IDENTIFICATION AND FREQUENCY OF OCCURRENCE OF FOUR FORMS OF *HENNEGUYA* FOUND IN CHANNEL CATFISH

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ABSTRACT

The terms intracapillary, interlamellar, cutaneous and visceral are proposed as names for four working forms or categories of *Henneguya* spp. found in channel catfish. Guidelines for their proper identification are suggested and the severity and incidence of each form are documented.

Disease workers in diagnostic laboratories often find it convenient to separate *Henneguya* spp. infections into forms based on the nature of induced lesions. These forms include the interlamellar form, intracapillary form, which is referred to by many workers as the intralamellar form (Meyer, 1972, personal communication), visceral form, and cutaneous form. These working forms or categories are classified according to their location within the host tissue. The usefulness of such non-taxonomic divisions will be readily apparent when the pathogenicity and frequency of occurence of each form are considered.

Before these working categories can be effectively used, some agreement as to their proper identification needs to be reached. With this goal in mind, I submit the following observations which, hopefully, will help to clarify this sometimes confusing problem.

The cutaneous form includes all cysts which affect or involve the skin, such as those found in the adipose fin, dermis, and dermal "tumor-like" external growths (Fig. 9). The visceral form includes those cysts associated with the various internal organs, such as the kidney and liver. Economically, these forms are of little importance as they are observed rarely (Table 1) and then cause only light mortalities. A low percentage of the infected fish may be so disfigured they cannot be sold.

The intracapillary form includes those cysts which are confined within the capillary walls of a single lamellae as pictured in Figures 4 and 5. Several characteristics of these cysts and of the surrounding tissues are consistent enough to be useful in diagnostic work. In well-sectioned H&E stained material, red blood cells are almost always visible surrounding the entire cyst (Figs. 4, 5). Also in serial sections a capillary surrounding the cyst and opening into an arteriole should be visible (Fig. 5). In most sections, the outer epithelial membrane surrounding the lamella remains identifiable around the entire cyst (Figs. 4, 5). In large mature cysts these features are sometimes not as distinct but are generally still visible in well-stained sections. Another prominent characteristic is that a small immature cyst generally develops in the capillary from the tip of the lamella (Fig. 4) towards the base (Fig. 5).

The intracapillary form has the highest frequency of occurrence as indicated by Table 1 and Figures 1, 2, and 3. This form has never been diagnosed as the causative agent in an epizootic. It has occasionally been considered a minor contributing agent in an epizootic. It is not well understood why this is the case, as the intracapillary form is often relatively abundant in a large number of fish from a given population. It could be that the capillary surrounding the cyst limits its spread more than do the lamellar cells surrounding the interlamellar form. It also could be that because of the continuous flow of blood around the cyst, the lamellar tissue shows little response to the intracapillary cyst except for

a physical distortion of the capillary and lamellar cells. Conceivably, if the cysts were numerous enough lamellar respiration could be greatly retarded, possibly to the point of suffocation. This, to my knowledge, has never occurred.

The interlamellar form usually begins its development among the basal cells between two lamellae (Fig. 6) and develops outward carrying the outer epithelial membrane with it. Eventually, the interlamellar cyst involves the cells of two adjacent lamellae. In large cysts, the cyst wall may actually be touching the capillaries of the two adjacent lamellae. In identifying this form, one should look for an absence of red blood cells around the cyst, particularly at the outer edge (Fig. 7). A capillary should be visible on either side of the cyst (Fig. 7) but not at the lower center of the cyst as in Figure 5. The epithelial membrane should be restricted to the outer edge of the cyst (Figs. 6, 7). In serial sections a capillary which surrounds a cyst and opens into an arteriole as was previously described for the intracapillary form will not be found.

The interlamellar form is currently being diagnosed from 1% or less of the cases brought to Stuttgart and Mississippi State University (Table 1). Out of 2,784 cases there has been a total of 19 cases of the interlamellar for diagnosed In two of these cases epizootics caused by this form of *Henneguya* were incurred by the farmers (95% mortality) and in several other cases losses were underway. In minor infections, the cyst of this form caused little damage as there was no massive tissue reaction. However, in severe cases the lamellae of entire filaments were fused beyond the point of structural recognition (Fig. 8). It is obvious from Figure 8 that this gill filament can no longer carry on gas exchange.

Both the intracapillary and the interlamellar forms of *Henneguya* spp. are more often encountered in the spring months, particularly in April (Figs. 1, 2A, 2B). This is probably somewhat of a biased figure, as the case load of the diagnostic laboratories generally increases with rising water temperatures at that time of year. The high incidence in late spring does appear to be significant, however, because the two epizootics recorded took place in April and May. The incidence of both forms is lowest in summer and early fall. One cautionary note should be added. On occasion, both the intracapillary form and the interlamellar form occur on the same arch. The significance of this observation remains enigmatic. Most parasitologists who are familiar with the various forms consider it to reflect a double infection involving different species of the parasite. This determination, however, has not been made. Gross examination has not proven discriminating enough to accurately ascertain which forms are present. Until better guidelines for the gross identification can be established, histological methods should be used.

Since all forms of *Henneguya* spp. are refractive to chemical treatment, it is important to get as accurate an understanding as possible of their frequency within the catfish populations. If this can be done, the feasibility of their control can better be determined.

From 1960 through 1966 the intracapillary form was seen only twice. In 1967, 7% of the cases checked had at least a light infection. In 1968 the percent of infection dropped to 5% but then increased to 9% in 1969 and 1970. In 1971 the percentage was up to 12%, and in the first six months of 1972 it was up to 14%. For the last two years there was about a 2% increase per year. The increase in incidence of the interlamellar form parallels the increase in the incidence of the intracapillary form, but is slower and started several years later. From 1960 through 1968 no cases of the interlamellar form were recorded. In 1969 and 1970 it was found in less than 1% of the cases checked. In 1971 and 1972, it was found in 1% of the cases recorded (two epizootics in 1971). At this level the interlamellar form is hard to detect. This low incidence also helps to limit the severity of the disease as it is much more difficult for uninfected fish to come in contact with the parasite. However, as the level of the interlamellar form increases in the general population, the probability of a fish becoming infected in-

creases. Once the level of incidence reaches 3% or 4%, the rate of increase will probably go up much quicker. The above data suggest that the dangerous interlamellar form of *Henneguya* is increasing in incidence. Effective control of its spread must begin now, while it is still limited in its distribution and before a major problem develops for the industry.

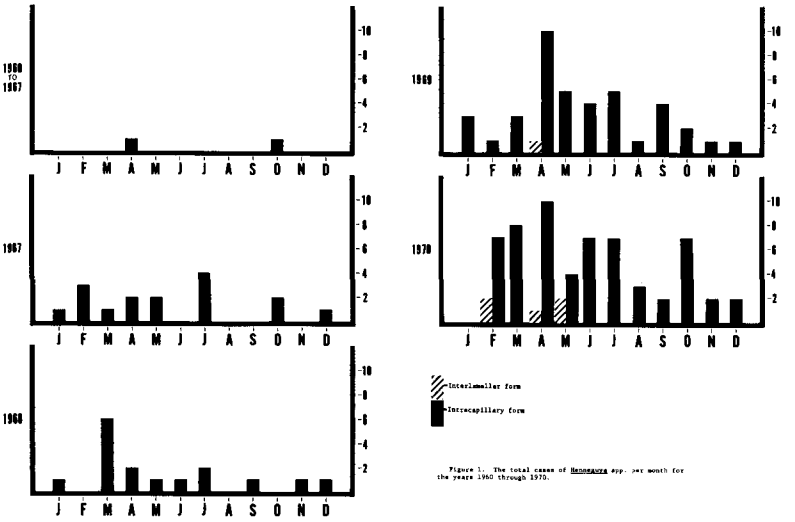


Figure 1. The total cases of *Henneguya* spp. per month for the years 1960 through 1970.

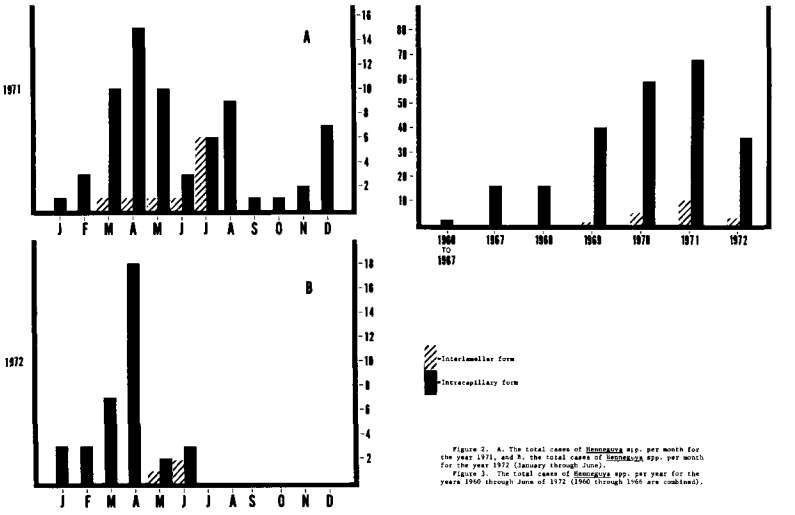
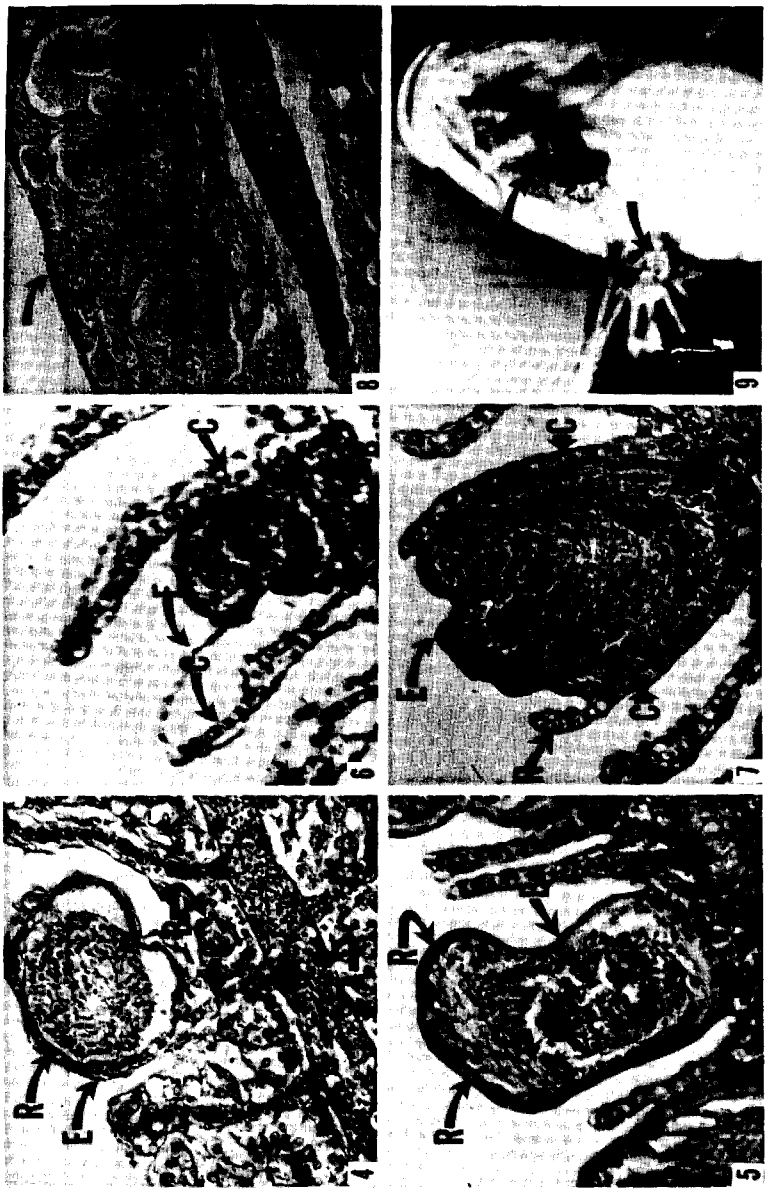


Figure 2. A. The total cases of *Henneguya* spp. per month for the year 1971, and B. the total cases of *Henneguya* spp. per month for the year 1972 (January through June).

Figure 3. The total cases of *Henneguya* spp. per year for the years 1960 through June of 1972 (1960 through 1966 are combined).



Figures 4-5. Photomicrographs of intracapillary form.
Figures 6-8. Photomicrographs of interlamellar form. [Arteriole (A); basal cells (B); capillary (C); epithelial membrane (E); intracapillary cyst (IC); interlamellar cyst (IL); red blood cell nucleus (R).]
Figure 9. Photomicrograph showing external "tumor-like" growths caused by the cutaneous form of *Henneguya* spp.

Table 1. Total disease cases per year showing the number and percent of the four working forms of *Henneguya* spp.[1]

YEAR	TOTAL CASES	INTRA-CAPILLARY	PERCENT	INTER-LAMELLAR	PERCENT	CUTANEOUS AND VISCERAL	PERCENT
1960-1966	314	2	.006	0	0	0	0
1967	212	16	.07	0	0	0	0
1968	291	16	.05	0	0	0	0
1969	427	40	.09	1	.009	0	0
1970	693	59	.09	5	.007	0	0
1971	581	68	.12	10	.01	2	.003
1972	266	36	.14	3	.01	0	0

[1]The combined disease records of Dr. Fred Meyer, Fish Farming Experiment Station, Stuttgart, Arkansas, and Dr. Thomas L. Wellborn, Jr., Extension Wildlife and Fisheries Department, Mississippi State University.