DAMAGE TO SEA ISLAND COTTON BY THE WEST INDIAN BLISTER MITE (*ERIOPHYES GOSSYPII* BANKS[1]) IN PUERTO RICO

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In Puerto Rico the West Indian blister mite constitutes one of the major cotton pests. In 1936 a few fields were completely destroyed and many others were severely damaged as a result of the attack of this mite. Damage was found to be most severe in fields in which the attack began on the young growing plants. In such cases the development of fruiting forms may be entirely prevented.

Serious damage to cotton by this pest has been reported from several widely separated areas. In India Thakar and Desai (1) report that this mite was first recorded in the year 1900, as a pest of cotton at Surat, the damage being as much as 50 per cent, and that since that date it has caused serious injury to cotton almost annually. In the West Indies Ballou (2) reports that this mite first occurred as a cotton pest in 1903, in Montserrat, and that soon afterwards it was found attacking wild and cultivated cotton in all the other islands of the Leeward and Windward groups and appeared in Barbados in 1912. During a visit to the Virgin Islands in 1931, U. C. Loftin was informed by former cotton growers that the blister mite had been known as a cotton pest for many years and was one of the principal "diseases" against which the ordinance passed by the Colonial Council of St. Croix in 1911 regulating the dates of planting and cleaning of fields was directed. The date of its first occurrence as a cotton pest in Puerto Rico is unknown but its presence was established in 1920 when Quarantine No. 47 of the United States Federal Horticultural Board against this mite was promulgated. According to Rainwater (3), "This cotton pest was not known to occur in the United States prior to June 1932, when U. C. Loftin collected it from wild cotton at Key Largo, and from dooryard plantings of Sea Island cotton in Key West." It is not known to occur in any section of the United States except southern Florida.

[1] Order Acarina, family Eriophydae. Determined by H. E. Ewing.

[2] In cooperation with the Puerto Rico Experiment Station of the United States Department of Agriculture.

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In Puerto Rico the West Indian blister mite was found during 1935 and 1936 in all cotton-growing districts along the northern coast. In November 1936, late in the season, every field in this region was found heavily infested. In addition, a light infestation

FIG. 1.—Young cotton plant showing characteristic injury by the West Indian blister mite (*Eriophyes gossypii* Banks). Lack of fruiting branches and forms, distorted and crumpled leaves, and distorted growth are very noticeable. Plant height, 16 inches. Isabela, P. R., May 16, 1936.

was found on cultivated cotton at Boquerón on the southern coast. In May 1936 wild cotton trees at Corozal, San Juan, and Naranjito were found heavily infested.

Nature of Injury.—Characteristic injury to cotton as a result of the feeding habits of the West Indian blister mite is shown in figure 1. This mite attacks all parts of the cotton plant except the roots. The invasion begins on the young fruiting buds which are located in the axils of the leaves. The external indication of attack is a distorted or crumpled appearance of the affected parts, which have a growth of fine, short, white hair. An extensive proliferation of hair, especially on the lower surface of the leaf, is also noted. On the leaves the mites are mostly found on the lower surface, sucking the plant juices from the outside, causing a chlorosis of the tissues on the upper and lower epidermis. The palisade cells of the affected leaves fail to develop their normal length, being about one-third the length of palisade cells not affected by gall formation. The small white blisters are evidently caused by the irritation set up by these mites and result in hypertrophy of the affected part. The most noticeable injuries to heavily infested plants are the crumpled leaves, distorted growth, and lack of fruiting branches and forms. The mites no doubt destroy the buds of these branches and forms, preventing their development. Later on small leaves develop where the fruiting branches normally form, and as a result many small leaves with short petioles are borne along the main stem. Severely affected squares do not open into normal flowers because the petals become so tightly bound together by overgrowth that they can not separate from one another. Abnormal shedding of the squares or young bolls was not noted as a result of mite attack.

Extent of injury.—In order to show the extent of injury caused to cotton plants by this pest, counts were made of the number of fruiting branches, squares, bolls, and blooms and the plant height on plants in each of three different groups. Since the infestation was very uneven and adjacent plants in the same row were affected to different degrees, plants were selected at random and divided into three groups according to the degree of infestation, namely, none or light, medium, and heavy. Counts of this nature were made on two different occasions, April 20 and May 6. The field contained about 3 acres. The distance between plants and number of plants per hill varied considerably but the sandy soil appeared to be uniform.

The results of counts made on the above-mentioned plots to determine the amount of damage to Sea Island cotton by this pest are shown in table 1. It will be noted that the number of fruiting

branches, squares, bolls, and blooms, and plant height varied inversely as the degree of infestation. Large differences in the number of fruiting branches, squares, bolls, and blooms per plant were especially noted between the heavily and lightly or noninfested plants. On April 20 the differences between the average number of fruiting branches and forms per plant on the heavily and the lightly or noninfested plants were as follows: Fruiting branches 7.81, squares 9.33, bolls 1.54, and blooms 0.25. The average difference in plant height on this date was 5.85 inches. The average number of fruiting branches and forms per plant on the medium infested plants was about one-half the number found on the lightly or noninfested plants. At this time, 100 plants were examined in each group.

On May 6 the differences between the average number of fruiting branches and forms per plant on the heavily and lightly or noninfested plants were as follows: Fruiting branches 6.98, squares 9.15, bolls 4.39, and blooms 0.44. The average difference in plant height was 5.44 inches. On this date the difference between the average number of bolls per plant on the heavily and lightly or noninfested plants had decidedly increased over that of the examination made on April 20. However, the average number of fruiting branches and forms per plant on the medium infested plants on this date was only slightly less than on the lightly or noninfested plants.

In order further to confirm the foregoing observations, similar counts were made in two adjacent fields. A plot of 100 plants was staked off in each field. The number of fruiting branches, squares, and bolls, and the plant height in each of these plots were recorded bimonthly from April 15 to July 10, 1936. At the beginning of these observations the infestation on one plot was heavy while on the other plot it was light. However, the infestation gradually increased in the latter plot, and by July 10 became rather heavy. Therefore the counts were discontinued on that date. Other than the difference in the degree of infestation of this mite on the two plots, all other factors appeared to be uniform. The results of these examinations are shown in table 2 and graphically illustrated in figures 2 and 3. It will be noted that large differences were found in the number of fruiting branches, squares, and bolls on the lightly and heavily infested plots. As shown in figure 2, the difference in the number of fruiting branches between these two plots progressively increased at each consecutive bimonthly examination. The average difference per plant between the number of fruiting branches on

TABLE 1.—RESULTS OF EXAMINATION TO DETERMINE DAMAGE CAUSED BY THE WEST INDIAN BLISTER MITE (*ERIOPHYES GOSSYPII*) TO SEA ISLAND COTTON, ISABELA, P. R., 1936

Degree of infestation	Average number of fruiting branches on—		Average number of squares on—		Average number of bolls on—		Average number of blooms on—		Average plant height (inches) on—		Number of plants examined on—	
	April 20	May 6	April 20	May 6	April 20	May 6	April 20	May 6	April 20	May 6	April 20	May 6
None or light	9.00	10.19	10.62	11.60	1.54	5.40	0.28	0.50	16.23	18.29	100	52
Medium	5.44	9.29	7.45	11.07	.14	3.21	.09	.48	13.45	18.06	100	75
Heavy	1.19	3.21	1.29	2.54	.00	1.01	.03	.06	10 38	12.85	100	100

the lightly and heavily infested plots was 3.12 and ranged from 1.69 on April 15 to 5.27 on June 24. All fruiting branches were counted on each plot whether it was bearing fruiting forms or not. If only the fruiting branches bearing forms had been counted on each plot, these differences would have been much greater.

TABLE 2.—RESULTS OF EXPERIMENT TO DETERMINE DAMAGE CAUSED BY THE WEST INDIAN BLISTER MITE (ERIOPHYES GOSSYPII) TO SEA ISLAND COTTON, ISABELA, P. R., 1936

Date examined	Average number [1] of fruiting branches on—		Average number [1] of squares on—		Average number [1] of bolls on—		Average plant height (inches)	
	Lightly infested plot	Heavily infested plot	Lightly infested plot	Heavily infested plot	Lightly infested plot	Heavily infested plot	Lightly infested plot	Heavily infested plot
April 15	4.33	2.64	5.83	3.53	0.09	0.01	9.72	9.72
May 6	6.74	4.30	5.96	4.15	3.01	1.36	14.32	13.65
May 19	8.15	5.46	4.76	2.89	5.12	2.03	17.39	15.53
June 8	10.38	6.86	5.75	1.82	6.73	2.37	22.68	21.44
June 24	12.74	7.47	5.93	4.87	7.50	2.45	26.27	24.04
July 10	.....	.....	4.80	7.40	10.50	3.19	.....	.....
Average	8.47	5.35	5.51	4.11	5.51	1.90	18.08	16.88

[1] 100 plants examined.

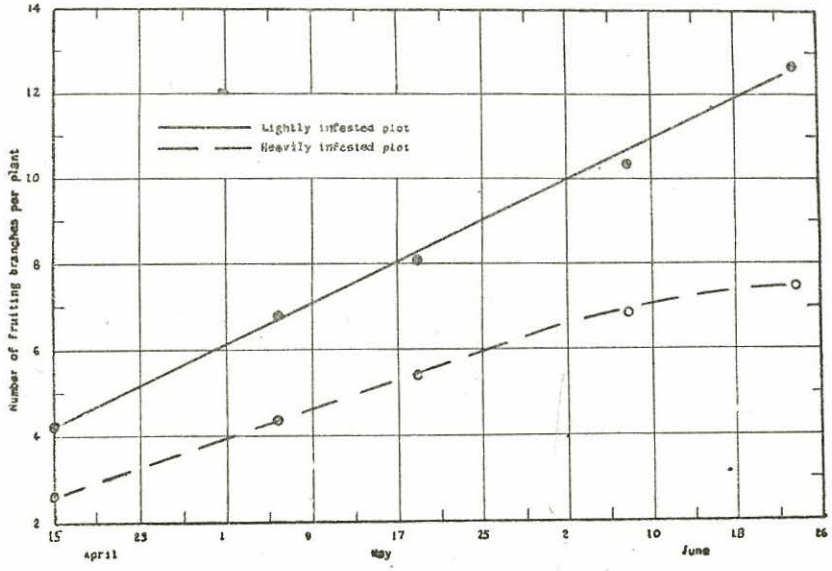

FIG. 2.—Average number of fruiting branches per plant on two plots, each plot containing 100 cotton plants with light and heavy infestation of the West Indian blister mite (*Eriophyes gossypii*) on each plot, Isabela, P. R., 1936.

Since these plots were also infested with the pink bollworm (*Pectinophora gossypiella* Saund.), the amount of seed cotton produced on each plot could not be used as a basis to estimate the damage caused by the West Indian blister mite. Therefore the best criterion was the number of bolls produced on each plot, since the pink bollworm causes but little if any shedding of the fruiting forms. As shown in figure 3, the difference in the number of bolls between the lightly and heavily infested plots also progressively increased at each consecutive bimonthly examination. The average difference per plant between the number of bolls in the lightly and heavily infested plots was 3.61 and ranged from 0.08 on April 15 to 7.31 on July 10.

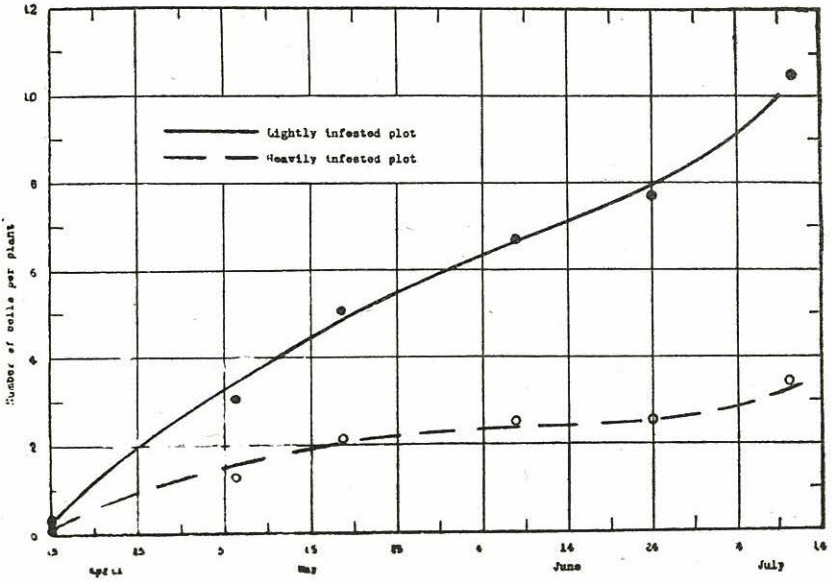

FIG. 3.—Average number of bolls per plant on two plots, each plot containing 100 cotton plants with light and heavy infestation of the West Indian blister mite (*Eriophyes gossypii*) on each plot, Isabela, P. R., 1936.

The average ratio of the number of squares on the two plots was 1 : 1.3+. The number of squares on the lightly infested plot was greater than on the heavily infested plot from April 15 to July 1, while the examination on July 10 showed the reverse to be true.

There is no doubt that the mites on the lightly infested plot caused considerable injury and consequently there was less difference in the number of fruiting branches and forms between these two

plots than would have been found if this plot had not become infested.

Carry-over and control.—So far as is known, cotton is the only host plant of the West Indian blister mite. In Puerto Rico cotton grows throughout the year and usually green plants that have not been destroyed or that have put out volunteer growth are present around the fields. Observations indicate that there is no hibernation period and that the mites continue to develop on these plants and spread to new plantings. In a field of young cotton at Isabela, on April 15, 1936, a heavy mite infestation was observed which had evidently spread from the new growth on old stalks in an adjacent field. These factors indicate that thorough cleaning of old fields and strict enforcement of a closed season when no green cotton is present would be an effective means of control. Wilson (4) has stated that a closed season of from 2 to 4 weeks is sufficient if properly enforced.

Blister mites of the genus Eriophyes on other malvaceous plants.—Blister mites of the genus *Eriophyes*[1] were found attacking two different species of malvaceous plants, namely, *Bastardia viscosa* and *Malachra capitata*. Since the blisters formed by these mites were quite similar to those made by the West Indian blister mite (*Eriophyes gossypii* Banks), it was deemed important to determine if these species were the same and would attack cultivated cotton. Twenty-four cotton plants, bearing mature green bolls, were divided into three lots containing eight plants in each. Leaves of *Bastardia viscosa* and *Malachra capitata* (*Malva*) and cotton (*Gossypium* sp.), heavily infested with mites of the genus *Eriophyes*, were fastened paper clips on the leaves of normal cotton plants. Only the transfers from cotton to cotton were successful, all the plants of this group becoming infested. This experiment was repeated with six young cotton plants, 10 inches in height, in each group. Again all the transfers from cotton to cotton were successful, and only these. These results show that the mites of the genus *Eriophyes* found on *Bastardia viscosa* and *Malachra capitata* in Puerto Rico will not attack cultivated cotton.

[1] Determined by H. E. Ewing of the Bureau of Entomology and Plant Quarantine.

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