although its size is consistent in specimens recovered from most vertebrate hosts, it is somewhat reduced in amphibian and reptilian hosts. The relative constancy in size of the holdfast organ in worms from all vertebrate hosts make variations in the shape of this structure difficult to ascertain. Furthermore, the shape of the holdfast is probably affected by the underlying musculature.



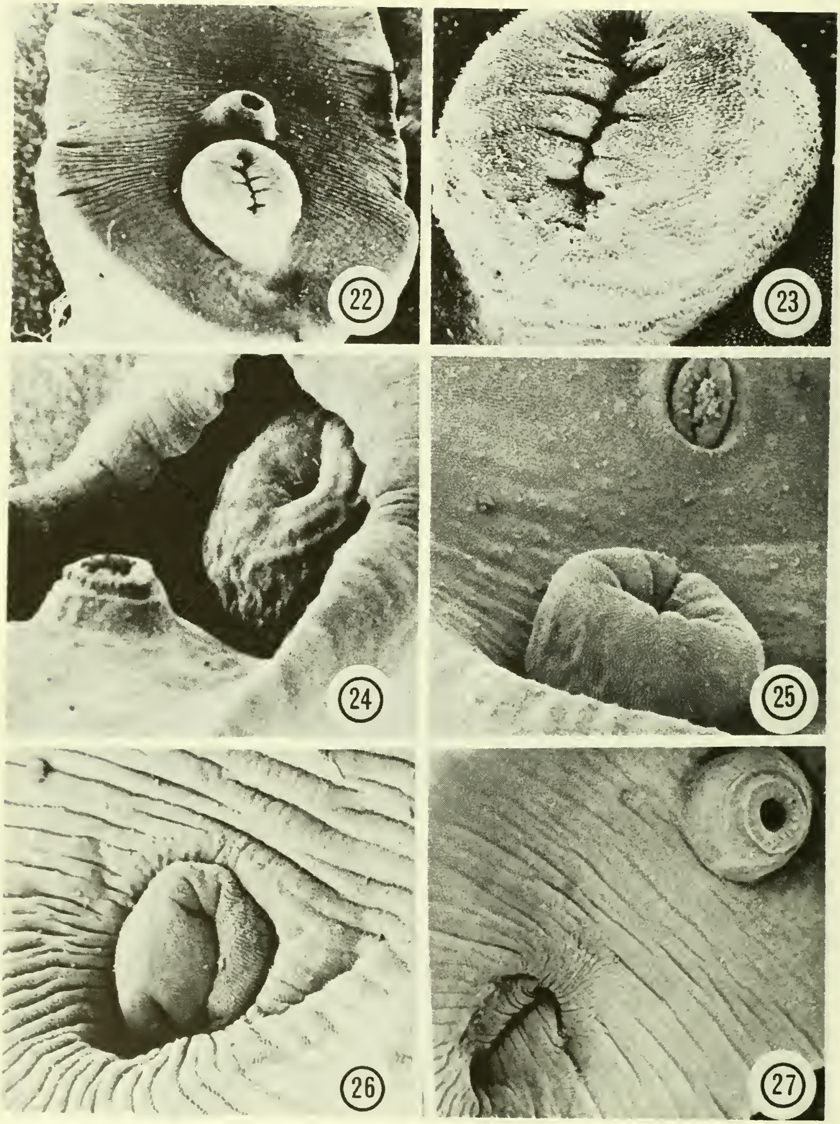


Figs. 7-12. Morphological variations of the oral sucker depicting the normally developed oral sucker and its reduction to an oral slit.

Figs. 13-15. Morphological variations of the oral sucker, vitelline gland, and testes.



Figs. 16-21. Morphological variations of the acetabulum of adult *P. minimum* recovered from vertebrate hosts. All specimens 72 hours old. 16, Host: *Rana pipiens*, note the loss of the base of the acetabulum and the reduction of sensory structures and tegumental spines. (Scale: 1 inch = .018 mm); 17, Host: *Meriones unguiculatus*; 18-19, Host: *Larus argentatus*, note the well-developed tegumental spines, sensory structures and muscular apical region. (Scale: 1 inch = .018 mm); 20, Host: *Bufo americanus* (Scale: 1 inch = .018 mm); 21, Host: *Chrysemys picta*, note the relationship of the acetabulum to the forebody and holdfast organ. (Scale: 1 inch = .055 mm).



Figs. 22-27. Morphological variation of the holdfast (tribocytic organ) of adult *P. minimum*. All specimens 72 hours old. 22-23, Host: *Felis catus*, note large well-developed holdfast; 24-25, Host: *Chrysemys picta*, two views of the holdfast and acetabulum, note the well-developed tegumental spination (Fig. 25); 26, Host: *Canis familiaris*, note the effects of the underlying musculature on the shape of the holdfast; 27, Host: *Meriones unguiculatus*, note the contracted appearance of the holdfast.

TABLE 2. Statistical analysis of acetabulum measurements of *P. Minimum* from experimental definitive hosts.*

Variable	Mean of Combined Host Class	Standard Deviation	Means			
			Amphibian	Reptilian	Aves	Mammalia
Acetabulum Length (AL)	0.047	0.009	0.046	0.049	0.049	0.047
Acetabulum Width (AW)	0.054	0.010	0.050	0.050	0.060	0.058
Cross-sectional Area of Acetabulum (AALYAX)	0.003	0.001	0.002	0.002	0.002	0.002
Ratio of Acetabulum Length to Width (RALAW)	0.888	0.193	0.929	0.969	0.832	0.794
Acetabulum Index of Length (ACEINDL)	0.095	0.024	0.090	0.142	0.083	0.081
Acetabulum Index of Width (ACEINDW)	0.205	0.045	0.191	0.237	0.212	0.202
Ratio of Oral Sucker Cross-sectional Area to Acetabulum Cross-sectional Area (ROSXXA)	0,524	1.552	0.684	0.388	0.429	0.371

TABLE 3. Statistical analysis of holdfast organ measurements of *P. Minimum* from experimental definitive hosts.*

Variable	Mean of Combined Host Class	Standard Deviation	Means			
			Amphibian	Reptilian	Aves	Mammalia
Holdfast Length (HL)	0.090	0.018	0.087	0.060	0.106	0.104
Holdfast Width (HW)	0.106	0.019	0.104	0.072	0.127	0.116
Cross-sectional Area of Holdfast (AHLXHW)	0.010	0.003	0.009	0.005	0.014	0.012
Ratio of Holdfast Length to Width (RHLHW)	0.841	0.245	0.854	0.672	0.872	0.912

*All measurements in mm.

Figures 22-23 show the appearance of the holdfast organ in the extended appearance, whereas Figures 26-27 demonstrate the holdfast organ being pulled inward by the underlying musculature.

Examination of the holdfast organ shows that it is well endowed with tegumental spines (Fig. 25). Such spines do not vary appreciably in size and shape as do tegumental spines from other body regions, as reported in part II of this study.

Acknowledgments

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