flew to Midland from Albuquerque and conducted two sessions per day on "Science and Religion" during the four days of that school. I also recorded with Jerry, a half-hour radio program on "The Scopes Trial and Its Effects on the Participants" and another on "A Community Education Project" which were broadcast in a series entitled "How Do You Feel?" under the auspices of the University of Texas. Tapes of those two programs are in my archives.

Back at Harvard, the memory of the Scopes Trial was kept alive long after I retired from active teaching in 1954. A course of study, known as "Natural Sciences 10", was developed as a part of the General Education Program. "Nat Sci 10" dealt with the geological history of life on earth and was taught by members of the faculty in the Department of Geological Sciences. Each spring that I was available, they invited me to take over one of the lectures near the end of the course to talk about the trial and its place in the continuing confrontation between science and religion. The last time I did so was on 10 April 1972, when I was in Cambridge to arrange for the shipping of my household goods from 3 Concord Avenue to Albuquerque. On that occasion, the large lecture room in Burr Hall was filled to overflowing with students and interested spectators, and I thoroughly enjoyed the hour.

Even in Albuquerque the ghost of the trial continued to haunt me. On 16 April 1973 I entertained "The 21 Club", of the University of New Mexico, with my account of the trial and its aftermath, and on 3 November 1976, I gave a similar talk and conducted a question and answer period in the University's Keller Hall, under the auspices of the local chapter of Sigma Gamma Epsilon.

One final item that should be considered as a part of the aftermath of the Scopes Trial: A law, somewhat similar to Tennessee's anti-evolution statute, was enacted by the legislature of the State of Arkansas in 1928. No case was ever brought to trial under it, and it slumbered among the Arkansas statutes until 1965 when Mrs. Susan Epperson, a biology teacher in a Little Rock high school, brought suit in the Chancery Court, seeking a declaration that the Arkansas statute was void and enjoined the officials of the Little Rock school system from dismissing her for violation of the statute's provisions. While preparing her case, she read D-DAY IN DAYTON and secured Jerry Tompkins' assistance in formulating her argument. The Chancery Court ruled in her favor and declared that the statute violated the Fourteenth Amendment of the United States Constitution. On appeal, however, the Supreme Court of Arkansas reversed that judgment in 1967, and the case was taken to the Supreme Court of the United States. The opinion of that Court was delivered on 12 November 1968 by Mr. Justice Fortas. It reversed the judgment of the Supreme Court of Arkansas and thus declared the Arkansas anti-evolution law to be unconstitutional.

Much of the credit for that striking down of the Arkansas statute should go to Susan Epperson, with whom I later became acquainted. It happened that in the early summer of 1972 she was visiting her family who at that time were residing in Corrales, one of the towns in the Albuquerque Metropolitan district. She had learned from Jerry Tompkins that I was then living in Albuquerque and at her invitation I spent an afternoon with her and her family in Corrales. It was an interesting and enjoyable occasion for me. Susan, her parents, and her brothers proved to be delightful people, thoroughly dedicated to the protection of academic freedom and civil liberties.

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NOTES ON THE LIFE HISTORIES OF *STROPHOPTERYX LIMATA* (FRISON) AND *OEMOPTERYX CONTORTA (NEEDHAM* AND CLAASSEN) (PLECOPTERA: TAENIOPTERYGIDAE) IN TENNESSEE

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ABSTRACT

Information on the life histories of *Strophopteryx limata* (Frison) and *Oemopteryx contorta* (Needham and Claassen) is presented from samples taken from Ramsay Prong of the Little Pigeon River, Great Smoky Mountains National Park, Tennessee. Both species appear to exhibit a slow univoltine cycle modified by undergoing a nymphal diapause. Nymphs were first collected in autumn and in subsequent samples exhibited continuous growth throughout winter. Adults emerged in late winter and early spring. Monthly cephalic width frequency histograms combined with a running average procedure indicated five postdiapause instars for both species.

INTRODUCTION

In recent years, life histories of three species of North American Taeniopterygidae have been examined: *Taenioteryx nivalis* (Fitch) by Coleman and Hynes (1970), Harper and Hynes (1972), and Knight et al. (1976); *T. burksi* Ricker and Ross by Harper and Magnin (1969) and Harper and Hynes (1972); and *Stropho-*

pteryx fasciata (Burmeister) by Harper and Hynes (1972). In the present study, information on the life histories of an additional two species of Taeniopterygidae, *Strophopteryx limata* (Frison) and *Oemopteryx contorta* (Needham and Claassen), is presented. *S. limata* is restricted in distribution to the southern Appalachians, whereas *O. contorta* apparently has a patchy distribution along the Appalachians of the eastern United States. Frison (1942) partially described the mature nymphs of both these species. However, in order to facilitate recognition of mature nymphs of *S. limata* and *O. contorta,* a more complete description of this stage is presented in this study.

MATERIAL AND METHODS

Study areas were situated on the Ramsay Prong (83° 18′ 30″ W longitude; 35° 42′ 30″ N latitude) which flows approximately 8 km in an east-west direction before entering the Middle Prong of The Little Pigeon River. Ramsay Prong is a second order stream found in the Great Smoky Mountains National Park, Sevier County, Tennessee, and is located within the Blue Ridge physiographic province (Fenneman, 1938). Area vegetation included *Rhododendron* spp., *Quercus* spp. (oak), *Carya* spp. (hickory), and *Liriodendron tulipifera L.* (yellow poplar).

Stream samples were obtained from two sites. The first site was situated at an altitude of 1060.7 m, and a second site was situated at 908.3 m. Stream bottom at both sites was composed of gravel, cobble, and boulders. Stream width at site 1 was 8 m, and depth was 0.20 m. Stream width at site 2 was 10 m, and depth was 0.28 m. During the sampling period, water temperatures at site 1 ranged from 0-18C° with a mean of 6.7C°, Temperature range at site 2 was 0-18.5C° with a mean of 7.6C°. Water pH values ranged from 4.2-5.5 with a mean of 5.0 at site 1 and ranged from 4.8-7.0 with a mean of 5.9 at site 2. Site 1 dissolved oxygen values ranged from 7.2-13.0 ppm with a mean of 11.4 ppm, and site 2 values ranged from 8.4-13.4 ppm with a mean of 11.5 ppm.

Samples were collected on a monthly basis from September 1977 to August 1978 using kick procedures outlined by Frost et al. (1971) and a fine mesh net having openings of 363 μm. Material was preserved in the field with 20% formalin and transported to the laboratory at the Department of Biology, University of Tennessee-Chattanooga for analysis.

Nymphal growth patterns were analyzed by measuring the cephalic width across the level of the compound eyes using an ocular micrometer (nearest 0.1 mm) in a Wild M-5 stereomicroscope. Determination of the number of post-diapause instars was then undertaken by using monthly cephalic width histograms and the running average method of Janetschek (1967).

LIFE HISTORIES

Strophopteryx limata (Frison)

Nymphs of *S. limata* were collected from November to May at site 1 (Fig. 1) and from November to April at site 2 (Fig. 2). A diapausing stage was not collected. However, it is likely that this species undergoes a nymphal diapause as reported for related *S. fasciata* by Harper and Hynes (1972). At both sites (Figs. 3, 4), slightly over 50% of the postdiapause nymphal growth rate occurred from November (mean cephalic widths 21.24 mm and 20.40 mm, respectively) to January (mean cephalic widths 38.68 mm and 45.00 mm, respectively). Additional growth occurred between January and time of adult emergence in April. Nymphal pattern of growth exhibited by *S. limata* is similar to that of *S. fasciata* as described by Harper and Hynes (1972), corresponding to these authors' type 2c (nymphal diapause followed by continuous nymphal growth throughout winter) modification of the S_1 (slow nymphal growth with an early adult emergence) univoltine cycle. Examination of the monthly cephalic width frequency histograms of nymphs at site 1 (Fig. 1) indicate that five peaks of cephalic widths are present; 0.32 mm, 0.48 mm, 0.66 mm, 0.85 mm, and 1.05 mm. These peaks correspond to the five largest peaks computed from using the Janetschek (1967) method of running averages for instar discrimination and suggests the presence of five postdiapause nymphal instars in the samples collected at site 1. Application of both procedures to the smaller number of nymphs obtained at site 2 (Fig. 2) again resulted in five discernable peaks of cephalic widths similar in size to those found at site 1: 0.35 mm, 0.55 mm, 0.75 mm, 0.89 mm, and 1.16 mm.

Oemopteryx contorta (Needham and Classen)

Nymphs of *O. contorta* were collected from October to April at site 1 (Fig. 5). Slightly over 70% of the nymphal growth (Fig. 6) occurred from October (mean cephalic width 30.67 mm) to December (mean cephalic width 61.7mm); additional growth occurred between December and February. While diapausing nymphs were not collected, it is likely that *O. contorta,* like *S. limata,* corresponds to the type 2c modification of the S_1 univoltine cycle (Harper and Hynes, 1972). Monthly cephalic width frequency histograms and the results of the Janetschek (1967) running average procedure indicated five noticeable peaks (0.42 mm, 0.76 mm, 0.94 mm, 1.23 mm and 1.37 mm) of cephalic widths possibly corresponding to postdiapause instars.

NYMPHAL DESCRIPTIONS

Strophopteryx limata (Frison)

Male.—General body color medium opaque amber. Ventral areas light opaque amber. Length of body 6.5-8.5 mm.

Head with numerous dark embossings extending from posterior margins of compound eyes to postocciput (Fig. 7A). A small dark semicircular area situated anterolaterad of each lateral ocellus. Frons with dark V-shaped mark extending anteriorly from median ocellus to anterior margin. Antennae two-thirds as long as body; proximal one-quarter lighter in color. Mouthparts closely similar to those described for *S. fasciata* by Frison (1929).

Thoracic nota with dark markings as shown in Figure 7A. Meso- and metathoracic wing pads slightly divergent from midline of body. Metathoraic wing pad with notch at posterior inner margin. Legs with dorsal margins of femur, tibia, and tarsi fringed with long, thin setae. Ventral margins of femur, tibia, and tarsi with rows of short, stout setae. Coxa and lateral areas of the femur and tibia with widely scattered short, stout setae.

Abdominal tergites with numerous dark markings. Terga with numerous intercalary hairlike setae; on occasional specimens one or two tergites bearing a short, stout seta. Posterior margin of each tergite bearing a fringe of numerous short, stout setae. Tergites 8, 9, and 10 bearing two erect long, thin setae near mid-region of posterior margin (Figs. 7B, D). Sterna 1-8 unsclerotized (Fig. 7E). Sternite 9 sclerotized and produced posteriorly into a subgenital plate with a narrowly rounded posterior margin (Fig. 7E). Posterior two-thirds of the plate densely clothed with numerous long, thin, erect setae. Paraprocts produced and slightly asymmetrical. Cerci three-quarters the length of the body; proximal one-third lighter in color. Posterior margin of each cercal segment bearing a whorl of short, stout bristles. Proximal cercal segments with posterior margins also bearing numerous long, thin setae (Fig. 7D).

Female.— Similar to the male with respect to coloration and setal pattern. Length of body 7.0-9.0 mm. Abdominal sternite 8, unlike that the male, is sclerotized (Fig. 7F). Paraprocts small and symmetrical (Fig. 7C).

Oemopteryx contorta (Needham and Claassen)
Male.—General body color light opaque amber ventral areas yellowish. Length of body 8.8-9.5 mm.

Head with numerous dark embossings extending from posterior margins of compound eyes to postocciput (Fig. 8A). A yellowish circular area found on mid-region of head. A small dark V-shaped mark extending from the median ocellus to anterior margin. Antennae as long as the body; proximal one-third light in color. Mouthparts similar to those of *S. fasciata* (Frison, 1929).

Pronotum with dark lateral embossings. Meso- and metanota with contrasting light and dark areas. Wing-pads of pteronota slightly divergent from mid-line of body. Metathoracic wing pad with notch at inner posterior margin. Legs with apex of each femur yellow; each tibia with dark proximal and distal band. Dorsal margins of femur, tibia, and tarsi covered with a fringe of long, thin setae. Femur, tibia, and tarsi with rows of short, stout setae on ventral margins. Coxa and lateral areas of femur and tibia sparsely covered with short, stout setae.

Anterior half of each abdominal tergite darker in color than posterior half. Mesally each tergite with small, rounded, dark markings. Terga covered with numerous intercalary hair-like setae and one to two mesally situated short, stout setae (Fig. 8B, D). Tergites 8 and 9 bearing two erect, long, thin setae near mid-region of posterior margin (Figs. 8B, D). Tergites 1-6 unsclerotized and 7-9 sclerotized (Fig. 8E). Sternite 9 produced posteriorly into a subgenital plate with broadly rounded posterior margin. Posterior two-thirds of plate moderately clothed with long, thin, erect setae. Developing adult vesicle visible through sternite 9 (Fig. 8E). Paraprocts produced and noticeably asymmetrical (Fig. 8B). Cerci three-quarters the length of the body; proximal one-third lighter in color. Posterior margin of each cercal segment bearing a whorl of short, stout bristles (Fig. 8D).

Female.—Similar to male with respect to coloration, setal pattern (Fig. 8C), and pattern of abdominal sternal sclerotization (Fig. 8F). Length of body 9.0-10.5 mm. Paraprocts small and symmetrical (Fig. 8C).

Acknowledgements

I would like to thank David C. Hales and Samuel D. Nichols for providing field and laboratory assistance during this study. Charles W. Palmer prepared the graphs illustrating the growth pattern of the nymphs under investigation. I would also like to thank Drs. Gene S. Van Horn and Richard E. Garth for their critical reading of this manuscript. This study was supported in part by the U. S. Department of Interior, National Park service contract #PX500070941.

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Explanation of Figures

Fig. 1. Nymphal growth of *Strophopteryx limata* at site 1; frequencies of cephalic widths at monthly intervals. Arrows (↑) indicate approximate time of adult emergence.

Fig. 2. Nymphal growth of *Strophopteryx limata* at site 2; frequencies of cephalic widths at monthly intervals. Arrows (↑) indicate approximate time of adult emergence.

Fig. 3. Monthly variation of cephalic width of *Strophopteryx limata* at site 1. Vertical line = range, horizontal line = mean, large open rectangle = ± 1 standard deviation, small lined rectangle = twice the standard error, dot = single individual, I = imago.

Fig. 4. Monthly variation of cephalic width of *Strophopteryx limata* at site 2. Vertical line = range, horizontal line = mean, large open rectangle = ± 1 standard deviation, small lined rectangle = twice the standard error, dot = single individual, I = imago.

Fig. 5. Nymphal growth of *Oemopteryx contorta* at site 1; frequencies of cephalic widths at monthly intervals. Arrows (↑) indicate approximate time of adult emergence.

Fig. 6. Monthly variation of cephalic width of *Oemopteryx contorta* at site 1. Vertical line = range, horizontal line = mean, large open rectangle = ± 1 standard deviation, small lined rectangle = twice the standard error, dot = single individual, I = imago.

Figs. 7 A-F. *Strophopteryx limata.* A, male nymph habitus; B, terminal abdominal segments, male nymph, dorsal; C, terminal abdominal segments, female nymph, dorsal; D, terminal abdominal segments, male nymph, lateral; E, terminal abdominal segments, male nymph, ventral; F, terminal abdominal segments, female nymph, ventral.

Figs. 8 A-F. *Oemopteryx contorta.* A, male nymph habitus; B, terminal abdominal segments, male nymph, dorsal; C, terminal abdominal segments, female nymph, dorsal; D, terminal abdominal segments, male nymph, lateral; E, terminal abdominal segments, male nymph, ventral; F, terminal abdominal segments, female nymph, ventral.

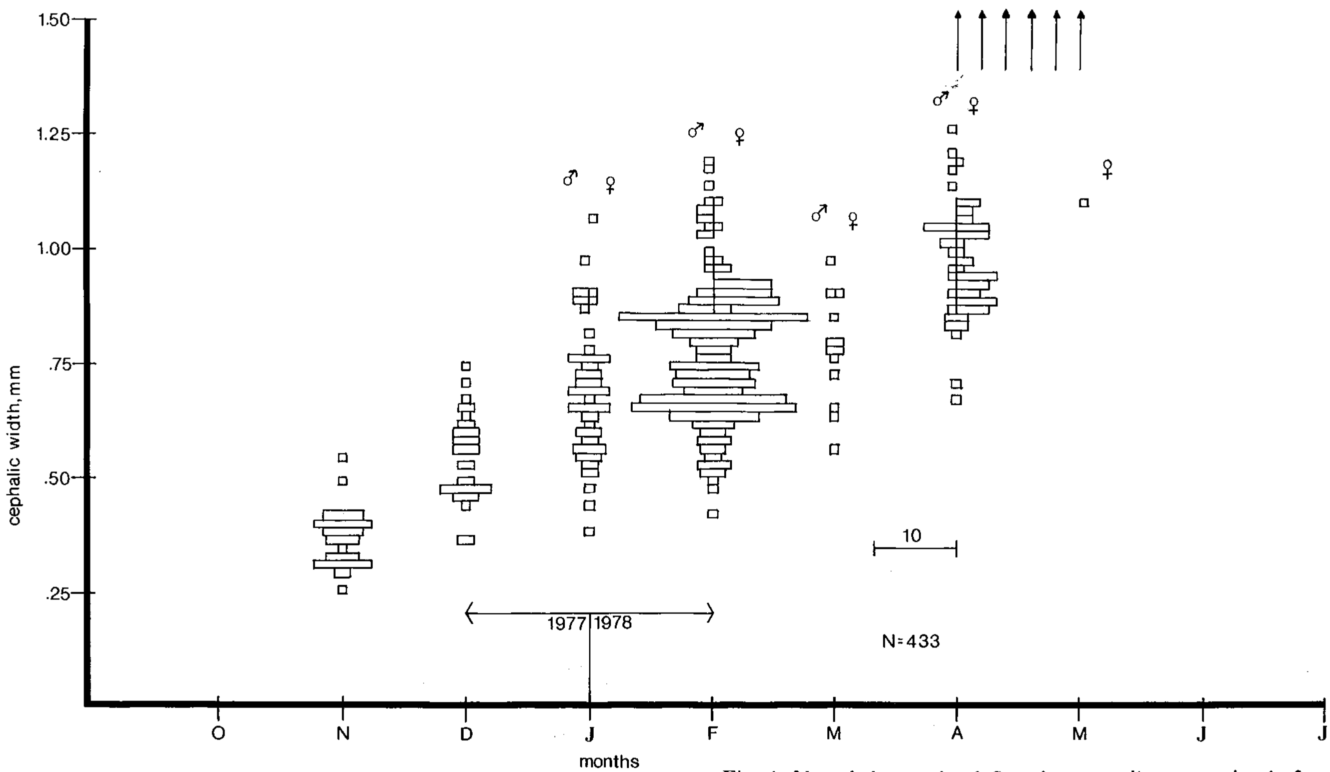


FIG. 1

Fig. 1. Nymphal growth of *Strophopteryx limata* at site 1; frequencies of cephalic widths at monthly intervals. Arrows (↑) indicate approximate time of adult emergence.

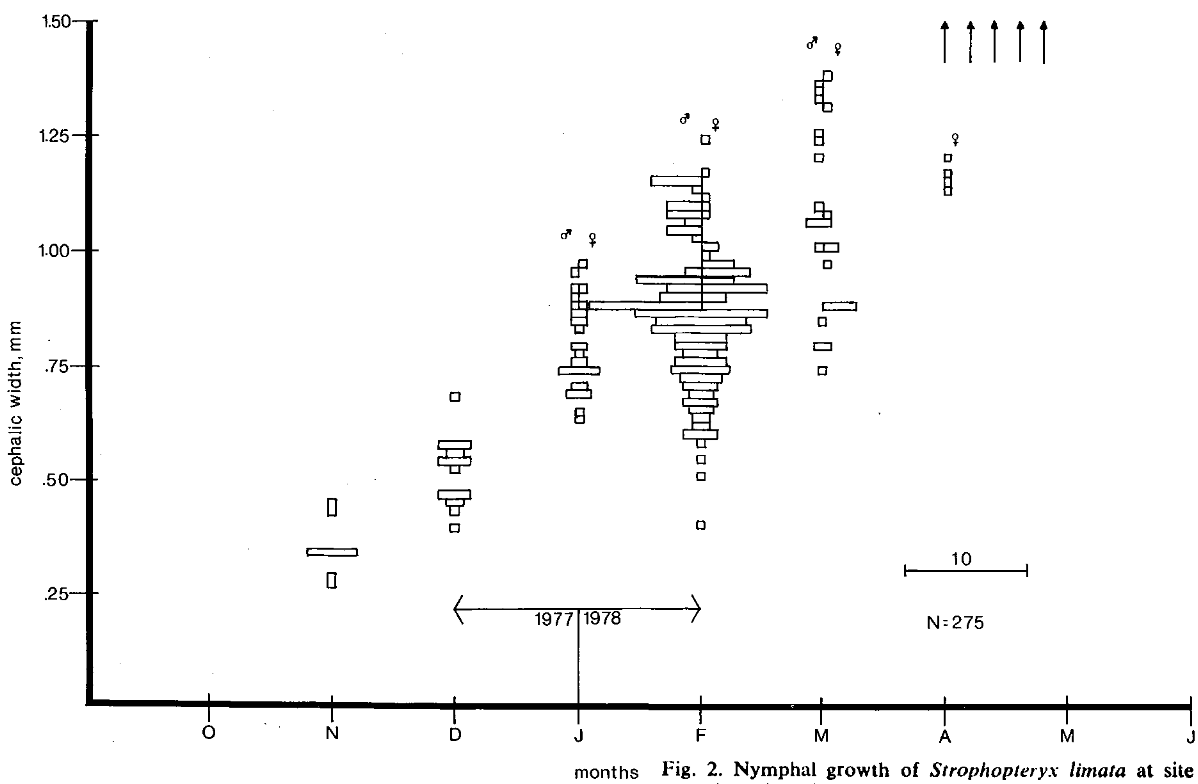


Fig. 2. Nymphal growth of *Strophopteryx limata* at site 2; frequencies of cephalic widths at monthly intervals. Arrows (↑) indicate approximate time of adult emergence.

FIG. 2

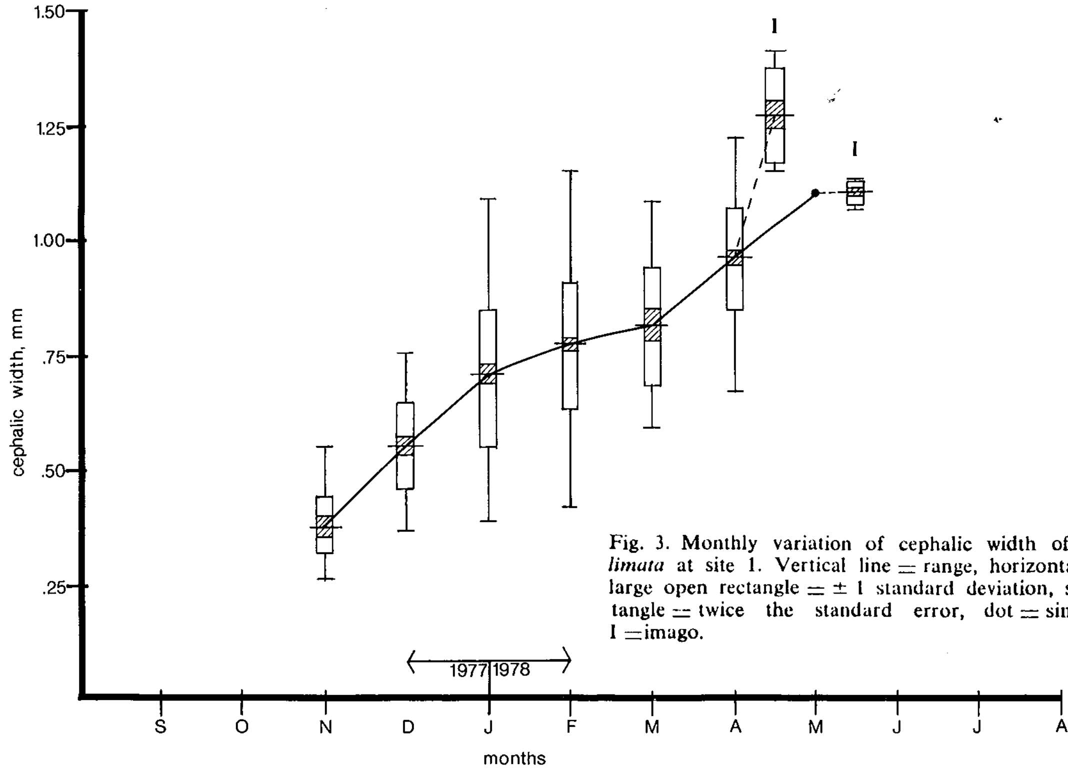


Fig. 3. Monthly variation of cephalic width of *Strophopteryx limata* at site 1. Vertical line = range, horizontal line = mean, large open rectangle = ± 1 standard deviation, small lined rectangle = twice the standard error, dot = single individual, I = imago.

FIG. 3

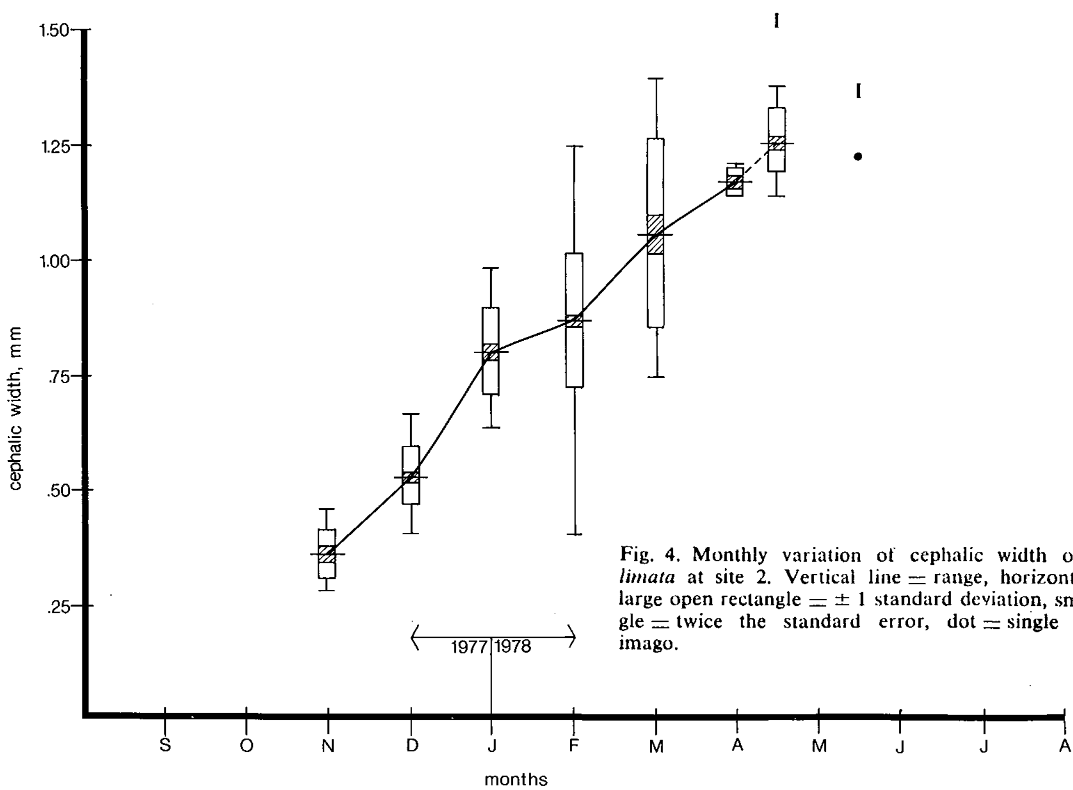


Fig. 4. Monthly variation of cephalic width of *Strophopteryx limata* at site 2. Vertical line = range, horizontal line = mean, large open rectangle = ± 1 standard deviation, small lined rectangle = twice the standard error, dot = single individual, I = imago.

FIG. 4

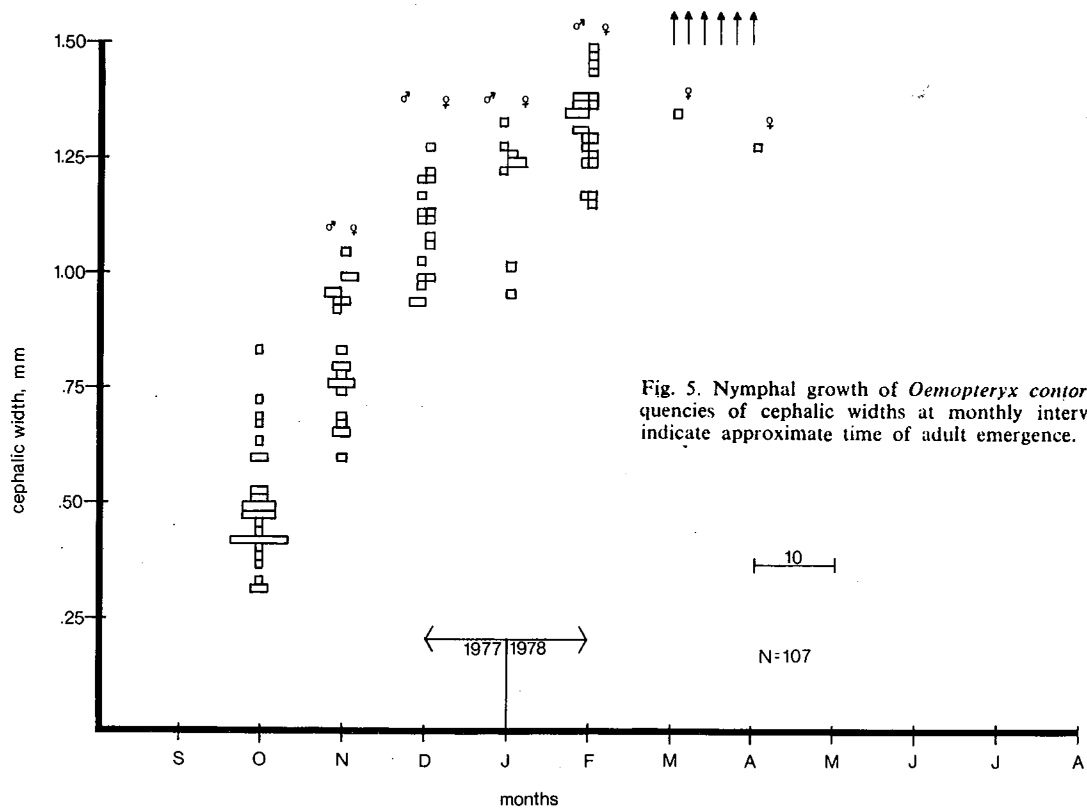


Fig. 5. Nymphal growth of *Oemopteryx contorta* at site 1; frequencies of cephalic widths at monthly intervals. Arrows (↑) indicate approximate time of adult emergence.

FIG. 5

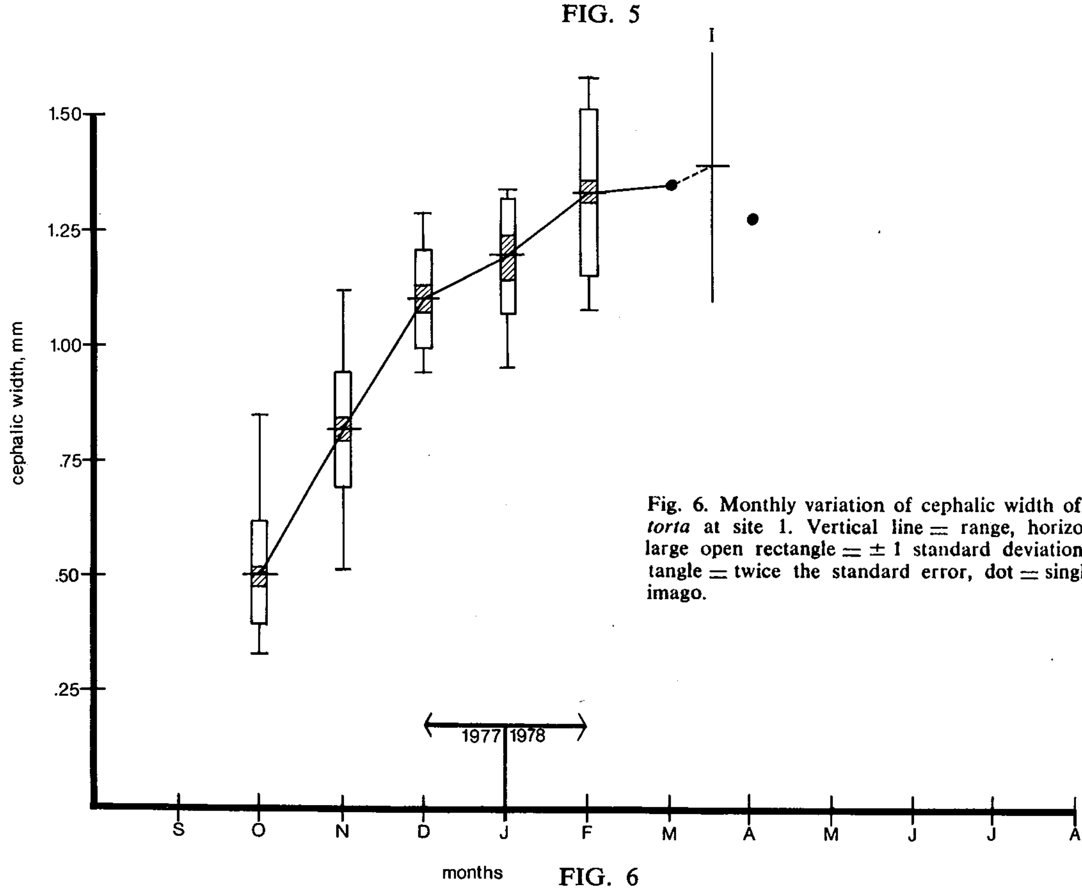
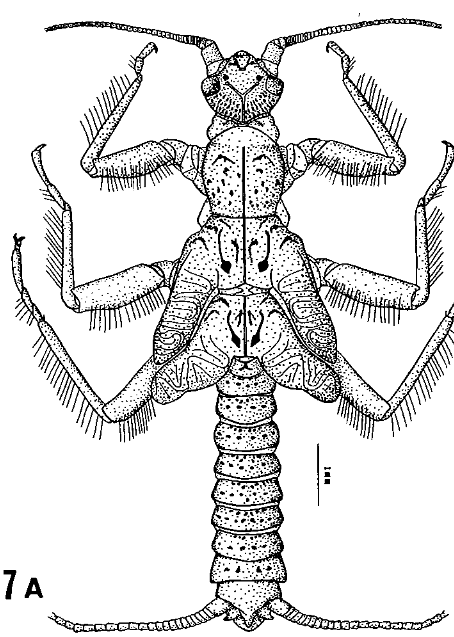
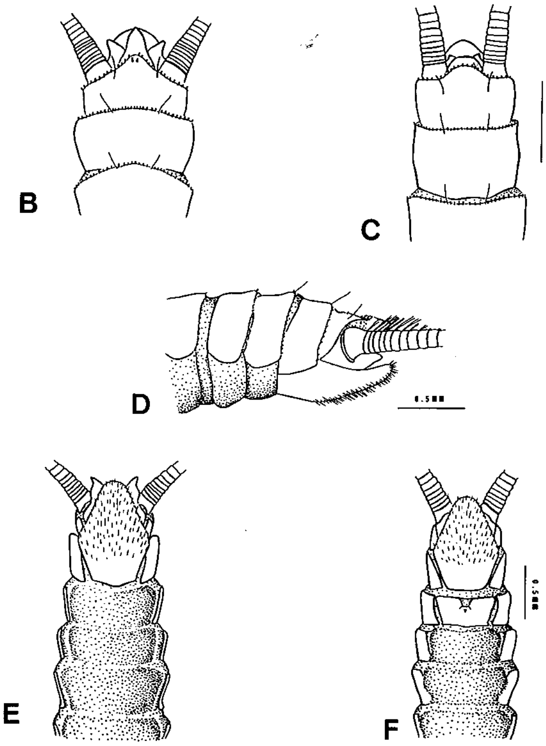


Fig. 6. Monthly variation of cephalic width of *Oemopteryx contorta* at site 1. Vertical line = range, horizontal line = mean, large open rectangle = ± 1 standard deviation, small lined rectangle = twice the standard error, dot = single individual, I = imago.

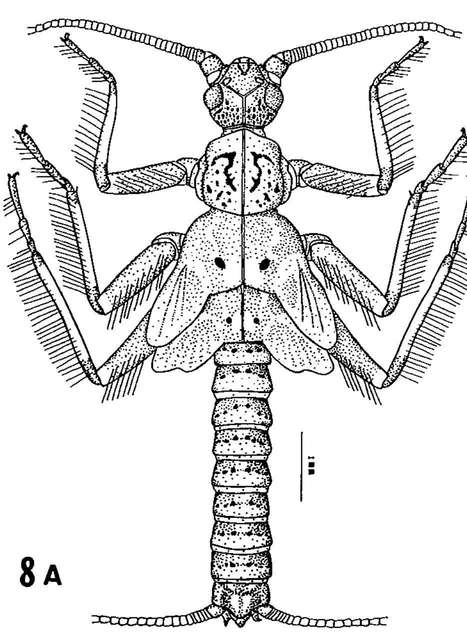
FIG. 6

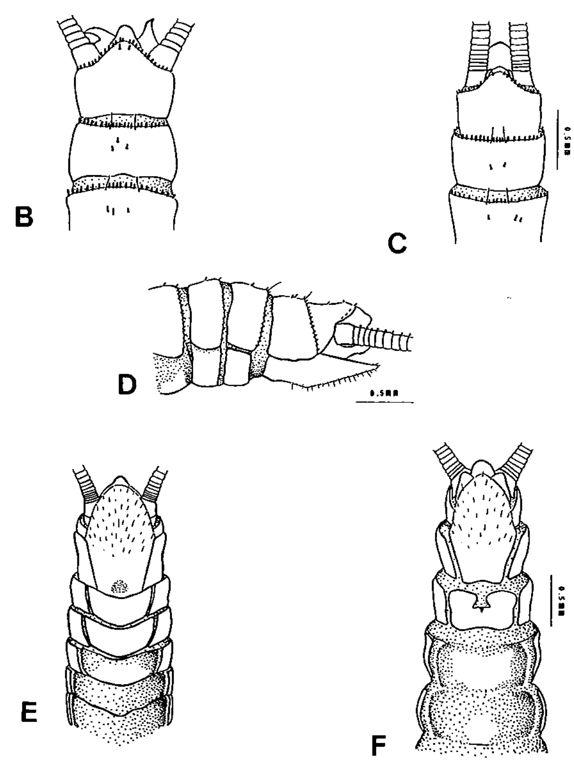




Figs. 7 A-F. *Strophopteryx limata*. A, male nymph habitus; B, terminal abdominal segments, male nymph, dorsal; C, terminal abdominal segments, female nymph, dorsal; D, terminal abdominal segments, male nymph, lateral; E, terminal abdominal segments, male nymph, ventral; F, terminal abdominal segments, female nymph, ventral.

FIG. 7





Figs. 8 A-F. *Oemopteryx contorta*. A, male nymph habitus; B, terminal abdominal segments, male nymph, dorsal; C, terminal abdominal segments, female nymph, dorsal; D, terminal abdominal segments, male nymph, lateral; E, terminal abdominal segments, male nymph, ventral; F, terminal abdominal segments, female nymph, ventral.

FIG. 8