BIOLOGICAL NOTES ON ANAGYRUS ANTONINAE TIMBERLAKE (HYMENOPTERA-ENCYRTIDAE) AND ITS HOST ANTONINA GRAMINIS (MASKELL) (HOMOPTERA-COCCIDAE)

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The first record of the Rhodes grass scale, Antonina graminis, in the United States is November 17, 1942. Nick R. Diaz, Agronomist for the King Ranch and at that time with the United States Department of Agriculture, Nursery Division of the Soil Conservation Service, collected specimens from Rhodes grass near Kingsville, Texas. The specimens were identified by Dr. Harold Morrison of the Bureau of Entomology and Plant Quarantine. Dr. Morrison reported that this was the first record of the species from continental North America.

The Rhodes grass scale was first brought to the attention of the Texas Agricultural Experiment Station in November 1945. Dr. F. L. Thomas, then Chief, Division of Entomology of the Texas Agricultural Experiment Station, made surveys of the infested areas in December, 1945, and in July, 1948. Dr. Thomas concluded in his report of the surveys that, "The destruction of good stands of Rhodes grass in South Texas in less than three years where the grass is subjected to reasonable grazing or cutting for hay and infested with the scale shows without any doubt that the Rhodes grass scale Antonina graminis (Maskell) is a pest of major importance in Texas where grass is concerned." Quoting Robert J. Kleberg, President of the King Ranch, Dr. Thomas further reports: "Rhodes grass pastures formerly contributed good grazing for six to ten years after planting. Since 1940 there seems to have been a decided and rather abrupt change in the ability of Rhodes grass to survive more than three years". In his 1948 report Dr. Thomas observed one particular area of 50,000 acres where a good stand of Rhodes grass observed at the time of his 1945 survey, was at the time of his 1948 survey completely changed. In 1945 the scale had spread over a large portion of the area and considerable dead grass was present. By 1948 very few patches of Rhodes grass could be found in the area.

The following list of grasses, taken largely from Dr. Thomas' report, have been found infested with Antonina graminis. The grasses in this report were identified by Nick R. Diaz. The rec-
ord from sugar cane was furnished by Mr. W. K. Clore. A bunch of the cane growing in his yard at Harlingen, Texas, was killed by the attack of the scale.

Andropogon littoralis  
Andropogon saccharoides  
Bouteloua filiformis  
Bouteloua hirsuta  
Brachiaria ciliatissima  
Buchloe dactylon  
Cenchrus pauciflorus  
Chloris gayana  
Chloris ciliata  
Chloris cucullata  
Cynodon dactylon  
Digitaria decumbens  
Digitaria yunyoni  
Elyonurus triplusacoides  
Eragrostis secundiflora  

Panicum halli  
Paspalum plicatulum  
Paspalum solitarius  
Saccharum officinarum  
Setaria geniculata  
Setaria sp.  
Sorghum halepense  
Sorghum sp.  
Sorghum sp.  
Stenolophrum secundatum  
Trachypogon montufari  
Trichloris puriflora  
Triodia albescens  
Vaseyochloa multinervosa

Zimmerman (8) gives the following host from Hawaii: aerial roots of sugar cane

Chloris sp.  
Cynodon dactylon  
Panicum spectabile

Panicum torridum  
Panicum variegatum  
Paspalum sp.  
Pineapple roots.

Dr. Thomas made the following recommendation in his final report: “Because of the abundance of Rhodes grass scale in South Texas, the wide spread area which it covers, the large number of hosts attacked and the apparent lack of natural enemies, it is imperative that a complete research program in cooperation with the Bureau of Entomology and Plant Quarantine be initiated.”

The biological control work was started at the Texas Agricultural Experiment Station, Substation No. 15 at Weslaco, in January, 1949, where the following native parasites were reared from Johnson grass infested with the scale:

Encyrtidae
  Xanthoencyrtus sp. Determined by A. B. Gahan
Braconidae
  Orgitus getechiavorus Cush. Determined by C. F. W. Musebeck
Cynipidae
  Charips sp. Determined by L. H. Weld
Chalcidoidea
  Meromyzobia sp.
  Meromyzobia sp.
  Polynema logipes (Ash). All Determined by A. B. Gahan
Working with Mr. C. P. Clausen, in Charge of the Division of Foreign Parasite Introduction, Bureau of Entomology and Plant Quarantine, Dr. D. W. Clancy collected the parasite Anagyrus antoninae Timberlake in Hawaii for introduction into this area. The first shipment of parasitized scale was received on March 7, 1949. The parasites were reared out and introduced on Antonina graminis in the Insectary for multiplication.

A secondary or hyperparasite, Marietta graminicola Timb., was reared from the parasitized scale received from Hawaii.

The parasite Anagyrus antoninae was reared in the insecory on Antonina graminis infesting Johnson grass. Flats 18" x 18" x 6" with an 18" x 18" x 18" cage covered with 60 mesh per inch plastic screen were used for propagating the parasites. Johnson grass crowns infested with the scale were clipped to approximately three inch lengths and set in moist soil in the flats. The parasites were released in cages for oviposition. A few days before the new generation of parasites were due to emerge, the grass stems bearing the parasitized scales were placed in emergence boxes. These boxes were 6" x 6" x 15". The bottom and ends were constructed of ordinary 3/4" pine lumber. The top and two sides were covered with black cloth. The lid was hinged to one side with the cloth. A hole 1 1/2" in one end of the emergence box was fitted with a cork in which a hole was bored of sufficient size for the open end of a shell vial 23 x 83 mm. to fit snugly. As the parasites emerged and were attracted to the light in the vial they were removed and placed in extra large test tubes where they were fed a mixture of honey and water applied on a leaf in a hair streak.

In making detailed observations, a portion of a Johnson grass stem bearing Rhodes grass scale was placed in a shell vial with parent parasites for observation.

**Life History**

*Anagyrus antoninae* Timberlake

There is very little published information on *Anagyrus antoninae*. The species was described by P. H. Timberlake (2) in 1920 from Hawaii. He states that it was presumably introduced into Hawaii with the host years before from some part of the Orient. Zimmerman (3) lists *Anagyrus antoninae* under parasites of *Antonina graminis* with no comments.

**The Egg:** The egg is transparent when laid and oval in form, approximately .20 mm. in length (Figure A). The surface
is shiny and without sculpturing. As the egg is oviposited, it retains a portion of the ovariole pedicel of about one-half to one-third the length of the egg proper. It lies free among the egg mass of the host without any attachment to the body wall of the host. At room temperature in late spring and early summer the egg hatches in three to four days.

**The Larva:** The newly hatched larva is about .40 mm. in length when extended, white in color with distinct segmentation. (Figure B). After the larva has fed, the brownish content of the digestive tract gives the larva a darker color. Apparently most, if not all, of the feeding was on the eggs of the host. The fully developed larva is white in color with the reddish-brown content of the digestive tract showing in the central portion of the body. The larvae vary considerably in size with the average length of 1.75 mm. The width in proportion to the length increases as the larva develops. (Figure C). At this stage the usual holopneustic type of tracheal system is evident. The larva will continue to feed on the eggs of the host after the host is dead, if maturity is not reached before the death of the host.

**The Pupa:** When the pupae stage is first reached, it is pure white in color; the eyes show pigmentation first, followed by a general darkening of the body. The pupa is loosely inclosed in a thin, brown parchment-like membrane within the body of the host.

**The Adult:** Emergence is normally accomplished by cutting a circular hole in the posterior-dorsal end of the body of the host. Mating takes place within a short time after emergence. Oviposition may also take place shortly after emergence, at least within an hour. The female will oviposit irrespective of mating. When reproduction is parthenogenic, the progeny are exclusively males. Under laboratory conditions the normal ratio of females to males is about equal; however, in some instances, when placed immediately after emergence into cages with host, the number of male progeny was greater proportionally due to the lack of some females being fertilized.

**Oviposition:** The female makes a nervous examination of the prospective host by tapping with the antennae. Any live, gravid host apparently is satisfactory. If the individual host is found satisfactory, the female turns around and inserts the ovipositor. During the period of oviposition the wings are held in the normal position flat on the body with the antennae close
together and extended forward. Under laboratory conditions oviposition in the same individual may occur repeatedly. The female may leave the host and wander about a short time then return and oviposit again in the same host. The average number of eggs found in gravid females was 50. The minimum length of time elapsed from oviposition until emergence was 15 days under room temperature in summer, and the maximum time was 30 days at early spring temperatures. The average time was 18 to 19 days. Male individuals are the first to emerge.

Camera lucida drawings of immature stages of *Anagyrus antoninae*

*Timberlake*

A. Eggs as they are deposited in the host
B. Larvae immediately after hatching
C. Mature larva

**REFERENCES**