sort themselves out from diploid *A. neglecta*, without any sharp break, and they form among themselves a complex pattern which could be related to the varieties of *A. neglecta* which I had earlier recognized. They could also be organized *inter se* in any of several other ways, so far as their position on the graph is concerned.

It thus appears that by following the method of emphasizing the sexual and especially the sexual diploid plants, one comes up here with two species, each with a single diploid phase with which other polyploid or polyploid-apomictic phases can be associated. Inasmuch as this group is widely distributed in the northeastern United States, whereas Beals' analysis pertains only to Wisconsin, it remains to be seen whether the correlations he has demonstrated will hold true elsewhere. Nevertheless it seems to be significant that the species and at least some of the varieties which I had earlier recognized on more classical grounds, in a treatment for the whole of the northeastern United States (1945, 1952), correlate well with the groups discovered in Wisconsin by starting with the sexual diploids and proceeding to the polyploids and apomicts. At least until information to the contrary is presented, I believe the needs of the taxonomic system are best met here by recognizing two species, each with several infraspecific groups.

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The Naiad Fauna of Indian Creek, Madison County, Alabama

ABSTRACT: *Six of 11 naiad species found in Indian Creek, Madison Co., Alabama, are of Cumberlandian origin as defined by Ortmann, 1924. Naiads in Indian Creek are restricted to a rather localized habitat between miles 7.75 and 9, due to pollution downstream and substrate conditions upstream. Cursory examination of Indian Creek in November, 1966, indicated the naiad fauna may be terminal. There has been some silting of the habitat, apparently due to highway construction upstream. The only other change noted since 1964 has been an increase in the* Corbicula manillensis *Philippi population.*

INTRODUCTION

Naiads of northern Alabama streams have received much attention, especially the fauna at Muscle Shoals on the Tennessee River. Flint River, Gurley; Flint River, Maysville; Hurricane Creek, Gurley, tributary to Flint River; and Paint Rock River, New Hope, all in Madison Co., Alabama, have been collected (Ortmann, 1925).

With the exception of Stansbery (1964), most of the work was published between 1900 and 1939, and was thus based on data collected prior to impoundment of the Tennessee River. Analyses of the naiad fauna of the lower Tennessee River by Ortmann (1925), Van der Schalie (1939), and Stansbery (1964) are particularly pertinent as regards the fauna of the Muscle Shoals area.

Indian Creek, situated on the north side of the Tennessee River, flows in a meandering southerly direction to its confluence with the Tennessee River at Tennessee River mile 320.8. Indian Creek lies entirely within the western half of Madison Co., Alabama. Madison County encompasses 521,202 acres, with an average elevation of 190 m above sea level. Mean annual temperature in the region is 61 F.

First naiad collections of record from Indian Creek were made by the author on 17 November 1964, and at this time the presence of Cumberlandian species was noted. A second collection was made 10 June 1965, a third on 6 August 1965, and a fourth on 17 November 1966. Naiads of Indian Creek are restricted to a short length of habitable stream between miles 7.75 and 9.0. A cursory examination of the area downstream from U. S. Highway 72A, Alabama 20 bridge, Indian Creek mile 11.75 to 11.50, did not reveal any naiads. The substrate here is covered with erosion silt, apparently from construction along the U. S. 72A, Alabama 20 Highway. A survey of Indian Creek from Highway 72A upstream revealed no naiads. A few gastropods were found immediately above where U. S. 72 crosses Indian Creek. These were found on the right shore (facing downstream). Snails (*Goniobasis laqueata*) were mostly restricted to the region influenced by a small stream entering at this point.

Restriction of naiads in Indian Creek is due in part to the substrate. The stream bed above U. S. Highway 72A is composed of compacted chert and bedrock. Below this highway the creek is a series of pools, with a heavily silted substrate, downstream to near mile 9. From mile 9 to mile 7.75 the stream is a series of shallow pools with gravelly shoals between.

There was no evidence of industrial or municipal pollution affecting the stream above Indian Creek mile 7.65. Benthic fauna, fish population data, chemical data, and physical data, taken prior to 1966, indicate the suitability of Indian Creek above mile 7.75 for habitation by naiads. Below mile 7.65 to its confluence with the Tennessee River, Indian Creek is polluted to the extent that it precludes maintenance of a naiad fauna; however, *Corbicula manillensis* Philippi occurs in the downstream area.

ANALYSIS OF THE NAIAD FAUNA

Six naiad species of Cumberlandian origin were found in Indian Creek, four of which previously inhabited the Muscle Shoals — *Fusconaia barnesiana* (Lea), *Villosa nebulosa* (Conrad), *Villosa taeniata* (Conrad), and *Villosa vanuxemensis* (Lea). The other two Cumberlandian species were *Pleurobema oviforme* (Conrad) and *Caruncula muerta* (Lea).

Other species found were *Tritogonia verrucosa* Rafinesque and *Cyclonaias tuberculata* (Rafinesque) common to the Tennessee and Cumberland rivers (Stansbery, 1964, Neel and Allen, 1964); *Lampsilis ovata ventricosa* (Barnes), *Lampsilis fasciola* Rafinesque stream species; and *Anodonta imbecillis* Say, a lake or pond species, a typical inhabitant of lower Tennessee River reservoirs (Bates, 1962).

Indian Creek naiads were restricted to a habitat between Indian Creek miles 7.75 and 9.0, approximately. *Corbicula manillensis* Philippi was also limited to this distribution in the upper reach of the stream. At present it cannot be determined whether the restricted distribution of *Corbicula* is due to its recent introduction to the stream or whether some unknown parameter is a limiting factor in its upstream migration.

Examination of Indian Creek on 17 November 1966 revealed only 16 naiad specimens. Apparently construction work and subsequent rainfall runoff have destroyed the previously suitable habitat. Indications are that the Indian Creek naiad fauna is now terminal.

Collections have been placed in the Museum of Natural History of the Ohio Historical Society, Columbus, Ohio, Dr. David H. Stansbery, Curator of Natural History.

Acknowledgments.—Dr. Robin Vannote assisted with the collection in November, 1964, and Mr. Paul Yokley, Jr., in August, 1965. Dr. David H. Stansbery assisted with identification of specimens. This paper was prepared for a special problems course at the Franz Theodore Stone Laboratory of Ohio State University during the summer of 1965.

TABLE 1.—Naiads occurring in Indian Creek

Species	17 Nov. 1964*	10 June 1965*	6 Aug. 1965**	17 Nov. 1966*
Fusconaia barnesiana (Lea)	C	C	C	R
Tritogonia verrucosa Rafinesque	R	R	R	....
Cyclonaias tuberculata (Rafinesque)***	....	R†	....	....
Pleurobema oviforme (Conrad)	....	C	C	R
Anodonta imbecillis Say	....	R‡	R	....
Carunculina moesta (Lea)	C	C	C	R
Villosa nebulosa (Conrad)	R	....	....	....
Villosa taeniata (Conrad)	....	....	R	....
Villosa vanuxemensis (Lea)	C	C	C	R
Lampsilis ovata ventricosa (Barnes)	....	....	R	....
Lampsilis fasciola Rafinesque	R	R	R	....
Corbicula manillensis Philippi	R	C	C	C
Other molluscs as follows:				
Sphaerium Scopoli	R	R	R	....
Pleurocera canaliculata	C	C	....	....
Goniobasis laqueata	C	C	C	....
Oxyloma	R	....	....	....
Campeloma Rafinesque	....	....	R	....

C = Common, R = Rare.

* Collected Indian Creek mile 7.75 to 8.25.

** Collected Indian Creek mile 7.75 to 9.0, aproximately.

*** Doubtful record, only 1 subfossil valve.

† One valve only.

‡ One fragment only.

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Carapacial Algae in a Population of the Painted Turtle, Chrysemys picta[1]

ABSTRACT: *Colonization by carapacial algae* (Basicladia chelonum) *was found to be more extensive in a natural population of the painted turtle,* Chrysemys picta, *than previously reported. Shedding of the scutes in late summer and fall is the main factor controlling the colonization of* Chrysemys *by vegetative carapacial algae.*

INTRODUCTION

The occurrence of carapacial algae on turtles is a common phenomenon often reported in the literature. Most of these reports have been based on small numbers of turtles and limited to the identification of turtles and algae. Exceptions are those of Edgren *et al.* (1953), Neill and Allen (1954), and Proctor (1958). Although these authors compared the degree of colonization by carapacial algae between species of North American turtles, there has been no comparison of the variation in algal abundance on a seasonal basis within a single population of turtles.

The purpose of the present study was to determine the seasonal changes in abundance of the carapacial algae (predominantly *Basicladia chelonum*) that occur in a population of the painted turtle, *Chrysemys picta*, and to investigate the factors influencing these changes.

METHODS

From a marsh in southwestern Michigan, 667 *Chrysemys*, including 156 recaptures, were collected and marked for individual identification during the period from 20 July 1964 to 31 October 1965. Sex, plastron length, and percentage of the carapace covered by algae, estimated to the nearest 10%, were determined for each capture.

RESULTS AND DISCUSSION

The late April sample had the smallest percentage of *Chrysemys* colonized by vegetative carapacial algae (15%). The algae present represented new growth during the spring. In the first two weeks of May approximately 30% of the individuals had algae on their carapaces, as compared with more than 65% during the last two weeks. Nearly 75% had visible carapacial algae in June.

The period of greatest algal colonization was during July, when more than 90% of the collected individuals had carapacial algae. In August and September only 70% of the turtles were colonized, reflecting the completion of shedding in some of the population. There was a reduction to 55% colonization in October. Since no specimens were collected from November to April, the percentage having carapacial algae during winter is not known.

The majority of *Chrysemys* probably spend the winter without heavy carapacial algae infestation, since there was no indication that algae established colonies on shed individuals in the fall. It is likely that *Chrysemys* actually retain algae beneath the shed scutes in the summer and fall but have no measurable growth of algal filaments during the winter. The rapid appearance of carapacial algae from May through June may indicate the advent of favorable light conditions for the algae due to the increased activity of the turtles. The lack of noticeable growth in the fall could be due to the shorter day length in September as compared to May.

[1] Contribution No. 138 from the W. K. Kellogg Biological Station, Michigan State University.