

- DALY, J. J., H. E. FARRIS and H. M. MATTHEWS. 1976. Pseudoparasitism of dogs and cats by the land planarian, *Bipalium kewense*. VM/SAC 71:1540-1542.
- DALY, J. J., H. M. MATTHEWS and H. E. FARRIS. 1977. Evidence against gastrointestinal pseudoparasitism by the land planarian, *Bipalium kewense* Mosely 1878. Health Lab. Sci. 14:39-43.
- DINDAL, D. L. 1970. Feeding behavior of a terrestrial turbellarian *Bipalium adventitium*. Amer. Midl. Nat. 83:635-637.
- DUNDEE, D. S. and H. A. DUNDEE. 1963. Observations on the land planarian *Bipalium kewense* Mosely in the Gulf Coast. System. Zool. 12:36-37.
- HYMAN, L. H. 1943. Endemic and exotic land planarians in the United States with a discussion of necessary changes of names in the Rhynchodemidae. Amer. Mus. Nov. No. 1241, 12 pp.
- HYMAN, L. H. 1951. The Invertebrates: Platyhelminthes and Rhynchocoela. The acelomate Bilateria. Vol. II. McGraw-Hill, New York, 550 pp.
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ADDITIONAL RECORDS AND UPDATES ON THE ARKANSAS FLORA

During 1979 and 1980 the Arkansas Natural Heritage Inventory Program conducted field surveys to assess vascular plant rarity in the state. Five taxa were discovered new to the flora of Arkansas:

Psoalea digitata T. & G. var. *digitata*. MILLER COUNTY; scattered in a sandy churchyard northwest of Doddridge about 4.0 Km north of Hwy. 160 and Hwy. 237 junction. Davis and Kral 2689, 25 June 1980. Shinners (Field and Laboratory 19:14-25, 1951) cites a Nuttall voucher of this taxon from "sandhills of the Red River, Arkansas Territory." Since it is impossible that this voucher was collected in either Oklahoma or Arkansas, it should be treated as a new record in Arkansas.

Tradescantia reverchonii Bush. MILLER COUNTY; sparse on very sandy soils northwest of Doddridge about 1.1 Km south of the junction of Hwy. 237 and Hwy. 134, T18S R28W, Sec. 17, E 1/2 NW 1/4. Davis and Tucker 2580, 17 June 1980.

Aletris aurea Walt. MILLER COUNTY; local in a moist, mowed pine-barren about 2.4 Km north of Fouke on west side of Hwy. 71, T17S R27W, Sec. 9, SW 1/4 NW 1/4. Davis and Tucker 2547.

Xyris baldwiniana R. & S. CALHOUN COUNTY; small remnant of savannah in railroad and gravel road rights-of-way, 2.1 Km north of Hwy. 172 along road paralleling railroad east of Hwy. 67. Davis and Roberts 2606.

Rhynchospora rariflora (Michx.) Ell. CALHOUN COUNTY; same location as above cited *Xyris*. Roberts and Davis 1500.

The *Rhynchospora rariflora* voucher is deposited in Vanderbilt University and the remaining vouchers are filed in Arkansas Tech University.

Four species which had previously been reported to Arkansas were confirmed with vouchers. Demaree (Taxodium 1:1-88, 1943) reported *Rhynchospora cephalantha* Gray, but the location of the voucher was unknown until located in February, 1980 at Vanderbilt University. This voucher is annotated by Robert Kral. *Carex latebracteata* Waterfall has been vouchered from Polk, Garland and Howard counties, and specimens are deposited in Vanderbilt University Herbarium (Davis and Tucker 2124; Davis, Pell and Smith 2146; Davis and Shepherd 2159). *Anthraenantia rufa* (Ell.) Schult. was confirmed from both Bradley and Drew counties (Davis and Pell 1896; Davis and Shepherd 2820b). This species was reported without voucher by Moore (Proc. Ark. Acad. Sci. 15:9-25, 1961). After having been considered extirpated, five stems of *Cypripedium reginae* Walter were discovered in Stone County (Davis and Foster 2414). The previous two species are deposited in Arkansas Tech University Herbarium.

The author is grateful to Dr. Robert Kral and Jerry Roberts, who deferred reporting two of these state records. Thanks are due to The Nature Conservancy under whose funding this research was conducted.

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OBSERVATIONS ON THE OCCURRENCE OF CHALKY DEPOSITS ON FOREWINGS OF *ONCOMETOPIA ORBONA* (F.) (HOMOPTERA: CICADELLIDAE)

Many homopterans produce a chalky or waxy, white material. Metcalfe (1969) mentioned that the most distinctive feature of the nymphs of the delphacid *Saccharosydne saccharivora* (Westw.) was the white wax rods formed on the head, tail, and lateral abdomen. He added that among adults the white wax was present only on females.

Oncometopia orbona (F.) is a large cicadellid in the tribe Proconiini, a group commonly called sharpshooters. This species is a vector of phony peach disease virus and Pierce's disease virus of grape (Nielson 1968). Individuals of *O. orbona* frequently possess conspicuous white deposits as a globular lump on each forewing (Fig. 1; see also Borror and White 1970, p. 131, and Fenton 1952, p. 242). Riley and Howard (1893) described similar deposits on the wings of female *Homalodisca coagulata* (Say), another proconiine leafhopper.

Swain (1936) described oviposition into plant tissue by *O. undata* Fabr. (= *orbona*), which is followed by scraping the hindlegs over the chalky deposits and coating the egg scar with the white powder. He suggested the powder was camouflage for hiding the eggs from parasites or predators.

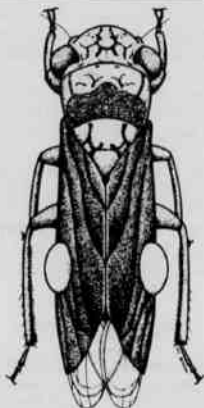


Figure 1. Drawing of *Oncometopia orbona* (F.) female with chalky deposits on forewings (dorsal view).

Turner and Pollard (1959) mentioned that females of *H. coagulata* and *H. insolita* (Walker), as well as *O. undata*, coat their egg batches. They said that "... gravid females transfer some of the chalk from the tips of their bodies to their elytra by means of their hind tibiae." Pollard and Yonce (1965) described the presence of long tibial spines on the hindlegs of those female proconiines which produce chalky spots on their forewings and coat their oviposition sites with white powder. Males of all species and females of species lacking the deposits have shorter tibial spines.

Severin (1950) mentioned a peculiarity in oviposition by the nonproconiine cicadellid *Texanus incurvatus* (Osborn and Lathrop): "After inserting the egg in the [celery] petiole, the female secretes a liquid (which becomes white when dry) in the form of threadlike papillae over each egg puncture." Metcalfe (1969, Plate XVII, Fig. 4) recorded that females of *Saccharosydne saccharivora* deposit wax threads at the oviposition site.

Storey and Nichols (1937) made no mention of oviposition in describing a special method of defecation by both nymphs and adults of a small nonproconiine leafhopper, *Cicadulina mbila* Naude. Adults transfer drops of a "viscid opaque yellowish fluid" from the anus onto tibiae of hindlegs, spread the drops on upper surfaces of wings, and then scrape the dried material off the wings with violent cleaning movements of the legs. Although the authors were not explicit, it is assumed that both sexes exhibit this behavior. Nymphs transfer the drops from the anus onto tarsi of hindlegs, and by slow kneading movements of all legs, distribute the material onto the legs where it dries. Cleaning movements by nymphs continue until the material falls as a powder. The authors hypothesized that the cloudy feces enable elimination of products excreted through the Malpighian tubules.

Specimens of *O. orbona* (both sexes) were collected from various localities in Illinois during the summers of 1974-76 in order to observe them in the laboratory and to determine the significance of the white chalky material regarding oviposition and/or excretion.

Adults of *O. orbona* taken in the field from milkweed plants (*Asclepias incarnata* L. and *A. syriaca* L.) and sunflower (*Helianthus* spp.) were brought into the laboratory and placed in acetate cylinder chimney cages over potted milkweed and sunflower plants for observation. Record was made of any behavior associated with the chalky deposits, oviposition, or excretion.

Thin-layer chromatography was used to qualitatively determine which arthropod excretory products were present in the chalky material. Lithium carbonate was used as a solvent. Spots of the chalky material along with known spots of urea, allantoin, uric acid, adenine, guanine, cytosine, thymine, and uracil were placed on silica gel plates which were developed two-dimensionally in methanol:conc. HCl-H₂O and butanol-methanol-H₂O-NH₄OH tanks.

Of the 14 *O. orbona* adults (8 ♀♀, 6 ♂♂) observed in the laboratory, six (all ♀♀) had chalky deposits on their forewings at some time. Only one female was observed ovipositing and then scraping the chalky deposits onto the egg site. Three different females were observed scraping off their chalky deposits, although exhibiting no oviposition behavior. Four females, with deposits one day, had scraped the material off their wings by the next day without making any signs of oviposition sites on the plants in the cages. Thus, only one of the eight recorded instances of removal included actual oviposition.

Examination of 60 *O. orbona* adults in the insect collection of the Field Museum of Natural History in Chicago revealed that only four (all ♀♀) had chalky deposits, while the Illinois Natural History Survey collection revealed that of 110 individuals, seven (all ♀♀) had deposits.

Thin-layer chromatography analysis of the chalky material indicated that urea was present. Both R_f values and ninhydrin color reaction also showed that allantoin was present in the chalky material.

Observations of *O. orbona* in laboratory cages indicated two methods of apparent defecation. In one, tiny clear liquid droplets (ca. 1 mm diam.) were flung from the anus, often in rapid succession, for several minutes. These droplets dried, leaving only a slight film on the cage walls. The other method involved large drops (up to 6 mm diam.) of clear liquid issuing from the anus and collecting under the posterior edges of the folded wings. When a drop touched the host plant, surface tension was broken and liquid flowed down the plant. On one occasion a large drop was flung vigorously against the cage wall by the leafhopper, and the insect then expelled small droplets as described above. Another large drop

formed and the leafhopper used its hindlegs to touch the drop; this was followed by intensive "kneading" movements of the legs. Again this behavior was followed by normal small-droplet defecation. The liquid material from the large drops consistently dried as a two-dimensional, translucent film.

Chalky deposits on the forewings of *O. orbona* appear to be restricted to females, and an ovipositing female can certainly scrape the chalky material onto an egg site. But non-ovipositing females with chalky deposits will also scrape the material off their wings.

Powdery white material on an otherwise green oviposition site seems an unlikely visual camouflage against predators and parasites, but it may be a chemical protection for the site. A white fungus began growing on a sunflower plant stem where oviposition and scraping behaviors were observed in the laboratory. The growth was much less extensive several days later in the deposit area than it was on the uncovered parts of the stem.

The antibiotic properties of allantoin became apparent earlier this century in connection with the "maggot therapy" of treating certain types of human wounds (Robinson 1935). The presence of allantoin in the chalky material from *O. orbona* could protect the oviposition site from microbial attack.

None of the literature describes the appearance of the chalky material on *O. orbona* before it is placed on the wings and dries. Turner and Pollard (1959) were vague about the physical form of the substance, saying only that "... gravid females stroke the tips of their bodies with their hind tibiae, transferring some of the chalk to their legs." I have never seen in *O. orbona* the opaque yellowish drops described by Storey and Nichols (1937) for *Cicadulina mbila*.

DeLong (1971) described the proconiine leafhoppers as xylem-feeders. In the meadow spittlebug *Philaenus spumarius* (L.), this method of feeding results in copious excretion of water (Wiegert 1964) without the familiar honeydew excreted by phloem-feeding homopterans. Observations of the excretion of copious amounts of clear liquid by *O. orbona* exemplify this situation.

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LITERATURE CITED

- BORROR, D. J. and R. E. WHITE. 1970. A field guide to the insects of America north of Mexico. Houghton Mifflin, Boston. 404 pp.
- DELONG, D. M. 1971. The bionomics of leafhoppers. *Annu. Rev. Entomol.* 16:179-210.
- FENTON, F. A. 1952. Field crop insects. MacMillan, N. Y. 400 pp.
- METCALFE, J. R. 1969. Studies on the biology of the sugar-cane pest *Saccharosydne saccharivora* (Westw.) (Homoptera, Delphacidae). *Bull. Ent. Res.* 59:393-408.
- NIELSON, M. W. 1968. The leafhopper vectors of phytopathogenic viruses: taxonomy, biology, and virus transmission. U.S.D.A. Tech. Bull. 1382. 386 pp.
- POLLARD, H. N. and C. E. YONCE. 1965. Significance of length of tibial spines relative to oviposition processes by some leafhoppers (Hemiptera:Cicadellidae). *Ann. Entomol. Soc. Amer.* 58:594-595.
- RILEY, C. V. and L. O. HOWARD. 1892-93. The glassy-winged sharp-shooter. *Insect Life* 5:150-154.
- ROBINSON, W. 1935. Allantoin, a constituent of maggot excretions, stimulates healing of chronic discharging wounds. *J. Parasit.* 21:354-358.
- SEVERIN, H. H. P. 1950. *Texananus incurvatus* III. Life history on virus-infected and on healthy plants. *Hilgardia* 19:546-548.
- STOREY, H. H. and R. F. W. NICHOLS. 1937. Defaecation by a jassid species. *Proc. Roy. Ent. Soc. London, Ser. A* 12:149-150.
- SWAIN, R. B. 1936. Notes on the oviposition and life history of the leafhopper *Oncometopia undata* (Fabr.) (Homoptera:Cicadellidae). *Entomol. News* 47:264-266.
- TURNER, W. F. and H. N. POLLARD. 1959. Life histories and behavior of five insect vectors of phony peach disease. U.S.D.A. Tech. Bull. 1188. 25 pp.
- WIEGERT, R. G. 1964. The ingestion of xylem sap by meadow spittlebugs, *Philaenus spumarius* (L.) *Amer. Midl. Natur.* 71:422-428.

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OBSERVATIONS ON SIZE AND FECUNDITY OF THE LEAST BROOK LAMPREY, *LAMPETRA AEPYPTERA* (ABBOTT), FROM NORTHCENTRAL ARKANSAS

Information on the least brook lamprey (*Lampetra aepyptera*) in Arkansas is limited to reports of distributional data (Robison, 1974; Harp and Matthews, 1975; Sewell et al. 1980). This is based on the fact that only 32 *L. aepyptera* are known from Arkansas (Sewell et al. 1980). However, in other parts of its range, *L. aepyptera* has been extensively studied (Schwartz, 1959; Brigham, 1973; Pflieger, 1975; Rohde et al. 1976; Rohde, 1977; Rohde and Jenkins, 1980).

The purpose of this investigation was twofold: first, to provide quantitative data for Arkansas *L. aepyptera* to compare with data reported from other portions of its range, and second, to provide foundation for future studies of the biology of the least brook lamprey in Arkansas.

Thirteen mature *L. aepyptera* were collected on 30 March 1980 with a 1.8 x 0.9 m straight nylon seine (3.2 mm mesh) from North and South Sylamore Creeks, Stone County, Arkansas (T.16N, R.12W, Sec.16; T.15N, R.11W, Sec.21). Of these, seven were males, and six were females. Total length to the nearest mm and weight to the nearest 0.01 g were obtained from all formalin-preserved fish. Mid-ventral incisions were made in females and ovarian compliments removed, weighed and preserved separately. Eggs were not free in the coelomic cavity, suggesting that spawning had not begun. Actual counts of ova were made utilizing a binocular microscope. Diameters of 20 ova were measured in each of six females to the nearest 0.01 mm with an ocular micrometer.

Mean and standard deviation ($\bar{X} \pm s.d.$) were calculated for each character examined. Sexes were compared with a one way analysis of variance (ANOVA) test. The relationship in females between characters was examined by correlation analyses. The Statistical Package for the