

# The Mussel Fauna of Duck River in Tennessee, 1965

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**ABSTRACT:** Duck River Basin, Tennessee, stations collected by A. E. Ortman in 1921, 1922, and 1923 were revisited and collections made in 1965. *Plethobas cooperianus* found at Columbia, Tennessee, on the Duck River is the only new record, but many new distributional records are reported for individual stations on Duck River. Nine new records are reported for Buffalo River. Forty-eight species were collected, as compared with the 63 reported by Ortman. This is a 24% reduction in number of mussel species in Duck River, Tennessee, since Ortman's 1924 report. General habitat has not been altered appreciably since 1924; however, municipal and industrial water use can be correlated with mussel decline in some areas. *Corbicula manilensis* has a wide range in the Duck River Basin and was found at 10 stations on the Duck River between Duck River miles 71 and 242.5.

### INTRODUCTION

Ortman (1924) is the only published work on the mussel fauna of Duck River in Tennessee. Ortman reported collections from 11 stations in the Duck River proper, and one station each on the Buffalo River and Garrison Fork Creek (Garrison Creek) tributaries to Duck River. His collections were made in 1921, 1922, and 1923.

The present study includes material collected from 13 stations in the Duck River and one each in Buffalo River and Garrison Fork Creek. Stations were selected to conform to Ortman's locations as closely as present conditions allow.

A Needham scraper was used to great advantage in obtaining specimens from shoals. Feeling the substrate with the fingertips produced many specimens in deeper water. Hundreds of shells were taken from muskrat heaps. The majority of the material taken from muskrat heaps often had tissue still evident in the shells. Live material was preserved. Most of the collection is held by Mr. Paul Yokley, Jr., at Florence State College, Florence, Alabama. The balance of the material is in the museum of the Ohio Historical Society, Ohio State University.

### ANALYSIS OF THE FAUNA

*Plethobas cooperianus*, found at Columbia, Tennessee, is the only new record reported for Duck River. Presence of *Elliptio crassidens* is a confirmation of Hickley's and Marsh's report (1885) referred to by Ortman (1924). We were able to add considerable information to the individual station records in most instances. Station 1 was at Duck River mile 71-71.5, Centerville (Centerville), Hickman Co., Tennessee (31 August 1965). This station was

collected precisely at the location described by Ortman (1924). Only the piers of the "Wagon Bridge" remain; a steel bridge now stands between the railroad bridge and the wagon bridge piers referred to by Ortman.

Ortman collected 13 species from Station 1 and we collected 21 species (Table 1). Additions are *Pleurobema cordatum*, *Elliptio crassidens*, *Lamignona costata*, *Alaspidonta marginata*, *Actinonaias carinata*, *Carunculina moesta*, *Ligumia recta*, and *Lampelis ovata*. Station 2 was in "Alexander Bend" (Near Ben), Duck River mile 127.5, Maury Co., Tennessee (1 September 1965). A new bridge was under construction in the "bend." Most of the specimens were collected above the bridge construction site on the shoals. Ortman collected 19 species here and we took 15 for a total of 24 species. New records are *Megalonaias gigantea*, *Quadrula quadrula*, *Truncilla donaciformis*, *Lepidocera fragilis*, and *Lampelis anodontoides*.

Station 3 was at Duck River mile 130.5-131.5, just above Rutherford Creek, Columbia, Maury Co., Tennessee (1 September 1965). Ortman collected 38 species here and we found 25 for a total of 44 species. New distribution records include *Quadrula quadrula*, *Elliptio crassidens*, *Anodonta grandis*, *Obliquaria reflexa*, *Truncilla donaciformis*, and *Lampelis anodontoides*. Ortman collected this station on 6 September 1922 at which time the mean daily flow was 118 ft<sup>3</sup>/sec. Mean daily flow at the time of our collection was 118 ft<sup>3</sup>/sec (3.30 m<sup>3</sup>/sec). Average mean daily flow for this station over the past 49 years was 1,936 ft<sup>3</sup>/sec (54.21 m<sup>3</sup>/sec). It can readily be seen that flow conditions were quite similar to those encountered by Ortman. The gravel bar described by Ortman is still evident at this station.

Station 4 of Ortman, located at Duck River mile 141.1 near Union Grove, is now inundated by a small hydroelectric dam located at about Duck River mile 134. A station was collected below this dam which should be comparable to Ortman's station (1 September 1965). Ortman collected 15 species at his station and we took 29 species, for a total of 31 species recorded. A new record for the Duck River, *Plethobas cooperianus*, was collected at this station. New records for this station were *Quadrula quadrula*, *Levingtonia dolabelloides*, *Pleurobema cordatum*, *Obliquaria reflexa*, *Actinonaias carinata*, *Truncilla truncata*, *T. donaciformis*, *Lepidocera fragilis*, *Proptera alata*, *Carunculina moesta*, *Villosa (Microvna) jabalis*, *V. canuveni*, *Lampelis anodontoides*, *L. fasciola*, and *Dynamia capsaformis*.

Station 5, Duck River mile 156 area, Leftwich, Maury Co., Tennessee, was collected 3 September 1965. Ortman took 19 species at this station and we found 23 for a total record of 29 species. New records are *Megalonaias gigantea*, *Quadrula cyfobibia*, *Obliquaria*

U. S. Geol. Survey data.

TABLE I.--(continued)

| Species                           | 1  | 2 | 3 | 4 | 5 | 6 | 6B | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-----------------------------------|----|---|---|---|---|---|----|---|---|---|----|----|----|----|----|
| Station Number                    |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Alamandonta culcerolus</i>     |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Alamandonta marginata</i>      |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Strophitus undulatus</i>       |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Pygohbranchius fasciolaris</i> | OX |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>(B)ligularia reflexa</i>       | O  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Oboraria subrotunda</i>        |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Aethionahas carinata</i>       |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Aethionahas pectorosa*</i>     |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Truncella truncata</i>         |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Truncella donaciformis</i>     | OX |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Lepidodera fragilis</i>        | O  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Propiera alata</i>             | O  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Carmenclima moesta*</i>        | X  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Conradilla curvata*</i>        |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Methionidus conradicus*</i>    |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Lagunia recta</i>              | X  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Villosa fabalis</i>            |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Villosa iris complex</i>       |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Villosa nebulosa complex*</i>  |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Villosa laevigata complex*</i> |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |

| Species                           | 1  | 2 | 3 | 4 | 5 | 6 | 6B | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-----------------------------------|----|---|---|---|---|---|----|---|---|---|----|----|----|----|----|
| Station Number                    |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Fusconata barnesiana*</i>      |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Megalonotus giganteus</i>      | OX |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Ambleria plicata</i>           | O+ |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Quadrula quadrula</i>          | O+ |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Quadrula pustulosa</i>         | OX |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Quadrula intermedia*</i>       |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Quadrula cylindrica</i>        |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Triligona verrucosa</i>        | O  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Cyclonius tuberculata</i>      | OX |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Plethobasus cooperianus</i>    |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Lexingtonia dolabelloides*</i> |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Pleurobema orthorne*</i>       |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Pleurobema cordatum</i>        | X  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Elliptio crassidens</i>        |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Elliptio dilatatus</i>         |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Lastena lata</i>               |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Lastigona costata</i>          | X  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Lastigona complanata</i>       | O  |   |   |   |   |   |    |   |   |   |    |    |    |    |    |
| <i>Ancodonta grandis</i>          |    |   |   |   |   |   |    |   |   |   |    |    |    |    |    |

TABLE I.--Mussels of Duck-River, Tennessee, 1965: + = live, X = shells only, -- = none, O = Ormann collected at this station

| Station Number | Species | <i>Villosa</i> sp. | <i>Lampilis anodontoides</i> | <i>Lampilis ovata</i> | <i>Lampilis fasciata</i> | <i>Dysnomia triquetra</i> * | <i>Dysnomia brevidens</i> * | <i>Dysnomia cupaeformis</i> * | Number of species taken by Isom and Yokley | Number of species taken by Ortman | Number of Ortman's species by Isom and Yokley | Total No. records | Total new records | Grand Total = 47 | Ortman's Grand Total = 63 | <i>Sphaerium</i> sp. | <i>Corbicula muniflora</i> |
|----------------|---------|--------------------|------------------------------|-----------------------|--------------------------|-----------------------------|-----------------------------|-------------------------------|--|-----------------------------------|---|-------------------|-------------------|------------------|---------------------------|----------------------|----------------------------|
| 14             | OX      |                    |                              |                       |                          |                             |                             |                               | 1  | 8                                 | 1   | 8                 | 0                 | 8                |                           |                      |                            |
| 13             | X       |                    |                              |                       |                          |                             |                             |                               | 8  | 18                                | 8   | 27                | 9                 | 36               |                           |                      |                            |
| 12             | OX      |                    |                              |                       |                          |                             |                             |                               | 8  | 8                                 | 0   | 10                | 8                 | 18               |                           |                      |                            |
| 11             | OX      |                    |                              |                       |                          |                             |                             |                               | 8  | 8                                 | 4   | 12                | 4                 | 16               |                           |                      |                            |
| 10             |         |                    |                              |                       |                          |                             |                             |                               | 16   | 18                                | ...   | 16                | 16                | 34               |                           |                      |                            |
| 9              | OX      |                    |                              |                       |                          |                             |                             |                               | 19   | 27                                | 11  | 30                | 7                 | 37               |                           |                      |                            |
| 8              | X       |                    |                              |                       |                          |                             |                             |                               | 19   | 20                                | 9   | 28                | 10                | 38               |                           |                      |                            |
| 7              | +       |                    |                              |                       |                          |                             |                             |                               | 16   | ...                               | ...   | 16                | 16                | 32               |                           |                      |                            |
| 6B             |         |                    |                              |                       |                          |                             |                             |                               | 25   | ...                               | ...   | 23                | 23                | 48               |                           |                      |                            |
| 6              | X       |                    |                              |                       |                          |                             |                             |                               | 25   | ...                               | ...   | 28                | 9                 | 34               |                           |                      |                            |
| 5              |         |                    |                              |                       |                          |                             |                             |                               | 23   | 19                                | 14  | 31                | 16                | 47               |                           |                      |                            |
| 4              |         |                    |                              |                       |                          |                             |                             |                               | 29   | 13                                | 19  | 41                | 6                 | 50               |                           |                      |                            |
| 3              |         |                    |                              |                       |                          |                             |                             |                               | 25   | 15                                | 13  | 38                | 3                 | 48               |                           |                      |                            |
| 2              |         |                    |                              |                       |                          |                             |                             |                               | 25   | 19                                | 10  | 44                | 5                 | 54               |                           |                      |                            |
| 1              |         |                    |                              |                       |                          |                             |                             |                               | 21   | 13                                | 13  | 34                | 8                 | 52               |                           |                      |                            |

Table 1.—(continued)

*reflexa*, *Actinonaias pectorosa*, *Truncatella truncata*, *T. donaciformis*, *Leptodea fragilis*, *Proptera alata*, and *Lampilis anodontoides*.

Station 6 was at Duck River mile 160 area, Sewell Ford, Maury Co., Tennessee (2 September 1965). This station was not collected by Ortman. The authors collected 28 species here. Yokley made a collection here on 7 July 1965, and both authors on 2 September 1965, assisted by Mr. John Conder, Fisheries Biologist with the Tennessee Game and Fish Commission.

Station 6b, Duck River mile 167.5 (approx.), Hardison Mill, Maury Co./Marshall Co. line, Tennessee, was collected by B. B. Carroll and Bobby Grinstead, Tennessee Valley Authority, Fish and Wildlife Branch, on 30 June 1965. This station was not collected by Ortman. Sixteen species are listed in Table 1.

Station 7 was at Duck River mile 179.2, Lillard's Mills, Milltown, Marshall Co., Tennessee (3 September 1965). The station looked as described by Ortman. Ortman collected 29 species here and the authors 19, for a total species record of 30. Ten live *Conradilla caelata* were collected here. New distribution records are *Megalonaias gigantea*, *Quadrula pustulosa*, *Truncatella truncata*, *T. donaciformis*, *Proptera alata*, *Carunculina modesta*, *Conradilla caelata*, *Villosa fabalis*, *V. rauxemi*, and *Villosa* sp.

Station 8 was at Duck River mile 186.5, Wilhoite, Marshall Co., Tennessee. The dam referred to by Ortman was broken in the middle. Henry Horton State Park is on the left shore here, and an associated tent-camping area a few hundred meters downstream on the right shore. Collections were made adjacent to the tent-camp area. Ortman collected 27 species here and we found 22 for a total station species record of 33. New records are *Quadrula pustulosa*, *Lexingtonia delabellae*, *Anodonta grandis*, *Actinonaias pectorosa*, *Villosa* *ire* complex, *V. rauxemi*, and *Dysnomia brevidens*.

Station 9, Duck River mile 221.3, Shelbyville, Bedford Co., Tennessee, was collected from the dam downstream to just below Highway US 231 bridge (8 September 1965). Mean daily flow on date of collection was 89 ft<sup>3</sup>/sec (2.49 m<sup>3</sup>/sec). Ortman collected 18 species at this station and the authors 19 for a total record of 26 species. New records for this station are *Trilobania verrucosa*, *Lexingtonia delabellae*, *Elliptio dilatatus*, *Actinonaias pectorosa*, *Truncatella truncata*, *Villosa nebulosa* complex, *Villosa* sp., and *Lampilis fasciata*.

Station 10 was at Duck River mile 242.5, below Haley-Normandy Bridge, below Normandy and above Haley, Bedford Co., Tennessee (8 September 1965). Ortman did not collect this station but at Station 11, about three miles upstream. Sixteen species were collected at Station 10.

Station 11 was at Duck River mile 245.5, upstream from the bridge at Normandy, Bedford Co., Tennessee (8 September 1965). Collections were made on a small island from muskrat heaps only. Ortman collected eight species from this station and the authors eight species for a record of 12 species for the station. New records are

*Obovaria subrotunda*, *Actinonaias pectorosa*, *Lampilis fasciata*, *Dynomia florentina*,<sup>2</sup> and *D. capsaeformis*.

Station 12 was at Duck River mile 249 area, Coffee Co., Tennessee, below Hiles Bridge and perhaps 0.5 to 1.0 mile below Ortmann's station (8 September 1965). Ortmann reported two species from this station. The authors collected eight species for a total of 10 species recorded for this station. New records are *Fusconia barnesiana*, *Alamidonia calcobus*, *Obovaria subrotunda*, *Actinonaias pectorosa*, *M. didionis covadivus*, *Villosa vanuxemi*, *Lampilis fasciata*, *Dynomia florentina*, and *D. capsaeformis*.

Station 13 was on Buffalo River about 1.5 miles above Tennessee State Route 13, between Waynesboro and Hohenwald, Wayne Co., Tennessee (31 August and 7 September 1965). We examined Ortmann's Riverside station (Lewis Co.) thoroughly without finding a single shell. He had reported 18 species for his station. The authors took 17 species from the station described for a total of 27 species recorded for Buffalo River. Comparison was made with Ortmann's station. New records for Buffalo River are *Tritogonia verrucosa*, *Cyclonaias tuberculata*, *Elliptio crasidens*, *Lacuna lata*, *Anodonta grandis*, *Psychobranchus fasciolaris*, *Actinonaias carinata*, *Propleta alata*, and *Villosa* sp.

Station 14, Garrison Fork Creek (Garrison Creek) was located above Wartrace near Fairfield, Tennessee, between a dam and a bridge located downstream (8 September 1965). The streambed here is mostly bedrock and only *Fillosa vanuxemi* was found, compared with eight species reported by Ortmann.

PRESENT STATUS OF THE DUCK RIVER MUSSEL FAUNA

The authors collected 48 species from Duck River as compared with 63 reported by Ortmann (Table 2). Only one new species was added to Ortmann's list—*Platobaeus cooperianus*—and he anticipated its addition.

The genus *Pleurobema* has almost disappeared from the Duck River; otherwise we were unable to collect or at least differentiate some of the forms listed by Ortmann. We included *Quadrula fragosa* with *Quadrula quadrula*. *Alamidonta minor* is considered synonymous with *A. calcobus*. The *leus* form of *Obovaria subrotunda* wasn't recognized and would have been included with the latter. *Lampilis orata ventricosa* could have been included with *L. orata*. The *Fillosa (Micromya) iris* and *V. uebulosa* complex material is in some doubt. The two latter species are extremely rare and dispersed.

Change in the mussel fauna of Duck River can be explained in terms of known water use. Pollution below cities and industries have affected some areas. Phosphate ore mining is extensive in the Duck

River basin as it was in Ortmann's day. Ore washings from this enterprise have contributed to siltation of habitat.

Duck River has a number of dams creating mill ponds that go back to pioneer days. The dam at Columbia was built in recent times, but it only replaced the one to which Ortmann referred. Its effect on the mussel fauna would be negligible. A small dam constructed below Manchester, Tennessee, in recent years has inundated the station Ortmann referred to as "Duck River, Manchester, Coffee Co., Tennessee" from which he took *Lamigonia helstonia*. With the above exceptions, the Duck River stations described and collected by Ortmann have changed little.

Mussel harvesting by "crowfoot brail," digging with forks on shoals, and simply handpicking in shallow water has been practiced on Duck River in the recent past. Harvesting was for specific shells, principally *Amblema plicata* and other thick-shelled species such as *Megalomias gigantea*. Duck River, upstream from that portion impounded by Kentucky Dam on the Tennessee River, has been closed to mussel harvesters since July, 1965.

*Corbiula manillensis* was found at 10 stations between Duck River miles 71 and 242.5. Sinclair and Isom (1963) reported *Corbiula manillensis* from the downstream, impounded reaches of Duck and Buffalo rivers. It is not known if this introduced species has contributed to the decline of river mussels through competition. In some areas *C. manillensis* population densities are in the hundreds per square meter.

The most revealing aspect of this study is the sparsely scattered mussel fauna in Buffalo River and its poor condition. All of the material collected in Buffalo River appeared terminal. Valves of most specimens were severely eroded. Some valves were eroded completely through, revealing the animal inside. There was no evidence of recent reproduction in any of the species. This is most interesting, since Buffalo River exists in an essentially pristine condition as far as can be

TABLE 2.—Species recorded for Duck River by Ortmann, 1924, and not found in the present study

|   |  |
|---|--|
| 1. <i>Fusconia barnesiana bigyensis</i> (Lea)       | 8. <i>Lamigonia helstonia</i> (Lea)                      |
| 2. <i>Quadrula fragosa</i> (Conrad)                 | 9. <i>Psychobranchus subrotundum</i> (Say)               |
| 3. <i>Lamigonia dolabelloides covadii</i> (Vanatta) | 10. <i>Cypronia irrorata</i> (Lea)                       |
| 4. <i>Pleurobema cordatum callis</i> (Conrad)       | 11. <i>Obovaria retusa</i> (Lamarck)                     |
| 5. <i>Pleurobema cordatum pyramidalium</i> (Lea)    | 12. <i>Obovaria subrotunda leus</i> (Lea)                |
| 6. <i>Pleurobema sulcifera argentearum</i> (Lea)    | 13. <i>Plagiola lineolata</i> (Rafinesque)               |
| 7. <i>Pleurobema sulcifera hobackense</i> (Lea)     | 14. <i>Lepidota leptodon</i> (Rafinesque)                |
|   | 15. <i>Carmichaelia cyfandraella</i> (Lea)               |
|   | 16. <i>Lampilis orata ventricosa</i> (Burnes)            |
|   | 17. <i>Dynomia florentina</i> (Lea)                      |
|   | 18. <i>Dynomia florentina walkeri</i> (Wilson and Clark) |

<sup>2</sup> This species was not included in Table 1 since it has not been compared with appropriate syntopic material; however, specimens compare with Ortmann's description (1924).

ascertained. Buffalo River receives no industrial wastes, no municipal wastes, and relatively little agricultural erosion at the present time. Buffalo River has been nominated for inclusion in the National Wild Rivers System (Church, 1967). Conjecture is that the mussel fauna here has been affected by impoundment of its lowermost reach by a dam on the Tennessee River with a subsequent change in fish fauna that may have been necessary in the life cycle of the resident mussel fauna.

Multiple-use dams are being planned on Duck River. It will be possible to ascertain the effects of impoundment on the mussel fauna of Duck River by comparing the postimpoundment mussel fauna with the present study.

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## Oviposition and Early Developmental Stages of *Lestes eurinus* (Odonata: Lestidae)<sup>1</sup>

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**ABSTRACT:** Selection of oviposition sites, oviposition, hatching, and the early larval stages of *Lestes eurinus* were studied in 1966. *L. eurinus* individuals oviposited in tandem above the water level in the fibrovascular tissues of *Spartanium americanum*. The female generally chose a section of the *S. americanum* leaf that was about halfway between the water level and leaf tip. Incisions were also more frequent in portions of the leaf nearest the midrib. As the reproductive period progressed oviposition occurred throughout most of the length and width of the leaf. The females, however, avoided the leaf tip and veins, which were unsuitable as oviposition sites.

The egg stage exhibited no diapause, but developed directly and uniformly. In nature, egg development was calculated to last about six weeks. The eggs hatched inside the leaf and the animals emerged from the leaves in the prelarval stage, which lasted only a few minutes. It then molted into the second instar, the first stage in which the typical form and shape of the damselfly larva appeared.

The egg stage of *Lestes eurinus* is relatively short and the winter is passed in several larval stages. Other published reports for representatives of this family have shown that most species have diapausing, overwintering, egg stages lasting about 30 weeks followed by rapid larval development.

#### INTRODUCTION

Early developmental stages in the life cycles of most Odonata are poorly known. In most cases the eggs are laid singly in the water, making it very difficult to find and study these eggs and stages of early larval development. In species that lay eggs in masses or that are endophytic ovipositors, the eggs are far more accessible. Oviposition studies have been made on a number of zygoteran species by a number of workers (Grievé, 1937; Johnson, 1961, 1962; Gower and Kourmaly, 1963; Bick and Bick, 1963, 1965; Bick and Hornoff, 1965, 1966; and Bick and Subbach, 1966). Of these studies, only that of Grievé (1937) on *Lathraea viticola* was also concerned with early developmental stages.

The life cycles of only three species of *Lestes* have been studied employing a regular program of sampling natural populations; they are: *L. sponsa* (Corbet, 1956); *L. verticillatus* (Gower and Kourmaly, 1963); and *L. eurinus* (Lutz, 1966). Individuals of both *L. sponsa* and *L. verticillatus* oviposited in autumn and the eggs overwintered in an obligate diapause stage. Eclosion occurred in the spring and larval development was completed by July. Lutz (1963) found that in *L. eurinus* oviposition occurred in the summer and eclosion began about 45 days later. Winter was passed in several larval stages.

The availability of this species, its endophytic oviposition habit,

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