

# PRELIMINARY OBSERVATIONS ON AN INSECT OF THE COTTON STAINER GROUP NEW TO THE UNITED STATES<sup>1</sup>

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## INTRODUCTION

During the past year *Dysdercus obscuratus* Distant,<sup>2</sup> an insect of the cotton stainer group not hitherto recorded in the United States, has been found in a number of cotton fields in the lower Rio Grande Valley of Texas, as well as in cotton fields in Tamaulipas, Mexico, on the opposite side of the Rio Grande. Although no injury of note has as yet been observed which can be attributed to the attacks of this insect, several closely related species have long been recognized as very serious cotton pests in different parts of the world. It was therefore considered advisable to obtain as much preliminary information as possible concerning the life history and habits of this species.

## OBSERVATIONS ON DYSDERCUS OBSCURATUS AT BROWNSVILLE, TEX.

The first specimens of this species collected in the United States were found by the writer near Brownsville, Tex., in July, 1922. They were fairly numerous, and a note made at the time of collection stated that they "were common on grass and weeds near Brownsville." Although some were seen in cotton fields, they could be found more easily in a number of places quite distant from cotton, and the writer gained the impression that the species was mainly a nectar feeder. In June, 1923, H. C. Millender and F. F. Bibby, field inspectors for the Federal Horticultural Board, collected numerous specimens of the insect in cotton fields in the vicinity of Matamoros, Mexico. These collections first directed attention to the possible economic importance of the insect.

## PRESENT KNOWN RANGE OF THE SPECIES IN AMERICA

From information furnished by W. L. McAtee, this insect has previously been collected from Central America and Mexico, in the following localities: San Geronimo, San Juan, Guatemala; Cache, Costa Rica; Atoyac in Vera Cruz, Teapa in Tabasco, Mexico. In addition, T. E. Holloway and the writer collected specimens at Victoria, Tamaulipas, Mexico, in March, 1922, and the writer has recently (November, 1923) collected specimens from Tampico, Tamaulipas.

It may be remarked that specimens of three additional species of the cotton stainer genus have been collected by the writer in the Brownsville section, namely, *Dysdercus concinnus* Stal, *D. mimus*

<sup>1</sup> Received for publication Apr. 27, 1925; issued December, 1925.

<sup>2</sup> Determined by W. L. McAtee, of the Bureau of Biological Survey, U. S. Department of Agriculture.

Say, and *D. obliquus* H.-S., according to determinations made by McAtee. None of these species, however, has appeared in cotton fields.

#### DISTRIBUTION IN THE RIO GRANDE VALLEY

The species is known to occur over an area extending from the Gulf westerly to Donna, Tex., or a little more than 60 miles, and from the Mexican border north to Lyford, Tex., a distance of about 45 miles. The known area of distribution therefore contains several hundred square miles, and it is probable that this area will be considerably extended by careful scouting.

In general, it can be seen that the insect occurs, perhaps continuously, from Central America, and probably farther south, along the Gulf Coast of Mexico to the lower Rio Grande Valley of Texas.

#### MANNER OF SPREAD

Little is known regarding the manner in which the insect occupies new territory. The present indications are that it has been present in the Rio Grande Valley for an indefinite period, although not collected until recently. The adults are fairly strong fliers, and probably the area of infestation is extended mainly by flight. The young stages are gregarious and move in groups from plant to plant, but their progress is slow and extension in this way is relatively unimportant.

#### FOOD PLANTS

At Brownsville, Tex., the species has been found feeding in numbers upon at least four wild plants. These include (1) the plant which is apparently its natural host, *Sida carpinifolia* L., a member of the mallow family; (2) the common ragweed, *Ambrosia artemisiaefolia*; (3) wormwood, *Ambrosia elatior* L.; and (4) one of the sunflower family, *Verbesina encelioides* (Cav.) B. and H. Close observation of all these hosts has failed to reveal marked injury to flowers or seeds, and it appears that the feeding is mainly confined to sucking up the nectar produced by the plants. The writer has never been able, in the case of any plant, to find a definite injury to the living tissue which could be attributed to the attacks of the insects.

In addition, adults have been observed in considerable numbers in many localities upon cotton plants. At Donna and Mercedes, Tex., inspectors of the Federal Horticultural Board report having observed considerable numbers of the immature stages in the cotton fields, but always in decayed bolls. As will be shown later, the very young stages subsist chiefly upon decaying vegetable material, or, perhaps more correctly, upon the juices which they can extract from this material. Adults have been observed in small numbers within the blossoms of many different plants, evidently in search of nectar.

#### POSSIBLE ECONOMIC IMPORTANCE

Whether the insect is economically important has not yet been definitely determined, although numbers have been observed and collected in cotton fields. The most valuable field observation yet made was contributed by T. C. Richardson, of Lyford, Tex., for

several years agent of the Department of Agriculture for the county of Cameron, Tex. Mr. Richardson reported that during the cotton-growing season of 1923 a machine which he was using in his cotton fields for catching boll weevils picked up more of these cotton stainers than any other kind of insect. At the same time he harvested a crop of 22 bales of cotton from 25 acres of land and no perceptible staining of the lint was observed. This would indicate that no particular damage was inflicted upon the cotton, despite the numbers of the insect present, and it also tends to confirm the theory that the species feeds mainly upon the secretions of the nectary glands.

Although immature stages of the insect have been observed feeding within decaying cotton bolls on the plants, the adults have never been seen attacking a living boll, and no indications of injury have been observed upon the plants. The adults evidently rove at will, and gather in considerable numbers upon many different plants, especially upon those which, like the cotton plant, flower continuously. These insects seem to be essentially nectar-feeding. However, the fact should not be lost sight of that there are several closely related species which are important enemies of cotton.

The cotton-growing industry of the Rio Grande Valley is increasing rapidly, thousands of additional acres, mostly on freshly cleared land, being planted annually. The area maintaining the native host plants of the stainer is therefore being continually reduced. This is probably one of the main reasons for the sudden appearance of the insect in the cotton fields, vast numbers being forced to seek new food plants and new breeding territory. It is distinctly possible, therefore, that as this process is continued other host plants may be attacked. Since the genus in general has shown a marked preference for plants of the order Malvaceae, and since the natural host plants are being so largely displaced by the wholesale planting of cotton, it is reasonable to assume that the insects will be gradually driven into the cotton fields.

#### POSSIBILITY OF FUTURE SPREAD

With the information now available, the future advance of this insect can be only conjectural. The species has not yet been found beyond the limits of its main host plant, *Sida carpinifolia*. According to present information, its occurrence upon cotton and other plants of economic importance can be considered as more or less incidental to the wandering of the individuals in search of food. Unless the species should definitely transfer its breeding habits to other plants of economic importance, it now appears probable that its distribution will be mainly coincidental with the territory occupied by its principal host plant, but no definite prediction can be made.

#### STUDIES OF THE LIFE HISTORY OF THE INSECT

At the outset of work on the life history of the insect it was found difficult to rear the nymphs through the adult stage. After seven types of rearing cages had been tested and conditions gradually adapted to the requirements of the insects, much better results were obtained. Mating cages can now be stocked from the supply of insectary-reared adults. This could not be done when it was necessary to rely for breeding material on adults collected in the field.

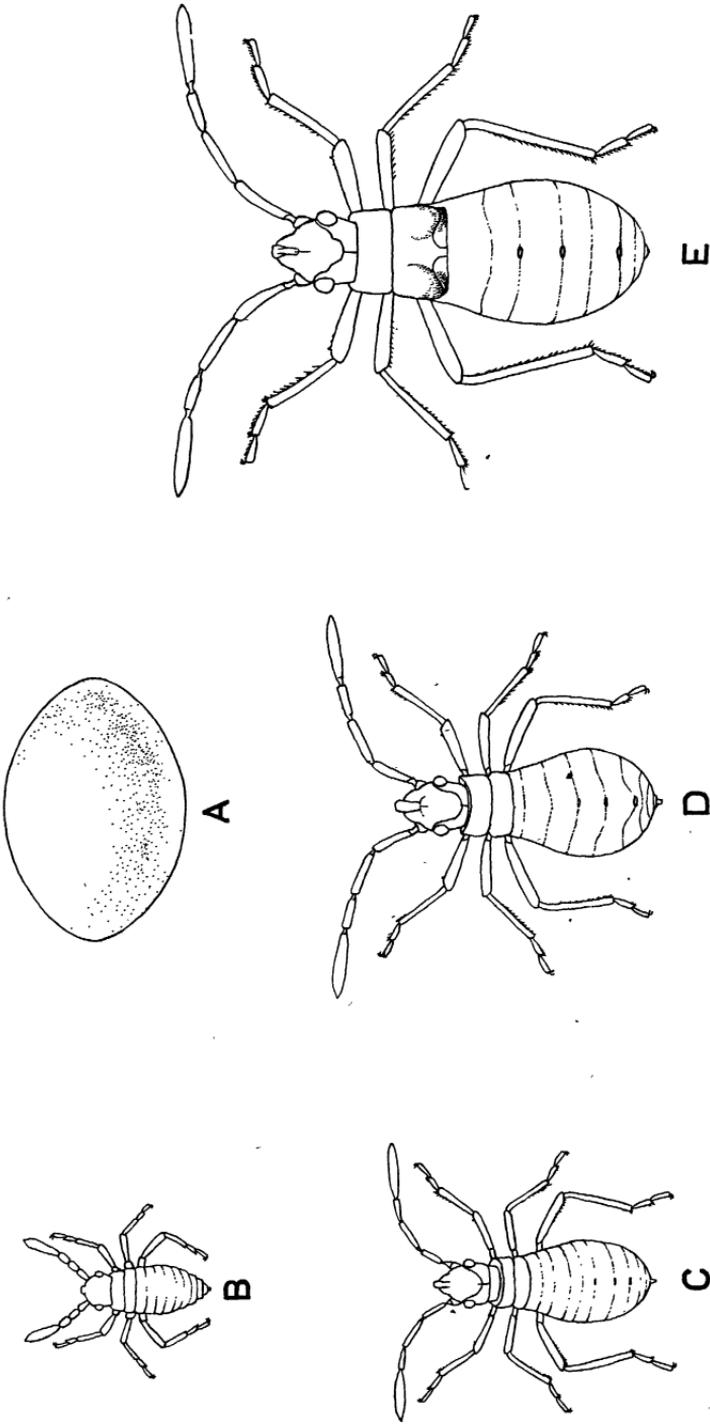


FIG. 1.—*Dysdercus obscuratus*: A, egg (25 times natural size); B, first-stage nymph; C, second-stage nymph; D, third-stage nymph; E, fourth-stage nymph (all drawings of nymphs 9 times natural size)

The type of rearing cage finally adopted consisted of large lantern globes, covered with cheesecloth on top, and with their bases inserted about 1 inch in soil in large trays. This soil was kept constantly moist. The host plants provided were planted in the soil and additional fruiting capsules were introduced into the cages when required for oviposition. This type of cage therefore provided a growing host plant, plenty of moist soil, and good ventilation through the cheesecloth cover. Moreover, in searching for eggs, the area of search was confined to the space covered by the base of the globe, or a circle about 4 inches in diameter, greatly simplifying the task of finding them.

All rearing was done on *Sida carpinifolia*, the native host plant of the insect, but present plans include a series of rearing tests on cotton.

#### NUMBER OF STAGES

It has been found that there are seven stages in the development of the insect. These include the egg, five nymphal stages, and the adult stage.

#### THE EGG

The eggs look very much like microscopic hens' eggs (fig. 1, A), being of about the same shape and similar in general proportions. They are about one twenty-fifth of an inch in length, and their greatest width, which is not exactly at the center of the egg, but slightly toward one end, is about two-thirds the length. When first deposited, the eggs are shiny, pearly-white, and semitransparent. As the incubation progresses they gradually turn a faint pink, and at the time of hatching are a light pinkish brown.

#### DURATION OF THE EGG STAGE

Up to the present 26 more or less exact incubation records have been obtained in the cages. It is difficult to make the incubation records with perfect accuracy owing to the female's habit of placing the egg under the surface of the ground, which sometimes results in the egg being overlooked until the second day. This probably occurred in two cases of the 26 considered, since one record of three days and one of four appeared too short in comparison with the average incubation period observed.

The 26 incubation records gave an average incubation period of 7.85 days. It should be taken into consideration, however, that life-history observations were not begun until after midsummer, and that a large proportion of these records were not secured until after cooler weather had arrived. In July and August, 5 records of 5 days each were obtained, as well as the two shorter records mentioned above. In September and October, 6 records of 6 days each were obtained, as well as 4 of 7 days, and several records of longer periods. On the other hand, in November and December the shortest incubation period recorded was 12 days, and the longest 17 days. Evidently the incubation period is about 5 days in midsummer and lengthens very considerably as the weather becomes cooler.

## FIRST-STAGE NYMPH

The nymphs of the first stage are of about the same color as the nearly hatched eggs, a very light brown, with a pinkish tinge. They are a little larger than the eggs and slightly more elongate, and the legs and antennae are threadlike and colorless (fig. 1, B). It may be remarked that the head of the embryo nymph develops within the long-pointed end of the egg, and that the general contour of the body after hatching much resembles the shape of the egg. This stage is spent entirely underground, the nymph evidently feeding upon the supply of decaying food usually provided by the adult female at the time of oviposition.

## DURATION OF THE FIRST STAGE

Twenty-one records of the duration of the first stage have been secured in the insectary. These cover a total of 132 days and give an average period of 6.29 days for this stage. As was the case with the incubation records, however, as well as with all subsequent records to be considered, cool weather undoubtedly resulted in the prolongation of many of them, so that the average secured is probably rather longer than the correct annual average. Since 8 records of 3 days were secured during the warm months of August, September, and early October, as well as 4 additional records of 4 days each, it seems evident that the midsummer period of the first stage is about 3 days. The longest record obtained was 19 days, from December 10 to December 29, 1923, but only 3 additional records were secured, each of 10 days or more.

## SECOND-STAGE NYMPH

The nymphs of the second stage are about twice the size of those of the first stage. After the first molt the light color of the first stage is lost, and the nymphs of the second stage emerge bright red in color, slightly paler on the abdominal surface. The general shape of the insect can now be plainly distinguished, since it has attained a length of about one-eighth of an inch (fig. 1, C). The legs and antennae are now much longer and stronger, and in this stage the nymph is very active, being able to run about rapidly. Second-stage nymphs are sometimes, though rarely, seen above the surface of the ground, but usually, as in the case of the first stage, this stage is spent below the surface.

## DURATION OF THE SECOND STAGE

Thirteen records of the second-stage nymphs have been secured, occupying a total of 109 days, thus giving an average period of 8.39 days. Four days are evidently the average midsummer duration of this stage, since four records of this length were secured in the warmer weather. The longest record covered 18 days, from December 11 to December 29, 1923.

## THIRD-STAGE NYMPH

In the third stage the insect is about twice as large as in the second stage, and resembles it closely except in size (fig. 1, D). The color is still an even, bright red, but the head, thorax, and abdomen can now be seen to be divided by very faint whitish lines. This stage

is also very active and is usually the smallest stage to be found upon the plants under field conditions. The nymphs of the third stage, as well as the few nymphs of the second stage which have been observed above the ground, have a habit of dropping to the ground when the plant is disturbed and quickly hiding themselves in crevices in the soil. For this reason it is very difficult to collect them in numbers.

#### DURATION OF THE THIRD STAGE

Nine records of the third stage have been obtained, the period varying from 4 to 18 days. The total time covered by the nine records was 85 days, giving an average period of 9.44 days.

#### FOURTH-STAGE NYMPH

The nymph of the fourth stage is decidedly larger than that of the third, the insect now having attained a length of slightly more than one-fourth of an inch, exclusive of the antennae, which are about half as long as the body (fig. 1, E). Although the general color of the body is still bright red, the segmentation is now distinctly marked by delicate white lines on the dorsal surface. The abdominal surface is much paler than the dorsal, and the segments are joined by bright red lines. The wing pads now appear for the first time as two heavy black spots at the rear end of the thorax, and the legs and antennae are almost black. The nymphs of this stage are rather numerous in the field and can be collected without difficulty, since they are not nearly so shy as those of the third stage.

#### DURATION OF THE FOURTH STAGE

Eleven records of the fourth stage cover a total of 110 days, and give a general average period of 10 days. These periods range from 4 to 19 days. Evidently the midsummer average period is about 4 or 5 days for this stage.

#### FIFTH-STAGE NYMPH

In the fifth stage the sexes differ considerably; so much so that at first they were thought to be two separate stages. The female nymph of the fifth stage is considerably larger than the male nymph of the same stage owing to the much larger abdomen, which makes the wing pads appear proportionately shorter. The fifth-stage male nymph resembles the adult much more closely than does the female, since the abdomen is not so large and the wing pads therefore lie flat along the back, appearing to be longer in proportion to the size of the abdomen (fig. 2, A).

The length of the body in the fifth stage averages about three-eighths of an inch, exclusive of the antennae. The wing pads are now about twice as large as they were in the fourth stage. The general coloration is much the same as before except that the segments of the body are very distinct, the dividing lines having become much more prominent.

## DURATION OF THE FIFTH STAGE

All of the preceding records of the insect, from the incubation of the egg to the fourth-stage nymph, have been based upon mass observations, all the individuals present in one cage being utilized

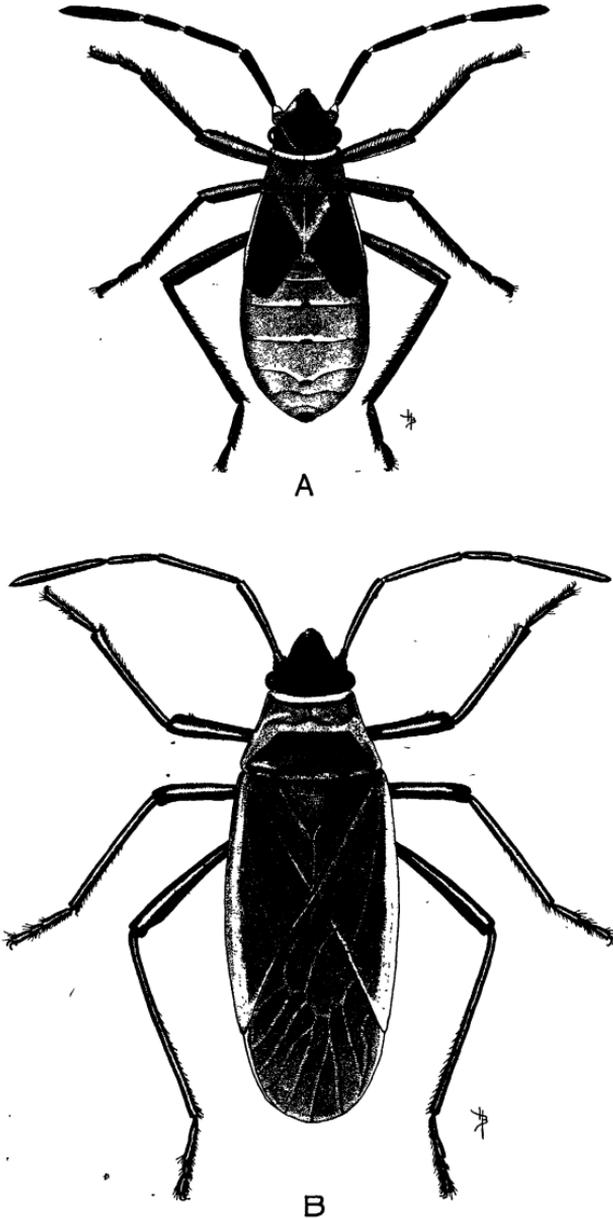


Fig. 2.—*Dysdercus obscuratus*. A, Fifth-stage nymph; B, adult.  $\times 6$

to make one record. A single record is therefore based upon the development of possibly a considerable number of individuals. In the case of the fifth-stage nymph, however, the number of specimens which were carried successfully through their entire life history, from

egg to adult, was only 31. These 31 records are therefore considered individually.

The total length of time occupied by these 31 fifth-stage records was 564 days, giving an individual average of 18.2 days each. The individual variation was from 10 to 29 days. Since, however, the first adult reared from the egg in the cages appeared on October 7, 1923, and all of the remainder were reared during the months of October, November, and December, 1923, it is evident that their life-history periods were longer than they would have been during the hotter months of midsummer.

#### TOTAL PERIOD OF DEVELOPMENT

From the data presented it is apparent that great variation exists between the total length of time required for development during the months of midsummer and those of fall and winter when the periods of development are considerably extended because of lower temperatures. Table I shows this more clearly, and presents the information in a more concise form.

TABLE I.—*Developmental periods of Dysdercus obscuratus at different seasons*

Stage	Midsummer period	Fall period	Winter period	Total number of records	Total number of days	Average period of development
	Days	Days	Days			Days
Incubation.....	5	8	12 to 17	26		7.85
First stage.....	3	5	10 to 13	21	132	6.29
Second stage.....	4	6	11 to 13	13	109	8.39
Third stage.....	5	9	15 to 18	9	85	9.44
Fourth stage.....	5	7	15 to 19	11	110	10.06
Fifth stage.....	10	20	24 to 28	31	564	18.20
Total development.....	32	55	87 to 108	111	1,000	60.17

#### THE ADULT

The adults are brightly colored, slightly more than one-half inch in length, the antennae adding to this about three-eighths of an inch (fig. 2, B). The head is coral red, with a narrow white band between the head and thorax. The thorax contains a transverse band of coral red, followed by a narrow yellow band, with a transverse black ridge at the base of the wings. The predominating colors of the wings are black and yellow, with faint white margins. The coloration of the wings varies considerably, irrespective of sex, some adults having much more yellow than black, others having nearly black wings with little yellow showing. The legs and antennae are orange at the base, with black extremities. The abdomen is bright red dorsally, with white lines between the segments. Ventrally the abdomen is white with a bluish tinge, and has bright red lines between the segments.

It is rather difficult to distinguish the sexes from each other. Usually the female is slightly larger than the male, and the abdomen is larger and stouter. The most easily distinguished sexual character is the wider red bands across the ventral surface of the abdomen of the male, particularly the last three segments.

## LONGEVITY OF THE ADULT

Only eight complete longevity records have been secured from observations in the mating cages, four of these being for females and four for males. The four females lived a total of 199 days, giving an average female longevity of 49.8 days. The four males lived a total of 193 days, giving an average male longevity of 48.25 days. The maximum individual longevity of the females was 55 days; the maximum male longevity 73 days. Although little difference between the longevity of the sexes is shown above, there are indications that on an average the females are longer-lived than the males. The survival of 37 field-collected females in the mating cages gave an average survival of 10.92 days from the date of collection. Thirty-six males lived an average of 9 days. Of course no data were available showing the ages of these adults at the time of collection.

## HABITS OF THE SPECIES

The adults are gregarious, not only in regard to each other but also in regard to the larger stages of the immature forms. They are commonly found in groups on the plants from which they derive their nourishment, the groups including both sexes of the adult and frequently considerable numbers of nymphs of the third, fourth, and fifth stages; sometimes, but very rarely, nymphs of the second stage. These groups move about from plant to plant, keeping more or less together, the extent of their movements apparently being controlled by the quantity of food which they are able to find. Frequently great numbers of the insects concentrate upon a certain group of plants which are evidently supplied with large quantities of the sought-for juices, and possibly hundreds of the insects will be found upon the plants for several days, after which, having apparently exhausted the food supply, they migrate to other plants in the neighborhood. The plants which have been "worked over" do not appear to be damaged to any appreciable extent by the wholesale visitation, although stalks have several times been observed so weighted with the insects that they have been bent nearly to the ground.

Mating appears to occur at any time after the adults have reached the age of 2 days. The eggs are generally deposited under the surface of the ground, a dead leaf or fruiting capsule of the host plant usually being buried with them for food for the nymphs after hatching. When no leaf or fallen capsule is available, the females sometimes oviposit in the soil immediately around the stem of the host plant where it emerges from the ground. Occasionally a simple groove in the ground is used for oviposition. Eggs may occur singly or in clusters of from 2 to 25 or 30, adhering together very slightly, although easily separable without damage. The act of oviposition has been observed on two or three occasions. When a suitable capsule had been selected, the female would deposit two or three eggs, then carefully cover them with soil, pulling the particles over them with her feet. More eggs would then be deposited and covered in their turn, until finally the entire capsule would be buried under the surface. These observations were all made under insectary conditions, since

the closest search has as yet failed to disclose eggs in the field under natural conditions.

From the manner of oviposition, it is very difficult to determine the exact number of eggs deposited. Although a considerable number of eggs were secured in cages containing no soil, there did not appear to be as many per female as there should have been, and it is probable that oviposition was curtailed by unnatural conditions. The greatest number of eggs definitely counted from two females was 107, laid on two consecutive nights (56 eggs on the night of July 26-27 and 51 eggs on the night of July 27-28). No eggs were subsequently deposited, so that the eggs, in this case, averaged 53.5 per female. Usually, however, only about 15 to 30 eggs were obtained from each female in this type of cage. It has not been possible to make definite counts of eggs deposited underground in the cages containing soil.

#### SUMMARY

During the past year *Dysdercus obscuratus* Distant, an insect of the cotton stainer group new to the United States, has been found in cotton fields in Texas.

The insect occurs, perhaps continuously, from Central America, and probably farther south, along the Gulf Coast of Mexico to the lower Rio Grande Valley of Texas.

Probably the area of infestation is extended mainly by flight.

At Brownsville, Tex., the species feeds upon four wild plants, *Sida carpinifolia* L., the common ragweed (*Ambrosia artemisiaefolia*), wormwood (*Ambrosia elatior* L.), and *Verbesina encelioides* (Cav.) B. and H.

Whether the insect is economically important has not been definitely determined.

The eggs are deposited in clusters, usually under the surface of the ground. The incubation period is about five days in midsummer.

The nymph has five stages. The duration of each stage varies with the time of year in which it occurs.

In the lower Rio Grande Valley the average period of development from egg deposition to the appearance of the adult insect was found to average 32 days in midsummer, 55 days in the fall, and to range from 87 to 108 days in the winter.

Male adults in cages were found to live an average of 48.25 days; females in cages lived an average of 49.8 days.

The adults and larger instars of the nymph stage are gregarious, being found commonly in groups on the plants from which they derive nourishment. These groups move about from plant to plant. Frequently great numbers of insects will concentrate upon a certain group of plants and remain there for several days.

