

LIFE CYCLES OF FOUR SPECIES OF LADYBEETLES¹

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As part of an investigation into the factors contributing to the natural control of insects and mites injurious to citrus in Florida, the life cycles of several predators have been determined. The present paper deals with the life cycles, under laboratory conditions, of four species of ladybeetles; *Exochomus marginipennis childreni* Muls., *Microweisea coccidivora* (Ashm.), *Stethorus utilis* Horn and *Delphastus pusillus* (Lec.).

Test tubes and petri dishes were used as rearing cages. Cabinets maintained at 80°F.—the mean June-July temperature for the past 10 years—were used for the incubation and development. The known or suspected favored host was utilized as food for each species.

Exochomus marginipennis childreni Muls.

Exochomus childreni Mulsant, 1850, Ann. Soc. d'Agric. Lyon, Vol. 2, p. 1037.

Adults of this species are broadly oval beetles that vary from one-tenth to one-eighth of an inch in length. The head, thoracic segments and legs are black, with the abdomen and elytra bright orange to red. The elytra is distinctively marked with a connected pair of black, ovate spots on the posterior margin. The slender, elongate-oval eggs are light, lemon-yellow, and were laid singly or in pairs under the armors of the scale insects provided as hosts during the study. Larvae in the first and second stadia are light yellow with grey to brown sclerites and long, slender, black spines arising from senti. Third and fourth instar larvae are dusky-yellow with the spines, senti and sclerites dark brown to black, and the first abdominal segment bright orange on the margins. The new pupa is bright yellow, but soon darkens to a dark brown, marked with a row of light triangular spots down the midline, a light yellow median stripe on the prothorax, a pair of light, lateral, transverse bars on the mesothorax and light yellow to orange margins on each abdominal segment.

Florida red scale, *Chrysomphalus aonidum* (L.), was chosen as the food host for the life cycle study on this beetle. On citrus the species has also been observed to feed on purple scale, *Lepidosaphes beckii* (Newm.), and the green citrus aphid, *Aphis spireocola* Patch, but heaviest infestations have been associated with Florida red scale.

Data accumulated on the life cycle of this ladybeetle are given in Table 1. Because of the uncommon occurrence of the species on citrus, only a few gravid females were obtained, and few eggs were produced. Mortality was relatively high, but complete data on development was obtained for 10 individuals.

The life cycle of the species approximates that of the average ladybeetle, varying from three to nine weeks, with an average of about five. It is possible that the species would develop more rapidly on the green citrus aphid. Inadequate numbers of ladybeetles have prevented further study.

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TABLE 1.—SUMMARY OF LIFE CYCLE OF *Exochomus marginipennis childreni* Muls., IN THE LABORATORY AT 80°F., WHEN FED FLORIDA RED SCALE, *Chrysomphalus aonidum* (L.).

Stage	No. Individuals			No. Days to Develop			Percent Mortality per Stage
	Total	Died	Lived	Max.	Min.	Mean	
Egg	28	6	22	8	6	6.6	21.4
First Instar	22	6	16	9	2	5.0	27.3
Second Instar	16	0	16	6	2	4.1	0.0
Third Instar	16	2	14	16	3	5.5	12.5
Fourth Instar	14	3	11	16	3	8.7	21.4
Pupa	11	1	10	7	5	6.1	9.9
Total		18	10	62	21	36.0	64.3
Adult Longevity	10	10	0	16	5	9.8	

Microweisea coccidivora (Ashm.)

Hyperaspidius coccidivora Ashmead, 1880, Orange Insects, p. 10.

Adults of this ladybeetle are ovate and vary from one-twentieth to one-sixteenth of an inch in length. The legs, ventral sclerites, head and prothorax are pale brown to mahogany red; the elytra is dark brown to black, marked with a wide brown to mahogany-red transverse band that in some specimens is interrupted to form a series of three spots. The ovate eggs are light yellow when laid, but soon darken to pink or orange. During the life cycle study reported here, eggs were laid singly or in pairs under scale armors. Newly hatched larvae are pale-yellow with pale legs, a brown head, and a pair of dark sub-parallel sclerites on the dorsal surface of the prothorax. Later instars are a pinkish-grey with a brown head, light brown legs and with the dark prothoracic sclerites forming a pair of parentheses. The pupae are dark grey and provided with numerous dark setae.

TABLE 2.—SUMMARY OF LIFE CYCLE OF *Microweisea coccidivora* (Ashm.), IN THE LABORATORY AT 80°F., WHEN FED FLORIDA RED SCALE, *Chrysomphalus aonidum* (L.).

Stage	No. Individuals			No. Days to Develop			Percent Mortality per Stage
	Total	Died	Lived	Max.	Min.	Mean	
Egg	55	32	23	10	6	8.2	58.2
First Instar	22	8	14	5	2	4.2	36.4
Second Instar	14	8	6	4	2	3.2	57.1
Third Instar	6	3	3	8	3	5.0	50.0
Fourth Instar	4	1	3	7	6	6.5	25.0
Pupa	3	1	2	5	5	5.0	33.3
Total		53	2	39	24	32.1	96.3

Although little is known of the food habits of this species, the beetles are invariably associated with purple or Florida red scale infestations. The latter scale was chosen as food for the beetles because the largest populations of the species have, to date, been found in infestations of Florida red scale.

Table 2 summarizes the life cycle data accumulated for this ladybeetle. Exceptionally high mortality occurred during the study. Although much of this mortality was due to handling of the eggs, it is possible that purple scale or a combination of purple and Florida red scale may be a more satisfactory food. The life cycle obtained with Florida red scale approximates that of the average ladybeetle but may be different on other foods. Additional life cycle studies are planned for this species.

Stethorus utilis Horn

Stethorus utilis Horn, 1895, Trans. Amer. Ent. Soc., Vol. XXII, p. 107.

Adult beetles are ovate in outline with the elytra truncate posteriorly and measure about one-sixteenth of an inch in length. They are dark brown to black with the appendages pale brown to yellow and are heavily clothed with dark setae. The elongate eggs are pale yellow to cream colored but darken to pink shortly after they are laid. During the life cycle study reported here, the eggs were laid singly on their sides in mite colonies. First and second instar larvae are pale cream with the head and thoracic segments light brown. Later instars are brownish-grey with a narrow median stripe, and the first and last two segments of abdomen light. The new pupa is light but soon darkens to a dark brown or black and is provided with numerous elongate curved setae.

Populations of this ladybeetle are nearly always associated with infestations of the six-spotted mite, *Eotetranychus sexmaculatus* (Riley). For this reason, this mite was used as food during the life cycle study.

Table 3 gives a summary of the life cycle data accumulated for this species. Owing to their small size, several of the early instar larvae escaped from the petri dishes and were recorded as deaths. Otherwise, mortality due to handling was relatively low.

TABLE 3.—SUMMARY OF LIFE CYCLE OF *Stethorus utilis* Horn, IN THE LABORATORY AT 80°F., WHEN FED SIX-SPOTTED MITE, *Eotetranychus sexmaculatus* (Riley).

Stage	No. Individuals			No. Days to Develop			Percent Mortality per Stage
	Total	Died	Lived	Max.	Min.	Mean	
Egg	30	0	30	5	3	3.7	0.0
First Instar	30	4	26	3	1	1.8	13.3
Second Instar	26	3	23	3	1	1.4	11.5
Third Instar	23	1	22	3	1	1.6	4.3
Fourth Instar	22	4	18	6	1	2.8	18.2
Pupa	18	0	18	3	3	3.0	0.0
Total		12	18	23	10	14.3	40.0

This ladybeetle is the only native species reared to date which has an average life cycle of approximately two weeks. The two-week period recorded probably would be even less under natural conditions and in the presence of abundant food. Additional life-cycle studies are planned for the species, using the citrus red mite, *Metatetranychus citri* (McG.), as food.

Delphastus pusillus (LeC.)

Oeneis pusillus LeConte, 1852, Proc. Acad. Nat. Sci. Phila., Vol. VI, p. 135.

Adult beetles of this species are broadly ovate and about one-sixteenth of an inch in length. They are dark brown to black with the head, prosternum and venter of the abdomen somewhat lighter. The elongate translucent eggs are laid singly on their sides on leaves infested with the eggs, larvae and nymphs of whiteflies. Newly hatched and second instar larvae are an off-white and provided with numerous short pale setae. The third and particularly fourth instar larvae are provided with numerous small dark senti and setae which give the larvae a grey-banded appearance. Pupae are white to light grey with numerous pale setae.

Although this ladybeetle has been recorded feeding on several species of whitefly, the cloudy-winged whitefly, *Dialeurodes citrifolii* (Morg.), was used as food for the life cycle study because of its common occurrence.

Table 4 summarizes the life-cycle data accumulated for this species. Large mortalities due to handling occurred in the first instar larvae, but sufficient material was reared to obtain adequate data.

TABLE 4.—SUMMARY OF LIFE CYCLE OF *Delphastus pusillus* (LeC.), IN THE LABORATORY AT 80°F., WHEN FED CLOUDY-WINGED WHITEFLY, *Dialeurodes citrifolii* (Morg.), AND CITRUS WHITEFLY, *Dialeurodes citri* (Ashm.).

Stage	No. Individuals			No. Days to Develop			Percent Mortality per Stage
	Total	Died	Lived	Max.	Min.	Mean	
Egg	102	15	87	5	3	3.6	14.7
First Instar	87	59	28	4	1	2.3	67.8
Second Instar	28	4	24	3	1	2.0	14.3
Third Instar	24	2	22	3	1	1.9	8.3
Fourth Instar	22	3	19	10	3	5.5	13.6
Pupa	19	0	19	5	4	4.4	0.0
Total		83	19	30	13	19.7	81.4
Adult Longevity	15	15	0	47	1	26.7	

The 20-day life cycle obtained for this ladybeetle may be shorter with other species of whiteflies as food, but inadequate food sources have prevented additional study. Life-cycle studies on this predator will probably not be continued because of the minor importance of whiteflies on Florida citrus.