NOTES ON SOME SARCOPHAGIDAE (DIPTERA) REARED FROM SNAILS (MOLLUSCA) IN FLORIDA[1]

CARL E. STEGMAIER, JR.[2]

11335 N.W. 59th Ave., Hialeah, Fla. 33012

ABSTRACT

Johnsonia elegans Coquillett (Diptera: Sarcophagidae), a parasitoid fly, was reared for the first time from *Succinea luteola* Pilsbry, a terrestrial snail. *Helicobia rapax* (Walker), *Sarcodexia sternodontis* Townsend, and *Sarcophaga bullata* Parker were reared from dead aquatic snails, *Marisa cornuarietis* (L.), at Miami, Florida.

During late 1970 and early 1971, I reared several species of Sarcophagidae from terrestrial and aquatic snails found in Miami, Florida. Most of these flesh flies appeared to be saprophagous, but at least one, *Johnsonia elegans* Coquillett, is a parasitoid. Besides reporting these rearings and some new information on the biology of these species, I am taking the occasion to review the rearing records of Sarcophagidae from snails in Florida.

Helicobia morionella (Aldrich)

This species is distributed from North Carolina west to southern California and south to the West Indies, Cuba, and Mexico (Downes 1965). The fly is a general saprophage but also has been reared from snails. Muma (1954, 1955) reported rearings of *H. morionella* (as *Sarcophaga morionella*) from living, nearly mature, citrus tree snails, *Drymaeus dormani* (Binney), in the Lake Alfred area of Florida. He found that a single maggot could easily be seen feeding on snail tissue through the transparent shell and that the pupation of the fly takes place within the soil. Muma noted that infestations of the species in the citrus tree snail occur from May through August and that the flies are less common than *Sarcodexia sternodontis*, occurring in ratios of 1 to 5.

Helicobia rapax (Walker)

I reared 58 adult specimens from 23 dead aquatic snails, *Marisa cornuarietis* (L.) (Gastropoda: Pilidae), 24 January 1971, Miami, Florida. From this single collection of snails, *Sarcophaga bullata* and *Sarcodexia sternodontis* were reared also. Two days after the initial collection of the dead snail infestations, larvae of the flies issued from the snails into the glass rearing container. Pupation was delayed until the following day when soil was placed for this purpose into the rearing container.

[1]Contribution No. 233. Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville.

[2]Research Associate, Florida State Collection of Arthropods, Division of Plant Industry, Florida Department of Agriculture and Consumer Services.

Aldrich (1916) reported rearing the species from *Polygyra thyroides* (Say) (Gastropoda: Polygyridae). He reported the species as *Sarcophaga* (*Helicobia*) *helicis* Townsend. Aldrich also recorded the species from live grasshoppers and from many kinds of live and dead insects. The species is found from Quebec to southern California, Florida, and Mexico (Downes 1965).

Johnsonia elegans Coquillett

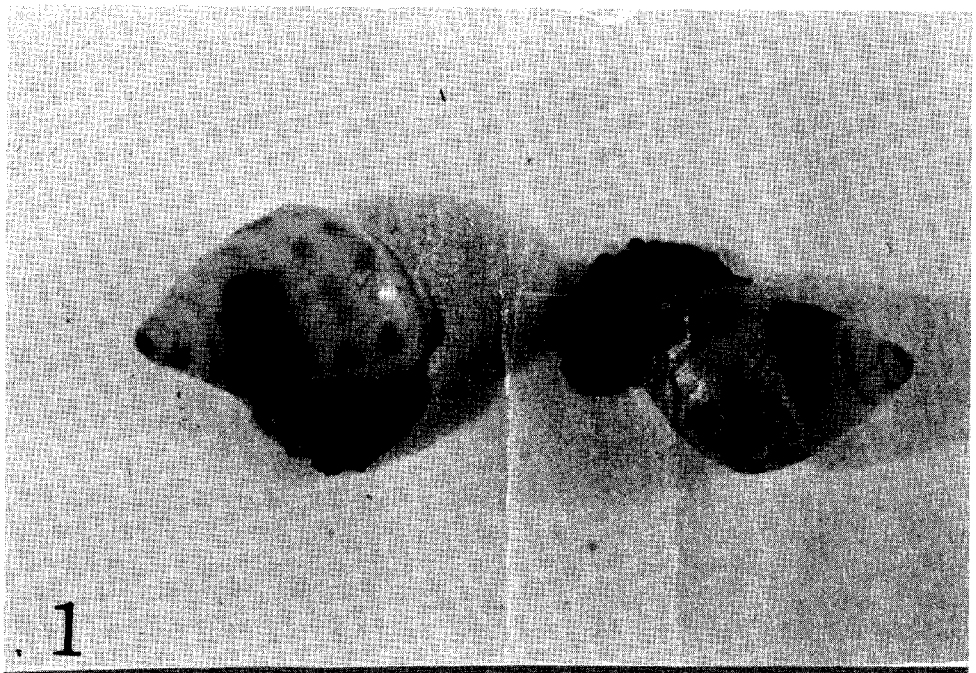
Johnsonia elegans was reported by Aldrich (1916) as follows: "on *Succinea brevis* on orange," Tampico, Mexico. Muma (1954, 1955) reported rearing the species from the citrus tree snail, *Drymaeus dormani*, and observed the parasitoid *elegans* parasitizing the living immatures when they were ¼ to ½ inch long. The parasitized snails always were observed tightly attached to various substrates, and each snail contained a visible larva or pupa which could be seen easily through the transparent shell. Pupation of this fly occurs within the shell of the snail (Fig. 1). *Melittobia* sp. (Hymenoptera: Eulophidae) parasitizes the pupae of *J. elegans*, throughout the Lake Alfred area of Florida.

The author found a very heavy concentration of parasitized snails. *Succinea luteola* Pilsbry (Gastropoda: Succinidae), Dodge Island, Miami, Florida, 26 November 1970, in an area 200 × 35 ft. I was able to rear 6 specimens of *J. elegans* from a single collection of parasitoid snails. The snails were found tightly fastened to dead ragweed stems and were usually found from 1 to 3 ft above the ground surface. A small wasp (Hymenoptera) severely parasitized numerous *J. elegans* pupae. The wasp still remains undetermined to genus or species.

I noted that in each case a septum covered the aperture of the snail and thus sealed off the pupa from the external environment. The septum is distinct from the black mass of dead snail tissue (Fig. 1.). Knutson, Berg, and Foote (1967) discussed the septa formed in shells of their host snails of 13 species of *Pherbellia* and *Colobaea* (Diptera: Sciomyzidae). They found that the septum or coating material is produced by the Malpighian tubules of the larvae just before pupation. I noted that the septum in the *Succinea* snail was a semi-frothy mass, was somewhat fragile, and was usually ruptured by a small opening or hole. The small hole, in some cases, may have been the emergence hole for some Hymenopterous parasite.

Each larva of *J. elegans* pupates with its anterior spiracles (Fig. 2) directed toward the aperture of the shell. Before pupation, the larva cleans out the interior of the host's shell by forcing uneaten snail tissue back past its body to the exterior of the shell or past the aperture where it may be seen as a black mass (Fig. 1).

The Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services has 3 collection records for *J. elegans*, which are as follows: Redington Beach, Fla., Pinellas Co., 4 Nov. 1964, coll. G. H. Raymond, in Steiner trap; Leesburg, Fla., Lake Co., 7 Sept., 30 Aug. 1965, coll. C. L. Felshaw, 2 specimens from McPhail trap.



1.

2.

Fig. 1. Two snails, *Drymaeus dormani*, each parasitized and containing a pupa of *Johnsonia elegans*. Before pupation, each larva cleans the interior of snail tissue forcing it past its body to form an accumulated black mass on the exterior of the aperture to form the substrate attachment material.

Fig. 2. A pupa of *Johnsonia elegans*, partially dissected from the snail, *Succinea luteola*. Before pupation, the single larva reverses its position within the shell so that its anterior spiracles are directed toward the aperture of the snail.

Johnsonia sp. probably *frontalis* Aldrich

Muma (1954, 1955) reported rearings of this species from parasitized *Drymaeus dormani* snails in the Lake Alfred area of Florida. This parasitoid infests living immature snails and pupates within the snail. Muma also reported snail parasitism from May through August in somewhat limited numbers.

Unknown species, possibly *Johnsonia* sp.

A single parasitized *Succinea luteola floridana* Pilsbry, swept from weeds and grasses, Hialeah, Fla., Dade Co., 30 Apr. 1969, and unfortunately, contained a parasitized pupa of a species resembling *Johnsonia*, which could not be reared to adult.

Sarcodexia sternodontis Townsend

Dodge (1968) refers to the species as a facultative parasite because it has been reared from various arthropods which suggest true parasitism. However, this species has been reared on laboratory media. Dodge reported rearings of *S. sternodontis* from beef, a field collected dead roach, *Polistes* prepupa or pupa, sphecid mud dauber cell, and a caterpillar from Barro Colorado Island, Canal Zone, Panama. Downes (1965) reported the distribution of the species from Georgia south to Texas and Florida, West Indies, Jamaica, and South America.

Greene (1925) reported rearing the species from *Erinnyis allo* L. in Puerto Rico. Callan (1946) reported rearing the species (as *Sarcophaga lambens*) from a South American bollworm, *Sacadodes pyralis* Dyar. Lopes (1969) reported rearing the species, in Argentinia, from the following Gastropoda: Bulimulidae: *Plagiodentes meieri* Weyrauch, *P. multiplicatus* (Doering), *Spixia juradoi* Parodiz, and *S. pseudosexdentatus* Doering. Muma (1954, 1955) reared the species (as *Sarcophaga lambens*) from living, nearly mature, *Drymaeus dormani*. The species pupates in the soil. Muma reported rearing *Aphaereta auripes* (Prov.) (Hymenoptera: Braconidae) from pupae of *S. sternodontis*. Muesebeck (1951) reported several Diptera hosts for *A. auripes*, including *Sarcophaga l'herminieri* (Desv.) and *S. rapax* (Wlkr.).

Six adults of *S. sternodontis* were reared by the author from 23 dead aquatic snails, *Marisa cornuarietis*, found parasitized along the banks of a canal, Miami, Fla., 24 Jan. 1971.

Numerous collection records of *S. sternodontis* were given the author by the Florida Department of Agriculture of captures plus various trap records indicating a range from Jacksonville, Fla., southward to Plantation Key, Fla. Three interesting records are as follows: *Microcentrum rhombifolium* (author not found) (Orthoptera: Tettigonidae), Gainesville, Florida, 30 Sept. 1957, coll. T. E. Cleveland, 1 reared adult; pupa under dead fish, Marco Island, Fla., emerged 12 Nov. 1957, coll. R. E. Woodruff; on *Drymaeus dormani*, Sumter, Fla., 21 July 1949, coll. J. T. Griffiths.

Sarcophaga bullata Parker

Parker (1916) reported rearings of this species from the head of a dead calf while Greene (1925) reported rearing it from beef liver and meat.

Frings and Frings (1953) reported rearings of *S. bullata* from dog biscuits and stated that the reared adults were short lived. Downes (1965) reported the distribution from British Colombia to Quebec, and southward to California and Florida. Greene (1925) and Sanjean (1957) illustrated the larvae of *S. bullata.*

Six adult specimens of *Sarcophaga bullata* were reared by the author from 23 dead aquatic snails, *Marisa cornuarietis,* Miami, Fla., 24 Jan. 1971. This species was the last to emerge as adult flies from among the 3 species of sarcophagid flies reared from the dead aquatic snails.

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to the following individuals for their help in making this paper possible: Dr. Raymond J. Gagné, U. S. Nat. Mus. Nat. Hist., for the determination of those Sarcophagidae reared by the author; Dr. Martin H. Muma, Univ. of Fla., Citrus Exp. Sta., for the loan of the snails, *D. dormani,* and for literature; Dr. W. J. Byas, U. S. Nat. Mus. Nat. Hist., for the determination of the snail, *Succinia luteola floridana;* Dr. J. Rosewater, U. S. Nat. Mus. Nat. Hist., for the determination of the snail, *Marisa cornuarietis*; Dr. F. Thompson, Univ. of Fla., Fla. State Mus., for the determination of *Succinea luteola* and *Marisa cornuarietis*; Dr. H. V. Weems, Jr., Coordinator, Florida State Collection of Arthropod Research Associates Program, for giving the author valuable host data cited in this paper; and finally, I wish to thank the following for their help with the critical review of this manuscript: Dr. R. J. Gagné and Dr. Lloyd Knutson, U. S. Nat. Mus. Nat. Hist., and Dr. H. S. Lopes, Academia Brasileira De Ciencias, Rio de Janeiro, Brasil.

LITERATURE CITED

Aldrich, J. M. 1916. *Sarcophaga* and allies in North America. Thomas Say Found. La Fayette, Ind. 301 p.

Callan, E. M. 1946. A note on *Sarcophaga lambens* (Wied.), a parasite of the South American bollworm, *Sacadodes pyralis* Dyar. Rev. Entomol. 17: 474-75.

Dodge, H. R. 1968. The Sarcophagidae of Barro Colorado Island, Panama (Diptera). Ann. Entomol. Soc. Amer. 61: 421-50.

Downes, W. L., Jr. 1965. p. 933-61. *In* A catalog of the Diptera of America north of Mexico. Stone, A., C. W. Sabrosky, W. W. Wirth, R. H. Foote, and J. R. Coulson (eds.). USDA Handbook. 276. 1696 p.

Frings, H. and *M. Frings.* 1953. Dog biscuit as a larval medium for *Sarcophaga bullata.* J. Econ. Entomol. 46: 183.

Greene, C. T. 1925. The puparia and larvae of sarcophagid flies. Proc. U. S. Nat. Mus. 66(29): 1-26.

Knutson, L. V., A. D. Bratt, C. O. Berg, and *B. A. Foote.* 1967. Calcareous septa formed in snail shells by larvae of snail-killing flies. Science 156(3774): 522-23.

Lopes, H. S. 1969. Neotropical Sarcophagidae reared from Gastropoda by Dr. W. Weyrauch (Diptera). Studia Entomol. 12: 133-60.

Muesebeck, C. F. W. 1951. p. 148. *In* Hymenoptera of America north of

Mexico. Muesbeck, C. F. W., K. V. Krombien, and H. K. Townes (eds.) USDA Agr Monogr. No. 2. Synoptic Catalog. 1420 p.

Muma, M. H. 1954. Predators and parasites of the citrus tree snail. Citrus Mag. June: 8-9.

Muma, M. H. 1955. Observations on the biology of the citrus tree snail. Citrus Ind. Jan. 6-9, 21.

Parker, R. R. 1916. New species of New England Sarcophagidae. Can. Entomol. 48: 359-64, 422-27.

Sanjean, J. 1957. Taxonomic studies of *Sarcophaga* larvae of New York with notes on the adults. Ithaca. Cornell Univ. Agr. Exp. Sta. Mem. 349. 115 p.

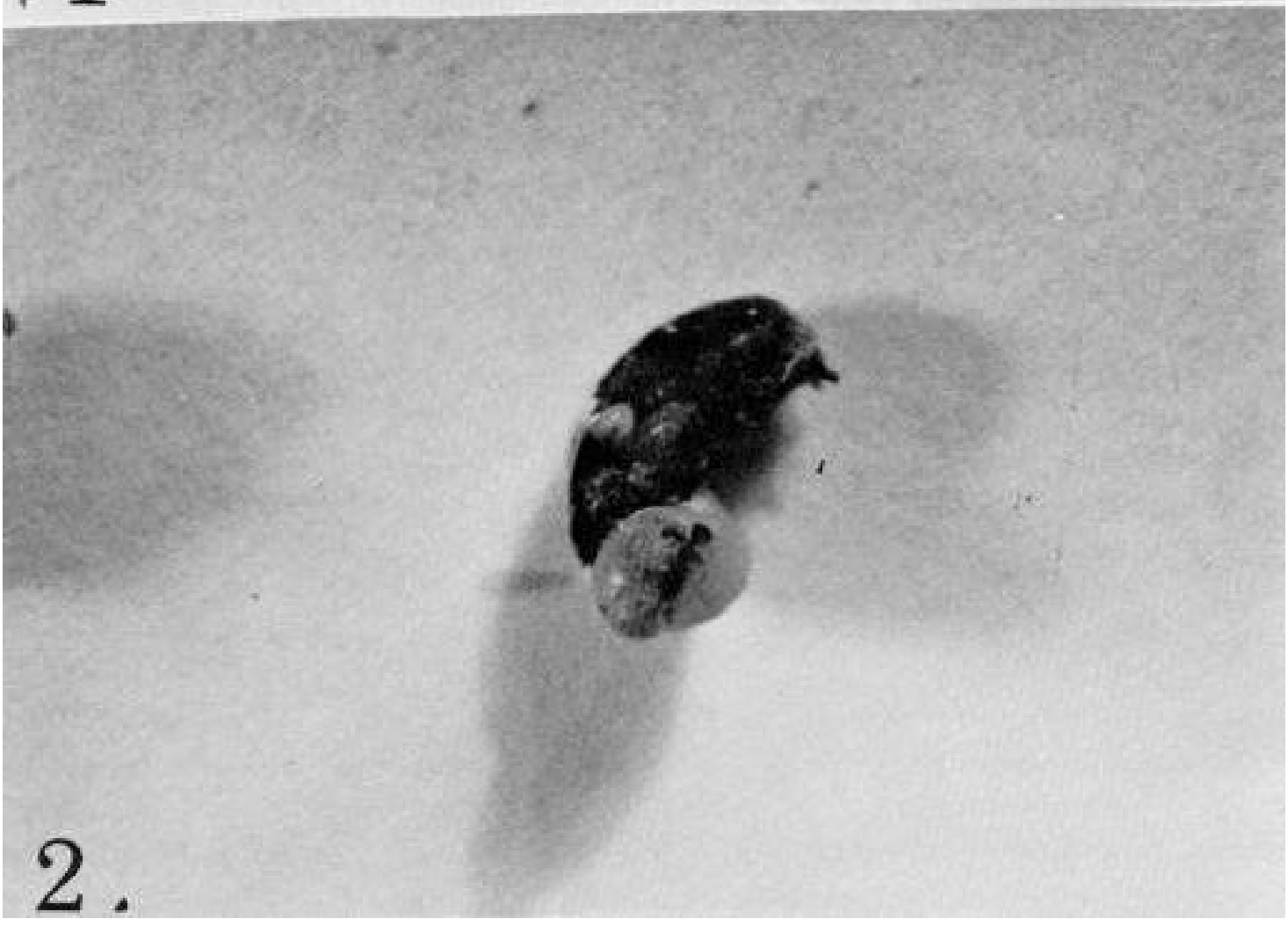
The Florida Entomologist 55(4) 1972

AMATEUR ENTOMOLOGY CLUB

The Children's Museum in Jacksonville is interested in forming an amateur entomology club for young people of the greater Jacksonville and northern Florida region. They want it to be more than a classroom situation, and to include speakers, demonstrations, slide and film presentations, work shops, field trips, and perhaps also a newsletter.

They would like to enlist support from our members and Society. You can help in forming and working with the club, and also by bringing to the museum's attention the names and addresses of the young people who might be interested. Contact Mr. Stuart M. Fullerton, Curator of Natural Sciences, Jacksonville Children's Museum, 1025 Gulf Life Drive, Jacksonville, 32207.

1.



2.