FEEDING HABITS OF THE BOLL WEEVIL ON PLANTS OTHER THAN COTTON

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In the course of the investigations on the biology of Anthonomus grandis at Victoria, Tex., during the summer of 1913, under the direction of Mr. W. D. Hunter, the writer was able to conduct a number of experiments on the possibility of the boll weevil's breeding in some of the native malvaceous plants. Since the results secured differ with the plants, they are grouped under the various species of plants tested.

The nutritive value of these plants is best shown by a comparison of the longevity of boll weevils fed upon them and the length of life of specimens fed upon cotton and also those kept without food. For this reason the following summary taken from experiments conducted at the same time is given. Forty boll weevils placed on moist sand immediately after emergence and left without food gave a maximum longevity of 6 days, the average for the two sexes being 3.3 days. A number of boll weevils fed only on cotton bolls gave a maximum longevity of 32 days and an average of 17.2 days. Those fed only on cotton leaves had a maximum life of 45 days and an average of 12 days. Of course, the boll weevils fed on cotton squares lived longer than any others. Their maximum life period was 74 days, the average being 40 days.

FEEDING EXPERIMENTS WITH SPHAERALCEA LINDHEIMERI

Sphaeralcea lindheimeri Gray is found in small groups on some of the sandy areas near Victoria, though it is comparatively rare. This is evidently the northern part of its range. It is a low-growing, crown-branching plant, and is extremely tomentose throughout. The petals in the buds are very loosely packed and are tightly covered by a heavy, woolly calyx. The buds are very poorly adapted either for the feeding or breeding of boll weevils.

Early in the season six hibernated individuals were collected from cotton in the field and placed with buds, blooms, and fruit of Sphaeralcea lindheimeri. These boll weevils fed quite readily, but deposited no eggs. In 22 daily examinations failure to feed was noticed on 5 days. The feeding was never very extensive and was usually confined to the corolla. The life of these boll weevils after being placed on Sphaeralcea was rather short, especially when the amount of feeding is considered. The maximum longevity was 15 days, and the average of both sexes was 8.5 days. It is quite probable that the boll weevils would have been able to live almost as long without any food whatever. The average life of a number of boll weevils collected in the field about the same time and fed on cotton squares was 46.2 days.

Later in the season another experiment was conducted in which boll weevils that had just emerged from cotton squares were placed with the buds, blooms, and fruit of Sphaeralcea lindheimeri. There was more
or less feeding in this series almost every day, but it was practically con-

fined to the blooms only.

Twenty boll weevils, ten of each sex, were used in this series, and their

longevity was quite regular, ranging from 2 to 8 days, with an average

of 4.2 days. This is not quite 1 day above the average for unfed boll

weevils; consequently the nourishing power of the plant was not very

high. In fact, it is quite doubtful whether the feeding in either series

prolonged the life of the boll weevils in the least.

It is hardly probable that the boll weevil will be able to breed in the

buds of this plant. The extremely heavy, woolly calyx renders oppo-

sition very difficult, and the contents of a bud are not likely to be suf-

ficient to nourish a boll-weevil larva to pupation.

FEEDING EXPERIMENTS WITH CALLIRRHOE INVOLUCRATA

Callirrhoe involucrata Gray is quite common in many parts of Victoria

County. In fact, it is the most abundant species of the plants studied

during the summer of 1913. Since this plant blooms in the early spring

and stops about the first week in June, it was impossible to conduct more

than one series of experiments with it as food. Fourteen hibernated

boll weevils collected from cotton in the field early in the spring were

used. Practically all these boll weevils fed freely on the buds and blooms.

Owing to the fact that more boll weevils were introduced later in some

of the series, very little accurate information can be given regarding

their longevity. The maximum certain longevity was 20 days.

A number of boll weevils were observed in copulation in this series.

Two females deposited eggs, one laying two and the other three. These

five eggs were placed in four buds. The buds were then placed

on moist sand and tested for emergence of adults. Since none emerged,

the buds were opened and examined. Three showed no signs of larval

work, but one showed that a larva had lived long enough to consume fully

one-half of the inner tissue of the bud.

FEEDING EXPERIMENTS WITH CALLIRRHOE PEDITA

Callirrhoe pedata Gray is much like the preceding species, but is erect

in growth instead of procumbent. It is comparatively rare near Vic-

toria. Rather thorough tests were made of this plant as a food plant for

boll weevils. Early in the spring eight hibernated individuals were col-

lected in the field and placed on it. These weevils fed freely on the buds

and blooms, but deposited no eggs.

In this series the maximum longevity after collection was 26 days, and

the average, 12.1 days. This is considerably above the record of the

field-collected boll weevils fed on Sphaeralcea, but is still far short of the

longevity of the boll weevils fed on cotton squares.

Later in the season 24 boll weevils which emerged from cotton squares

were placed with the buds and blooms of Callirrhoe pedata as food. The

longevity record of this series is rather surprising. With the exception

of one boll weevil, which lived for 21 days and ate regularly every day,

the maximum longevity was 6 days, and the average was about as low

as that for unfed boll weevils. In the case of the one exception the sus-

taining value of the plant is shown clearly, but for some reason the remain-

ing 23 boll weevils were not so well adapted to the food, though they ate

heartily during the few days they lived. Including the boll weevil which
lived for 21 days, the average longevity was 4.4 days. In this series no eggs were deposited.

This species of mallow probably ranks about the same as *Callirrhoe involucrata* as a host plant for the boll weevil. The buds are smaller, and consequently the chance of breeding is very slight. Both the buds and blooms seem to be of some nutritive value for the boll weevil.

**FEEDING EXPERIMENTS WITH HIBISCUS SYRIACUS**

*Hibiscus syriacus* L. is a large, woody perennial, commonly called "white althea." Quite a number of the plants were found growing in lawns and cemeteries throughout Victoria. Several cultural varieties are found, the chief differences being in the color and form of the bloom. The color varies from pure white, through pink to blue and purple. The most important difference, however, is in the arrangement of the stamens and petals. The latter vary from a single row to a great number very irregularly arranged.

The buds are covered with the tough pilose calyx until they begin to open. Superficially a section cut through a bud shows the interior tissues to be much the same as in cotton squares. There is the same arrangement of the petals and immature anthers.

The foliage is very tough, being so different from the tender, succulent foliage of cotton that the boll weevil could not be expected to feed upon it.

Attention was first attracted to *Hibiscus syriacus* by the fact that on June 16 the writer found a boll weevil feeding on the anthers of a bloom at Victoria. The plant was a large one in the rear of the laboratory and stood about 30 feet from a small patch of cotton which was rather heavily infested with boll weevils. When found, the boll weevil was busily eating the pollen of the bloom and had destroyed almost all of the anthers.

Since this was the first record of the species being found feeding on any plant except cotton and Thurberia (Arizona wild cotton), it was considered advisable to make thorough tests of the longevity of the boll weevil on *H. syriacus*, and also to determine whether they would breed in the buds. The experiments with this aim may be divided into three series, according to the locality from which the boll weevils were derived.

**EXPERIMENTS WITH TEXAS BOLL WEEVILS**

The first series consisted of Texas boll weevils (*Anthonomus grandis*) either collected in the field or reared from cotton squares in the laboratory at Victoria. Different lots were tested on buds alone, blooms alone, and on buds, blooms, and young fruit together.

In order to test the exact nutritive value of buds alone, one series of 10 boll weevils was started on buds alone. The results from this series were very surprising. Feeding was noted on only 2 days, and the maximum longevity was 5 days, with an average for both sexes of 3.7 days. This length of life is very little above that for unfed weevils, and it is extremely doubtful whether the buds prolonged the life of any of the boll weevils in the least. This is quite in accord with the fact that in all series offering a choice of food there was very little feeding on the buds.

Owing to the fact that in the feeding series where a choice of food was offered the boll weevil fed so very much more on the blooms than any other part of the plant, another experiment was conducted to determine the length of life of boll weevils fed only on blooms from the time of their emergence. Six insects were used, and they fed every day from the
starting of the experiment to the death of the last boll weevil. The longevity was surprisingly great, only one boll weevil dying in less than 24 days, and the average for both sexes being 25.3 days, with a maximum of 40 days. It is evident that the blooms are better food than the buds. The longevity of the bloom-fed boll weevils is much greater than of those fed either on cotton bolls or leaves and compares well with the longevity on squares.

The pollen is the first choice of the boll weevils. One weevil will soon destroy every anther in a large bloom and usually emerges covered with pollen. However, in practically every case there is more or less feeding on the corolla itself. This frequently takes the form of large areas eaten from a beginning on the margin of a petal, but often the petal is merely riddled with small holes.

By far the greatest number of experiments on feeding *Hibiscus syriacus* were series where buds, blooms, and young fruit were offered to the boll weevils every day.

Some boll weevils were reared in the laboratory and placed on Hibiscus immediately after emergence, while others were collected in the field and consequently had fed first on cotton.

Three lots of boll weevils collected in the field—12 in all—were used. In two lots they were collected in the field, brought to the laboratory, and were immediately placed in tumblers with a base of moist sand and containing fresh buds, blooms, and young fruit of *Hibiscus syriacus*. In the other lot, hibernated individuals that had been collected some days previously and fed on cotton squares until the time of starting the experiment were used in the same manner. The four pairs collected in the field were in copulation at the time of capture. When possible, the food was changed often enough to give a constant supply of fresh buds, blooms, and young fruit.

The boll weevils all began feeding immediately after being placed with the Hibiscus. In a total of 53 examinations feeding was found in all but 2 cases. Both of these were found toward the last of a series when only one boll weevil remained, affording striking evidence of the readiness with which they fed on Hibiscus even when accustomed to cotton.

An analysis of feeding by the parts of the plant attacked gives the following: Corolla, 40 times; stamens, 40 times; buds, 14 times; and young fruit, 6 times. This shows the very decided preference for the bloom.

Although the females used in two series were in copulation when collected in the field, only one egg was secured during the experiment. This egg was deposited normally in a bud 31 days after the female had been placed on Hibiscus. It hatched, and the larva lived until about half grown. During its life it consumed much of the tissue of the bud.

The maximum longevity was 36 days, the average being 16 days. While this longevity is short when compared with that on cotton, it certainly shows that it is possible for the boll weevil accustomed to feeding on cotton to subsist for a long time on Hibiscus.

Three series of boll weevils reared in the laboratory were used in another experiment—one lot in the spring, one in summer, and one in the fall. In all of these experiments the boll weevils were reared on cotton bolls or squares in the laboratory. They were then placed immediately in tumblers containing a layer of moist sand and offered a mixture of buds, blooms, and young fruit every day until the supply of food was exhausted.
The 12 weevils in the spring series fed quite freely and regularly. In a total of 69 examinations feeding was found in all but 3 cases, and 1 of these was when nothing but mature fruit was offered. An analysis of the feeding shows the following: Corolla, 39 times; stamens, 37 times; buds, 27 times; and young fruit, 10 times. While this shows the usual preference for the corolla and stamens, the amount of feeding on buds is unusually large.

Eggs were deposited by each lot of boll weevils, but on only four different days, a total of 15 being found. The maximum number per lot in one day was eight.

The maximum longevity of these boll weevils was 43 days, with an average of 19.2 days. This is above the average for boll weevils fed on either cotton bolls or leaves.

The period from emergence to deposition was 5 days in each series. Although 15 eggs were deposited in this series, they were distributed in only 4 buds. These were placed in cloth-covered tumblers on moist sand and tested for emergence of adults. When no adults appeared at the proper time, the buds were opened and the contents examined. Of course, it was impossible to determine at that time whether the eggs actually hatched, but if they did, the larvae died before reaching any considerable size, as there were no signs of larval work in any of the buds.

Only six boll weevils, divided into three lots, were used in the summer series. In a total of 37 examinations feeding was found in all but 8 cases. The feeding by parts of the plant was divided as follows: Anthers, 24 times; corolla, 13 times; and buds, once.

No eggs were found any time, but owing to the extremely dry weather, the buds at this season were not very choice and the supply was not sufficient to have fresh ones always present.

The maximum longevity for the series was 26 days, the average for the two sexes being 14.1 days.

Twelve boll weevils were started in the fall series on September 9 and 10. These were fed on the buds, bloom, and young fruit of the pink variety of Hibiscus, the food being renewed often enough to insure the presence of a fresh supply all the time. This was continued as long as the food was available.

Four females and seven males were used, one male having escaped on the second day of the experiment. Although these boll weevils were not examined more than once a day, each female was observed in copulation at least once at the time of this examination, seven acts of copulation by the four females being observed.

Each of the females deposited at least one egg, the four depositing 19 eggs. The period from emergence to deposition ranged from 12 to 18 days, with an average of 14 days. The period of oviposition varied from 7 to 15 days, excluding the record of one female that deposited only one egg. The average was 11 days.

In a total of 62 examinations for feeding during the period when food was present the feeding was usually quite extensive, and not a single case occurred when there was no feeding. An analysis by parts of the plant attacked gives the following: Stamens, 52 times; corolla, 50 times; buds, 5 times; and pistil, once.

On October 13 the supply of Hibiscus was completely exhausted, and the boll weevils died 4 to 5 days afterwards, the average being 4.4 days.
As a majority of the boll weevils were still alive at the time it was necessary to stop feeding them, no definite longevity can be given, but the following facts will show something of what might be expected. Of the 11 weevils tested, 1 was accidentally killed when 32 days old, 3 died with an average longevity of 30 days, and 7 were still alive at the time of closing the series—35 days after their emergence. From this it is readily seen that the longevity would have been very great had it been possible to continue the series to the normal death of the boll weevils.

All of the 19 eggs deposited were placed in buds, except 1, which was deposited on the inside of the base of a petal during a day when no buds were fed—September 21. This egg was left on the petal, covered with moist cloth, and placed on moist sand. It hatched on September 25—four days later. The larva appeared completely normal. A fresh Hibiscus bud was opened to the center with a knife, and the small larva was dropped into a cavity formed there. Then the bud was closed and placed on moist sand. This larva was watched by opening the bud every few days. Unfortunately, it became infested with mites (probably Pediculoides sp.) when nearly fully grown—October 3. On October 5 it pupated, but died soon after completing the change. The death was probably due to the attack of the mites, as larvae in immature stages being reared on cotton squares on the same shelf were killed by them.

The remaining 18 eggs were distributed in 11 buds. Two of these produced adult boll weevils, 4 bloomed and thus prevented breeding, 4 showed no signs of larval work, and 1 gave indications of the larva being alive until it had consumed most of the tissue of the bud.

The two adults that emerged were males. In one case the egg was deposited on September 24, the adult emerging on October 12. In the other the egg was deposited on September 27, the adult emerging on October 14—developmental periods of 18 and 17 days, respectively.

A summary of the spring, summer, and fall series of observations is of interest, in that it shows the conduct of the boll weevils throughout the season when offered their choice of all edible parts of the plant. Table I gives the results of the observations on the preference of the boll weevil for certain parts of Hibiscus. It is readily seen that the bloom (stamens and corolla) is very much preferred to all other parts, forming 83 per cent of the total number of times of feeding. That the feeding is quite constant is shown by the fact that in 168 examinations only 11 records of no feeding were made—only 6.5 per cent.

### Table I.—Summary of feeding experiments of the Texas boll weevil, showing its preference for certain parts of Hibiscus syriacus

<table>
<thead>
<tr>
<th>Series</th>
<th>Part of plant</th>
<th>Stamens</th>
<th>Corolla</th>
<th>Bud</th>
<th>Fruit</th>
<th>Pistil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td></td>
<td>37</td>
<td>39</td>
<td>27</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Summer</td>
<td></td>
<td>24</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fall</td>
<td></td>
<td>52</td>
<td>50</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>113</td>
<td>102</td>
<td>33</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

The longevity will be discussed in the general summary. Eggs were deposited in only two series, 34 being found.
EXPERIMENTS WITH LOUISIANA BOLL WEEVILS

In order to determine whether the feeding habits on *Hibiscus syriacus* of boll weevils reared from cotton at Victoria, Tex., were adaptive habits acquired by long presence there and whether they were peculiar to that locality, a number of cotton squares infested with the same species were imported from Tallulah, La., and the adults reared from them were also tested for feeding and longevity on *Hibiscus*. As blooms only were available, no other food was offered. The four boll weevils used fed very readily on the blooms and were able to subsist on them for very long periods. At the time of closing the experiment, owing to the lack of food, only one out of the four weevils had died, and this one had lived for 21 days. The remainder were still alive and feeding at this time—33 days after starting the first lot and 32 days after the second.

In the 39 examinations recorded, absence of feeding was found only once. The anthers were attacked 32 times and the corolla 18 times. It is greatly to be regretted that a supply of buds was not available so that tests could have been made of the breeding of these Louisiana boll weevils in them, as the lack of either positive or negative records on this point make the results less definite than they would otherwise have been. But the readiness with which these boll weevils fed on the blooms and their extreme longevity seem to indicate that they are quite as well adapted to *Hibiscus* as those from Texas and quite as likely to breed in it.

The importance of this plant as food for boll weevils is shown by the fact that the three remaining died in an average of 4.6 days after the last day of feeding.

FEEDING EXPERIMENTS WITH *ANTHONOMUS GRANDIS THURBERIAE*

Since *Anthonomus grandis*, var. *thurberiae*, was already adapted to at least one plant other than cotton (*Thurberia theespisiodes*), it was considered probable that it would be able to breed in *Hibiscus* buds. For determining this point a number of these boll weevils which had just emerged from *Thurberia* bolls imported from Arizona were placed on *Hibiscus*. The results of these experiments follow.

A few boll weevils emerging from *Thurberia* bolls were placed with blooms of *Hibiscus* and tested for the longevity and feeding. A number of boll weevils were started in this series, but several lots were killed in the first few days by what seemed to be a bacterial disease. This reduced the number to two, which were carried through the experiment. These boll weevils did not feed nearly so readily nor so much as the Texas or Louisiana boll weevils under observation at the same time. In the total of 21 observations two records of no feeding were made. Feeding on the anthers was noted 18 times and on the corolla, 13 times.

One boll weevil lived 15, the other 30 days, an average of 22.5 days. The number tested was too small for this record to be of much value.

In the second series nine weevils were fed on the buds, blooms, and fruit of *Hibiscus*—five females and four males. In the 40 observations made while food was present there was not a single case of no feeding. The analysis of the feeding shows parts of the plant fed on, as follows: Corolla, 31 times; stamens, 31 times; and buds, 15 times. The usual preference for the blooms is shown.

This series was also interrupted by exhaustion of the food supply. Of course, this prevents a definite statement of their longevity, but the fol-
Following summary will give an idea of what might have been expected from these weevils. Of the nine boll weevils started, two died with an average longevity of 6 days, while seven were still alive when the food became exhausted—34 days after the emergence. These seven weevils died on an average of 4.8 days after the stoppage of feeding.

Each female was observed in copulation at least once, and a total of 13 records of copulation were made in the course of the daily examination. The first pair observed in copulation performed this act 6 days after emergence.

Thirty-six eggs were deposited, eighteen in each series. The periods from emergence to oviposition were 12 and 14 days in the cases where this record was available.

The eggs deposited were placed in 21 buds, an average of 1.7 eggs per bud. Three of these buds produced adult boll weevils, 8 bloomed, 9 showed no sign of larval work, and 1 was nearly consumed by a larva before its death. The eggs deposited on September 21, 24, and 30 produced a male, a female, and a male on October 8, 10, and 15—developmental periods of 17, 16, and 15 days, respectively.

SUMMARY OF HIBISCUS EXPERIMENTS

From the foregoing experiments it is quite evident that it is possible for Anthonomus grandis and A. grandis thurberiae to breed in the buds of Hibiscus syriacus. And not only is this possible, but all indications point toward the conclusion that this breeding would be no rarity. While there was little oviposition and no breeding in the series conducted early in the season, this may have been due to the writer's lack of knowledge of the correct way to keep the food in proper condition. The oviposition in the fall series may seem low, but that of females on squares at this time was no higher. The weather was unusually cold during this period and the oviposition of all boll weevils, regardless of food, was extremely variable by days.

These data prove beyond doubt that the boll weevils fed from the time of emergence only on the buds and bloom of Hibiscus can develop sufficiently sexually to produce a number of normal fertile eggs and to deposit them normally. The copulation of these boll weevils was quite normal. Almost every pair was observed in copulation in the course of the daily examination. In a number of experiments in attempting to get weevils to copulate when they had been fed only on cotton leaves since emergence the writer was successful in only a very limited number of cases and was never able to secure a record of any of these depositing eggs, though they lived for long periods. From this it seems probable that some feeding on bud, bloom, or fruit tissue is necessary for sexual maturity, and the buds or bloom of Hibiscus will serve this purpose instead of those of cotton.

The eggs deposited were all placed in normally sealed punctures, and dissection of the buds always showed them to be placed partially within the inner folds of the corolla and partially within the outer layer of immature anthers. At least 90 per cent of all the eggs deposited were placed in older buds which had started to open slightly, and the punctures were made through the exposed tips of the involuted corolla. The favorite location of these egg punctures is through the corolla in the base of the clefts then forming between the sepal. This deposition in the corolla is probably due to the extreme pilosity and toughness of the calyx.
However, a few eggs have been deposited in punctures made through the calyx, but in these cases the boll weevils seem to experience great difficulty in sealing the opening. The tissue of the exposed corolla probably most nearly approximates that in which the boll weevils are accustomed to develop. It is of interest to note that of the boll weevils collected from cotton in the field and placed on Hibiscus only one deposited a single egg.

The older buds of Hibiscus are very hardy, and the puncture of the boll weevil very rarely prevents them from opening and shedding the eggs or larvae. The number of instances of this occurring is readily shown by a glance at the preceding records of tests of the eggs. Although these buds had been picked from the plants and placed in tumblers, a very large percentage of them bloomed and so prevented breeding. This characteristic of Hibiscus, taken in connection with the habits of the boll weevil, is undoubtedly of great importance in preventing it from breeding in the buds. The boll weevil naturally selects the older buds, which are slightly opened at the tips, for oviposition, but these buds are usually able to open and rid themselves of the pest.

The food preference displayed by the boll weevil is quite pronounced. Almost all feeding is on the corolla and the stamens of the bloom. Next to these in importance come the buds and then the young fruit. The latter are so very different in tissue and formation that it is not surprising that boll weevils will not feed on them to any extent. In fact, the only cases of feeding on fruit were when it was young, usually within a day or two of the dropping of the bloom.

While the various series of the Louisiana and Texas boll weevils and the Arizona Thurberia weevil were not sufficiently similar to allow an exact comparison, some indication of the extent and nature of the adaptation can be seen. The conduct of the three types of weevils in relation to feeding was practically the same. All showed the same food preference, and, allowing for quite natural variations, the extent of the feeding was much the same. While the experiments with the Louisiana boll weevils were quite limited in extent, they gave all indications of as much adaptation to the food as the native and Thurberia weevils.

The longevity of these weevils is of considerable interest. Since the three series under way when the supply was exhausted were by far the most important in this respect, the only figures which can be given are very unsatisfactory. The average longevity of both sexes feeding on buds alone was 3.7 days. That for blooms alone was 25.3 days. As these two series were carried on at the same time and were identical in conditions, the comparison shows the relative food values of the two. Of the boll weevils fed on buds, blooms, and fruit the spring series averaged 19.2 days and the summer series, 14.1 days. However, these records are shown to be of little value when compared with the fall series. The longevity of the three series, interrupted by the lack of food, may be summarized as follows: Of the 24 weevils started on this food, 17 were still alive, 1 was killed when 32 days old, and 6 had died with an average longevity of 20.5 days. This was on October 13, or 33 days after the emergence of the adults used. Both sexes of the boll weevils collected in the field and then fed on Hibiscus died on an average of 16 days after being placed on this food.

The developmental periods of the boll weevils under discussion are shown in Table II.
TABLE II.—Comparison of developmental periods of Texas boll weevils and Thurberia weevils in buds of Hibiscus and of Texas boll weevils in cotton

<table>
<thead>
<tr>
<th>Thurberia weevils on Hibiscus</th>
<th>Texas boll weevils on Hibiscus</th>
<th>Developmental period for Texas boll weevils in cotton squares at same time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs deposited.</td>
<td>Adults emerged.</td>
<td>Eggs deposited.</td>
</tr>
<tr>
<td>September 21...</td>
<td>October 8... 17</td>
<td>September 24... October 12...  18</td>
</tr>
<tr>
<td>September 24...</td>
<td>October 10... 16</td>
<td>September 27... October 14...  17</td>
</tr>
<tr>
<td>September 30...</td>
<td>October 15... 15</td>
<td></td>
</tr>
<tr>
<td>Average...</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

From Table II it is seen that there was little difference between the Thurberia weevils and Texas boll weevils in the Hibiscus buds. The average developmental period of native Texas boll weevils from eggs deposited in cotton squares during this same time is offered for comparison.

SUMMARY

Table III shows a summary of the longevity of the various series.

TABLE III.—Summary of longevity of boll weevils on various Malvaceae tested.

<table>
<thead>
<tr>
<th>Period of experiment</th>
<th>Food plant</th>
<th>Series and remarks</th>
<th>Longevity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Days</td>
</tr>
<tr>
<td>May 13 to May 28</td>
<td>Sphacelica lindheimeri</td>
<td>Hibernated boll weevils collected in field.</td>
<td>15 7-3</td>
</tr>
<tr>
<td></td>
<td>do</td>
<td>Boll weevils reared from cotton squares.</td>
<td>8</td>
</tr>
<tr>
<td>May 13 to June 2</td>
<td>Callirhoe involucrata</td>
<td>Boll weevils collected in the field.</td>
<td>20</td>
</tr>
<tr>
<td>May 16 to June 11</td>
<td>Callirhoe pedata</td>
<td>do</td>
<td>20</td>
</tr>
<tr>
<td>June 15 to July 11</td>
<td>do</td>
<td>Boll weevils reared from cotton squares.</td>
<td>20</td>
</tr>
<tr>
<td>June 27 to July 1</td>
<td>Hibiscus syriacus</td>
<td>Reared boll weevils fed on buds only.</td>
<td>5</td>
</tr>
<tr>
<td>June 27 to Aug. 5</td>
<td>do</td>
<td>Reared boll weevils fed on blooms only.</td>
<td>20</td>
</tr>
<tr>
<td>June 26 to July 2</td>
<td>do</td>
<td>Boll weevils collected in the field and fed on buds, blooms, and fruit.</td>
<td>20</td>
</tr>
<tr>
<td>June 15 to July 28</td>
<td>do</td>
<td>Boll weevils reared from cotton squares and fed on buds, blooms, and fruit; spring series.</td>
<td>20</td>
</tr>
<tr>
<td>Aug. 28 to Sept. 27</td>
<td>do</td>
<td>Boll weevils reared from cotton squares and fed cotton bolls, blooms, and fruit; summer series.</td>
<td>20</td>
</tr>
<tr>
<td>Sept. 2 to Oct. 2</td>
<td>do</td>
<td>Antirhonnus grandis thurberiae reared from Thurberia bolls and fed on blooms only.</td>
<td>20</td>
</tr>
</tbody>
</table>
### TABLE III—Summary of longevity of boll weevils on various Malvaceae tested—Contd.

<table>
<thead>
<tr>
<th>Period of experiment</th>
<th>Food plant</th>
<th>Series and remarks</th>
<th>Longevity.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Sept. 9 to Oct. 18.</td>
<td>Hibiscus syriacus</td>
<td>Boll weevils reared from cotton squares and fed on buds, blooms, and fruit; fall series; boll weevils still alive at conclusion of experiment.</td>
<td>35+</td>
</tr>
<tr>
<td>Sept. 1 to Oct. 18.</td>
<td>do</td>
<td>Boll weevils reared from squares imported from Tallulah, La.; fed on blooms only; still alive at conclusion of experiment.</td>
<td>33+</td>
</tr>
<tr>
<td>Sept. 9 to Oct. 18.</td>
<td>do</td>
<td>Anthonomus grandis thurberiae reared from Thurberia bolls and fed on buds, blooms, and fruit; still alive at conclusion of experiment.</td>
<td>34+</td>
</tr>
<tr>
<td>June 18 to July 26.</td>
<td>Cotton</td>
<td>Bolls only.</td>
<td>32</td>
</tr>
<tr>
<td>June 9 to July 22.</td>
<td>do</td>
<td>Leaves only.</td>
<td>45</td>
</tr>
<tr>
<td>June 5 to Oct. 10.</td>
<td>do</td>
<td>Squares only.</td>
<td>74</td>
</tr>
<tr>
<td>June 22 to July 2.</td>
<td>Unfed</td>
<td>On moist sand.</td>
<td>6</td>
</tr>
</tbody>
</table>

The averages of the three unfinished series are included in Table III for comparison. From this it is seen that the record for native Texas boll weevils on Hibiscus is very little short of the final average for cotton-square-fed boll weevils, although the latter were continued to death.

Eggs were deposited in only two plants, *Callirrhoe involucrata* and *Hibiscus syriacus*—5 in the former and 71 in the latter. By series those in Hibiscus were divided as follows:

Field-collected female, 1 egg; spring series, 15 eggs; fall series, 19 eggs; and *Anthonomus grandis thurberiae* series, 36 eggs.

All experiments were performed under cage conditions, but these were made as nearly normal as possible. No boll weevils have been found breeding in plants other than cotton and Thurberia under field conditions, and only one case of feeding under such conditions has been observed. This was in the case of a single boll weevil found feeding on *Hibiscus syriacus*, at Victoria, Tex., on June 16.