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Nonpredatory Fly Larvae (*Delia platura*: Anthomyiidae) in a Nest of a Northern Map Turtle (*Graptemys geographica*)

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ABSTRACT. – **Fly larvae were collected from a northern map turtle (*Graptemys geographica*) nest in which the eggs failed to hatch. The flies were identified as the seed corn maggot, *Delia platura* (family Anthomyiidae), a widespread phytophagous or saprophagous species in North America that is unlikely to have been a factor in nest failure. Thus, not all fly larvae encountered within turtle nests are the cause of mortality.**

Fly larvae belonging to 6 families are known to occur in association with turtle eggs and/or hatchlings. Muller (1921) described the occasional occurrence of unidentified fly larvae in the eggs of the smooth softshell turtle (*Apalone mutica*). He estimated that about 10% of the eggs in any given nest were decomposed and infested. Similarly, numerous species of dipterans, primarily from the families Sarcophagidae and Phoridae, have been collected from the nest chambers of sea turtles (McGowan et al. 2001a, 2001b). These authors suggested that the flies were attracted to decaying matter in the nest chambers and were thus feeding on eggs that had failed to hatch. Moreover, they questioned whether viable eggs or embryos were ever attacked. However, Vogt et al. (1994) documented the loss of 60.5% of 526 big-headed Amazon River turtle (*Peltocephalus dumerilianus*) hatchlings because of fly predation. Some uncertainty remains as to whether particular fly species prey upon infertile, decomposing, or pipped eggs, and/or hatchlings in the nest chamber.

Larvae of flesh flies (Sarcophagidae) have diverse habits, ranging from parasites to scavengers. The species found in association with turtle nests are apparently either predators or scavengers. Aldrich (1916) and Greene (1925) identified specimens of *Metoposarcophaga importuna* (identified as *Sarcophaga larga* and *Metoposarcophaga pachyprocta*, respectively) from diamondback terrapin (*Malaclemys terrapin*) eggs. Vogt (1981) noted that larvae of *M. importuna* consumed 36% of the hatchlings from 23 clutches of the false map turtle (*Graptemys pseudogeographica*) within 10 days of the first eggs showing signs of pipping. Fly larvae entered turtles through the yolk plug in the plastron of neonatal turtles. Interestingly, the unpipped eggs were not attacked by larvae. Conversely, Iverson and Perry (1994) observed sarcophagid flies (*Eumacronychia sternalis*) exiting through single holes in multiple eggs of the Gulf Coast box turtle (*Terrapene carolina major*). Eggs of *Graptemys*, *Deirochelys*, and *Testudo* from the same enclosure were not attacked. Lopes (1982) also reported *E. sternalis* from eggs and hatchlings of green turtles (*Chelonia mydas*). A congener, *E. nigricornis*, has been demonstrated to prey upon, rather than simply scavenge, eggs of fence lizards, *Sceloporus undulatus* (Mullen et al. 1984; Trauth and Mullen 1990). Finally, Pezzuti and Vogt (1999) noted that only 2% of 6-tubercled Amazon River turtle (*Podocnemis sextuberculata*) hatchlings were depredated by sarcophagid fly larvae when, as a preventative measure, pipped hatchlings were removed from their nests.

The scuttle flies (Phoridae) have an even broader range of habits than the Sarcophagidae, with almost every conceivable lifestyle represented in the family, even within individual species. Ewing (1933) found that 2 of 3 *Terrapene carolina carolina* eggs were infested with phorids; whereas Fowler (1979) discovered great numbers of larvae of *Megaselia scalaris* in 50 *C. mydas* nests. These nests were characterized as rotten clutches and postemergence nests. Such observations have suggested that *M. scalaris* is attracted to decaying infertile eggs and/or disturbed nests. *Megaselia scalaris* has also been found to consume eggs of the painted wood turtle, *Rhinoclemmys pulcherrima* and the slider, *Trachemys scripta* (Moll and Legler 1971; Acuña-Mesén and Hanson 1990). Moll and Legler (1971) noted that *M. scalaris* and another phorid, *Puliciphora borinquenensis,* were attracted to laboratory-incubated eggs but that turtles were especially vulnerable once eggs began to hatch.

Methods.— On 4 July 1997, a nest of the northern map turtle (*Graptemys geographica*) was discovered in a sandy area of Gravelly Bay, Long Point, Ontario, Canada (42°33'15" N, 80°06'00" W). The nesting area contained some grasses and received a maximum of 4 hours of direct sunlight per day because of a cabin and adjacent trees. The nest was protected with a wire-mesh predator excluder, as described in Fletcher (1998). By 26 August, the nest site was completely overgrown with unidentified grasses and vines. The nest was excavated, only to find the withered eggs completely enveloped in roots and fungal mycelia. In addition, several dipteran larvae were observed and collected. To facilitate their identification, larvae were placed in a plastic container with turtle egg remnants from the nest and allowed to pupate. On 17 September, 3 adult flies (2 males, 1 female) emerged. The specimens were pinned and deposited in the Lyman Entomological Museum, McGill University, Ste-Anne-de-Bellevue, Québec, Canada.

Results and Discussion.— The flies were identified as *Delia platura* (family Anthomyiidae), a very widespread species in North America. Commonly known as the seed corn maggot, *D. platura* is considered a pest of seed corn and other newly planted seeds (Ferrar 1987). In addition, larvae of *D. platura* have been recorded as feeding on many kinds of live or dead vegetation, and occasionally on fungi or dead insects (Ferrar 1987). However, they have not been reported feeding on vertebrate carrion or live animals. It is thus unlikely that the map turtle nest failure was related to the presence of these particular larvae. The adult flies may have been attracted to the presence of the freshly turned soil of the nest excavation site where the female flies would have laid eggs near the roots of exposed vegetation. The larvae would have remained in the soil until the map turtle nest was re-excavated in August. Alternatively, the flies may have been attracted to the presence of the fungi that enveloped the eggs. Potential causes for the failure of this map turtle clutch include insufficient exposure to solar radiation, competition with plants and fungus for resources (i.e., water), and/or egg infertility.

Previous records of anthomyiid flies in association with turtles were based on larvae feeding on dung in burrows of the gopher tortoise, *Gopherus polyphemus* (Johnson 1913; Huckett 1941). Our record of phytophagous or saprophagous anthomyiid larvae from a turtle nest indicates that not all fly larvae found in nests are a potential cause of mortality. The immature stages of many higher flies, including Anthomyiidae and Sarcophagidae, look very similar to nonspecialists; in fact, some larvae and puparia cannot be identified to the species level even by specialists. Given the very different ecological roles of these flies, our record illustrates the importance of collecting, rearing, and accurately identifying insect larvae found in turtle nests, especially when egg or hatchling mortality has occurred.

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