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Synopsis of the genus Tropisternus (Coleoptera Hydrophilidae) in Arkansas

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A SYNOPSIS OF THE GENUS TROPISTERNUS (COLEOPTERA: HYDROPHILIDAE) IN ARKANSAS

Information about *Tropisternus* species in Arkansas is restricted to listings in faunal surveys (e.g. Harp and Harp, 1980; Huggins and Harp, 1983; Cochran and Harp, 1990). Further, little has been written about preferred habitat for individual species (Spangler, 1960). The purposes of this study are to present a statewide list, to describe geographic distributions and to report preferred habitats for the water scavenger beetles of this genus, to the extent that current knowledge will allow. Arkansas species may be identified by using Spangler's (1960) keys.

This study has utilized specimens provided by those sources listed in Acknowledgments, literature records, and collections by the authors and students at Arkansas State University. The latter specimens are preserved in 70% ethanol and housed in the Aquatic Macroinvertebrate Collection of the Arkansas State University Museum of Zoology. Over 4,200 specimens have been analyzed.

Figure 1. T. l. nimbatus.

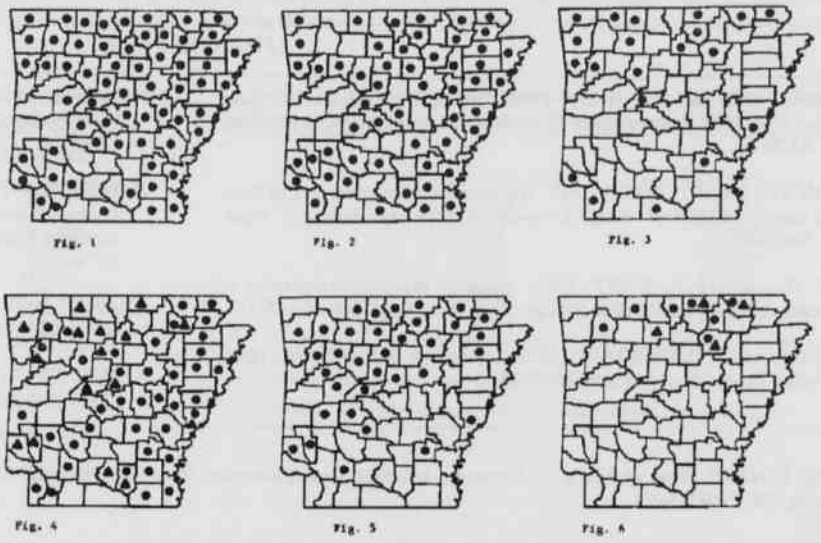
Figure 2. T. c. striolatus.

Figure 3. T. c. mexicanus.

Figure 4. T. b. blatchleyi ●
T. b. modestus ▲

Figure 5. T. natator

Figure 6. T. glaber ▲
T. ellipticus ●



Tropisternus lateralis nimbatus (Say) occurs from Nova Scotia to southern British Columbia, then south through Mexico to Panama, and through West Indies to Barbados (Spangler, 1960). It is predictably Arkansas' most common form. We have collected it in all six Natural Divisions (ecoregions), as defined by Shepherd (1984). It is known by 3,176 specimens in over 500 collections from 64 counties (Fig. 1). It occurs in a variety of aquatic habitats, including mineral acid lakes (Harp and Hubbard, 1972), acid bogs (Farris and Harp, 1982), sewage lagoons. springs and temporary ponds, but occurrence is greatest in lowland streams and ponds, followed by roadside ditches. Arkansas specimens have been collected during all months of the year.

The polytypic species *Tropisternus collaris* Fabricius is Arkansas' second most abundant form. Of the five subspecies, two occur in this state, *Tropisternus collaris striolatus* (LeConte) is found from New York west to Kansas City, then south to eastern Texas and Florida (Spangler, 1960). This subspecies is the more common of the two in Arkansas, as 461 specimens from approximately 87 collections in 52 counties have been examined (Fig 2). It is reported from all ecoregions and occurs in diverse habitats, but is most often collected in lowland streams or bayous. Arkansas specimens have been collected from January-November.

Tropisternus collaris mexicanus LaPorte occurs from Panama north to New Mexico, then east to eastern Missouri, Arkansas and eastern Texas (Spangler, 1960). This subspecies is uncommon in Arkansas, being known from 93 specimens in 30 plus collections from 10 counties (Fig. 3). It is known from all ecoregions except Crowley's Ridge. Discounting one collection of 32 specimens (44% of total specimens with habitat data) from Holla Bend National Wildlife Refuge, Ozark creeks and ponds (13 collections, 29 specimens) appear to be preferred habitat. Arkansas specimens were collected from January-November.

Tropisternus blatchleyi d'Orchymont is a fairly common beetle in Arkansas, where it is represented by both subspecies. *Tropisternus blatchleyi blatchleyi* d'Orchymont ranges from New Jersey west to northern Illinois, then south to eastern Texas and southern Florida (Spangler, 1960). We have examined 177 specimens in 69 collections from 39 Arkansas counties (Fig. 4). It occurs in all ecoregions. While it frequents diverse habitats, it is most often found in sloughs, lakes. swamps and ponds, in that order. This form has been collected from January-November in Arkansas.

Tropisternus blatchleyi modestus d'Orchymont is found from Massachusetts to northern Iowa and south to northern Arkansas and northern Virginia (Spangler, 1960). Our records extend its range much further south in Arkansas, and it should be found in Mississippi, Louisiana and Texas (Fig. 4). This form may be extending its range to the south. It is much less common in Arkansas than is *T. b. blatchleyi*. We have seen only 34 specimens in 18 collections from 16 counties (Fig. 4). These represent all ecoregions except Crowley's Ridge. Our habitat data suggest it may require waters of somewhat better quality than the nominate form. In Arkansas this form has been collected during February-June and September-October.

Tropisternus natator d'Orchymont occurs from southern New Hampshire west to northern Minnesota, then south through eastern Colorado to northeastern Texas and to southern Georgia (Spangler, 1960). Accordingly, it is represented in Arkansas by 277 specimens in 98 collections from 36 counties (Fig. 5). It is found in all ecoregions, but it is clearly found most often in upland streams (58% of collections, 69% of specimens). It thus seemingly justifies its specific name. In Arkansas it has been collected during all months of the year.

Tropisternus glaber (Herbst) ranges from Maine west to extreme eastern N. Dakota, then south to northcentral Nebraska, northern Illinois and northern Maryland (Spangler, 1960). Our records, then, are new for Arkansas and extend the known range considerably to the south. This species is quite uncommon in Arkansas; 23 specimens in ten collections from four counties are known (Fig. 6). All collections were from Ozark streams; however, collections totalling six specimens were from Curia Creek at a sewage outfall (Justus, 1990). Arkansas specimens have been collected during March, June-September and November. In our museum collection, we also have two specimens of this species which were taken in Missouri, one each from Loose Creek, Osage County, and Moniteau Creek, Cooper County. These, too, are probably first records.

Tropisternus ellipticus (LeConte) is found from Oregon to central Iowa and east central Missouri, then south through Central America (Spangler, 1960). We report it for the first time from Arkansas. For our rarest *Tropisternus* species, we have seven collections of one specimen each, and each is from a different county (Fig. 6). All specimens are from Ozark streams and were taken during January, February, April. June, July and November. Huggins and Harp's (1983) identification of this species in Franklin County material was incorrect.

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THE EFFECT OF BACTERIAL LIPOPOLYSACCHARIDE-INDUCED FEVER ON THE HUMORAL RESPONSE OF NEW ZEALAND WHITE RABBITS

The response to microbial infection and microbial products is often an elevation of body temperature commonly termed fever. It seems likely that fever may be a beneficial host response providing a mechanism that aids survival from infections (Kluger *et al.*, 1975; Kluger and Vaughn, 1978). Kluger and Vaughn (1978) and Dinarello and Wolff (1978) noted that infected rabbits had a higher survival rate at moderate febrile levels; although, the reverse occurred at high body temperatures. Largely resulting from advertising, the American public is conditioned to routinely administer antipyretics during infections to suppress the fever response. Recently, Doran *et al.* (1989) reported that the healing time was prolonged in 37 children with chicken pox who received the antipyretic acetaminophen compared to 31 children receiving a placebo. Graham *et al.* (1990) also reported a negative effect against a Rhino virus infection when human volunteers receiving aspirin or acetaminophen produced lower titer antisera and shed virus for a longer time than those given a placebo.

The fever response can be initiated by exposing an animal to a variety of different chemical substances termed pyrogens including a number derived from infectious agents. Among the latter is bacterial lipopolysaccharide (LPS), a component of the outer membrane of Gram negative bacteria. This material produces dose-related fevers in humans and rabbits and has frequently been employed as a fever inducer for experimental purposes (Wolff, *et al.*, 1965; Wolff, 1973). A complicating factor in predicting and assessing the potential benefits of an LPS-induced fever is the fact that injection with this material may also trigger the release of ACTH and corticosterone which can result in immunosuppression (Moberg, 1971; Yasuda and Greer, 1978; Nakano *et al.*, 1987; Derijk *et al.*, 1991).

The current study was undertaken to examine the effects that fever and antipyretic fever suppression might have on the humoral response in rabbits. *Salmonella typhi* lipopolysaccharide (*Salmonella typhosa* No. L-6386, Sigma Chemical Co., St. Louis, MO) and acetaminophen were employed as the pyrogen and antipyretic respectively. Since LPS is itself antigenic, the antibody response to this substance was studied. However, to better assess the overall effects of fever and fever suppression, sheep erythrocytes were also employed as a second antigen.

Three groups each of seven New Zealand White rabbits (4.0 to 4.5 Kg) were employed in the study. Each animal was injected via a marginal ear vein on five separate days at 48 hr intervals (days 1-9) with 1.0 mL of a 10% suspension of sheep erythrocytes (S-RBC) in sterile saline. One group (S-RBC Only) received only the S-RBC while a second group (Fever Group) received an injection of a specified dose of LPS (8 ng/Kg on days one and three, 12 ng/Kg on day five, 15 ng/Kg on day seven, and 18 ng/Kg on day nine) along with the S-RBC. The increased dosage schedule was necessary because a resistance to the effects of LPS had been previously observed by day five in preliminary trials. A third group (Fever-Suppressed Group) was treated identically to the Fever Group except that acetaminophen was administered per OS in a dose of 100 mg/kg 15 minutes prior to each S-RBC/LPS injection. Immediately prior to each injection, a rabbit's base-line rectal temperature was measured and recorded. Temperatures were then recorded at one hour intervals post-injection for a period of four hours.

Sera were collected for analysis by intracardial bleedings using clot activating Vacutainer tubes (15 mL) equipped with a 20G 1.5" sterile needle. Pre-injection samples were taken one week prior to immunization while the post-injection samples were drawn six days after the last injection. All sera were clarified by centrifugation and kept frozen for later analysis.

Antibodies against the LPS were measured by performing tube agglutination reactions using a somatic (O) antigen prepared in our laboratory from *Salmonella typhi*. Antibodies to the sheep erythrocytes were measured by direct tube hemagglutination. Both the bacterial agglutination and hemagglutination reactions as well as the O antigen preparation were done according to the procedures of Garvey *et al.*, (1977).