Waller, 1984

reaches 6 km upstream and 32 km downstream were thoroughly examined. No other artificially scoured stream sections were encountered, and no additional spawning sites or reproductive activities were observed. Spawning activity was restricted to a 1 m^2 area and involved several hundred fish spawning in mass. Construction of the temporary diversion dam artificially provided possible flooding cues (i.e., turbidity, scour, flow variation) and presumably triggered local spawning activity. The large concentration of spawning fish may have resulted from the limited (scoured) spawning habitat and from the physical upstream migration barrier created by the dam. If flooding cues are similarly important for other native Southwestern fishes, it may be possible to stimulate spawning effort during prolonged droughts or below regulated reservoirs by mimicking (i.e., mechanical scour, dam releases) the physical conditions or effects of spring runoff or summer spates.—GORDON A. MUELLER, *Environmental Sciences Branch, Bureau of Reclamation, Boulder City, NV 89005.*

PHOLEOMYIA TEXENSIS SABROSKY (DIPTERA: MILICHIIDAE): LABORATORY NOTES ON LARVAL BIOLOGY.—The Texas leaf-cutting ant, *Atta texana* (Buckley) (Formicidae: Attini), constructs huge nests that contain subterranean gardens of the ants' symbiotic fungus. The ants harvest live plant material for fungal substrate. Exhausted subtrate, dead fungus, and dead ants are stored together in subterranean detritus cavities (Moser, J.C., Ann. Entomol. Soc. Amer., 56: 286-291, 1963).

Many arthropod species live within these nests, but their life histories are not well known. One of these nest inhabitants, *Pholeomyia texensis* Sabrosky, has been collected as adult flies from *A. texana* detritus cavities in Texas (Sabrosky, C. W., Ann. Entomol. Soc. Amer., 52: 316-331, 1959). Gravid *P. texensis* females ride leaf burdens carried by *A. texana* foragers into ant nest entrances (Waller, D.A., Ecol. Entomol., 5:305-306, 1980).

In 1979 I reared *P. texensis* flies by placing gravid females in a small laboratory *A. texana* nest that contained fresh leaves, ants, fungus and detritus (Waller, D. A., 1980). It was not clear what the larvae ate, but larvae of a congener, *P. comans*, have been reported to feed on *A. texana* detritus in Louisiana (Moser, J. C., and Neff., S. E., Zeit. Angewandte Entomol., 69: 343-348, 1971). In this note I report results from rearing *P. texensis* in sterile cultures of *A. texana* nest detritus in isofemale containers. Number, sex ratio, and days to eclosion for offspring were recorded. Attempts to rear a second generation of flies were unsuccessful.

Female *P. texensis* flies were collected near *A. texana* entrances in May 1980. Each fly was housed individually in a sterile Corning 250 ml beaker with lid, partially filled with sterile moist *A. texana* detritus (a mixture of Texas laboratory colony detritus, and Louisiana detritus supplied by J. C. Moser). The detritus was quickly overgrown with fungal hyphae, and so a 1 % solution of proprionic acid was added to the cultures. Beakers were kept in a laboratory at approximately 80°F.

The parental adult females were usually found dead in the beakers within two days. Occasionally they could not be located and were presumed buried in the detritus. Larval offspring were usually not detectable in the detritus, but pupae appeared on the detritus surface, and on the beaker sides after approximately two weeks. As these pupae eclosed, they were removed from the cups daily and sexed. Occasionally flies escaped during this procedure, so that offspring counts are underestimates of fecundities. Some of the offspring were paired in sib and non-sib groups and placed in sterile beakers with sterile detritus. These flies died or disappeared within a few days as had their female parents, but this second generation never produced offspring.

Ten field-caught *P. texensis* females produced offspring, although one of these produced only one male progeny. Seven other female *P. tenexsis* collected in the field (one in September, two in February, and four in May 1980) never produced offspring in the laboratory. The nine most fecund flies produced an average 14.1 ± 5.3 female and 15.3 ± 7.7 male offspring. Females eclosed first in every case, and overall average time to eclosion for females (24.4 ± 4.7 days, $n = 9$ cultures) was significantly less than for males (26.7 ± 5.6 days, $n = 9$ cultures; Wilcoxon Paired-sample T-test: $T = 0$, $n = 9$, $p < .005$, 2-tailed). These maturation times are much faster than those recorded for *P. comans*, which took six weeks to develop in the laboratory (Moser, J. C., and Neff, S. E., 1971). Rearing temperatures were not reported for that study, however.

These results confirm that *P. texensis* can mature on ant detritus alone. *P. comans* larvae in Louisiana are considered to be the principle agents in the breakdown of *A. texana* detritus (Moser, J. C., and Neff, S. E., 1971). *P. texensis* may play a similar role in Texas.

The failure of the first generation of laboratory progeny to produce offspring may have resulted from several factors. First, it is possible that adult flies need resources not obtainable from detritus. Adult male *P. texensis* have been collected visiting flowers in Texas (Sabrosky, C. W., 1959). Second, the addition of proprionic acid to the detritus may have destroyed vital nutrients that may be important in reproductive development. Third, proprionic acid solution was added to the cultures before the first generation progeny were introduced (and not after, as was true for field-caught flies), and this may have inhibited mating or oviposition. Attempts to rear progeny from field-caught flies in subsequent years (1981 and 1982) in order to test these ideas have not been successful.—D. A. WALLER, *Zoology Dept., Univ. of Texas, Austin, TX 78712.* (Present address: *5154 Piedmont Place, Annandale, VA 22003*).

DIRECT MEASUREMENT OF ALLOCHTHONOUS LITTER ACCUMULATION IN A TALLGRASS PRAIRIE STREAM.—Species living in lotic ecosystems are often dependent on the deposition of organic litter from surrounding terrestrial ecosystems for a large portion of their energy requirements (Boling et al., Ecology 56:141-151, 1975). These same species may also be influenced by significant amounts of organic compounds (Suberkropp, Godshalk, and Klug, Ecology 57: 720-727, 1976) and inorganic elements (Killingbeck, Smith, and Marzolf, Ecology 63: 585-589, 1982) that are released into the water during the decomposition of allochthonous litter. Litter transfer into streams is usually estimated with catchment collectors located outside of the stream. The termination of flow in a tallgrass prairie stream in 1978 provided the opportunity to directly measure allochthonous litter accumulation in that stream channel. The objectives of this study were to document direct litter accumulation in the stream channel, and to compare this to vertical deposition of litter in the adjoining gallery forest.

In late winter and spring of 1978, high water flows flushed previously accumulated litter from the streambed in the mid-to-upper reaches of Kings Creek, a pristine stream surrounded by a deciduous gallery forest and draining a watershed dominated by tallgrass prairie vegetation on the Konza Prairie Research Natural Area in east-central Kansas (latitude 39° 05′ N, longitude 96° 35′ W). During the summer, water flow ceased and the streambed became dry and remained free of water until the following spring. This occurrence provided the opportunity to measure the direct accumulation of allochthonous litter in a 600 m segment of Kings Creek where I was monitoring terrestrial litterfall deposition with litter traps in the adjacent gallery forest.

Thirty 1.0 × 1.0 m quadrats in the streambed were cleared of all organic debris down to the limestone-rock-laden substrate on 14 November 1978. The quadrats were established in each of 10 transects perpendicular to the stream channel. One of the three quadrats was always placed in the middle of the streambed, and the remaining two were placed at the edges of the channel. The initial transect coincided with the edge of my northernmost permanent terrestrial plot, and all subsequent transects occurred at 60 m intervals. The tree stratum of the gallery forest, which formed a continuous border along this portion of Kings Creek, was dominated by hackberry (*Celtis occidentalis*) and bur oak (*Quercus macrocarpa*) and the shrub stratum was dominated by hackberry and red elm (*Ulmus rubra*). Litter was placed in paper bags, oven dried at 100° C to constant weight, and weighed. Litter collected on 14 November represents particulate organic matter accumulation that occurred after continuous stream flow ceased in summer and after more than 98% of the 1978 autumnal litter had fallen in the adjacent gallery forest (Killingbeck, manuscript in preparation). Although the upper reaches of this watershed, and all the land adjacent to the gallery forest, were dominated by tallgrass prairie vegetation, virtually none of the accumulated streambed litter had its origins in the prairie.

Accumulation of litter in the streambed was 468 ± 18 g m^{-2} (mean ± standard error of the mean). Even though the stream channel was relatively narrow (6.6 ± 0.5 m), litter accumulation amounted to almost 3100 g/linear meter. The edges of the stream channel accumulated slightly more litter (484 ± 20 g m^{-2}) than the middle (436 ± 36 g m^{-2}). Accumulation maxima at the stream edges would be expected for two reasons. First, laterally transported litter from the adjacent forest has a higher chance of reaching the edge of the stream channel than the middle. Second, because stream flow persists longer into summer in the middle of a channel than at its edges, uninterrupted accumulation time is greater at the edges.

A comparison between the actual accumulation of litter in the Kings Creek streambed and vertical litter deposition in the adjacent gallery forest indicates that forest litterfall measurement may be useful for estimating litter input into an adjoining stream. Total vertical litterfall in the