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Evaluation of Soybean Germ Plasm for Resistance to the Bean Leaf Beetle, Cerotoma Trifurcata (Forster), the Southern Green Stink Bug, Nezara Viridula (Linnaeus), and the SoybeanLooper, Pseudoplusia Includens, Walker.

Richard Leland Jensen
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EVALUATION OF SOYBEAN GERM PLASM FOR
RESISTANCE TO THE BEAN LEAF BEETLE, CEROTOMA
TRIFURCATA (FORSTER), THE SOUTHERN GREEN
STINK BUG, NEZARA VIRIDULA (LINNAEUS), AND
THE SOYBEAN LOOPER, PSEUDOLPLUSIA INCLUDENS
WALKER.

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Entomology

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Evaluation of Soybean Germ Plasm for Resistance to the Bean Leaf Beetle, *Cerotoma trifurcata* (Forster), the Southern Green Stink Bug, *Nezara viridula* (Linnaeus), and the Soybean Looper, *Pseudoplusia includens* Walker

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The Department of Entomology

by

Richard Leland Jensen

B.S., Southeastern Louisiana University, 1963
M.S., Louisiana State University, 1968
August, 1971
PLEASE NOTE:

Some Pages have indistinct print. Filmed as received.

UNIVERSITY MICROFILMS
To my wife, Sue
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>v iii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>ix</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>REVIEW OF LITERATURE</td>
<td>3</td>
</tr>
<tr>
<td>METHODS AND MATERIALS</td>
<td>12</td>
</tr>
<tr>
<td>Field investigations, 1969</td>
<td>12</td>
</tr>
<tr>
<td>Experiment 1 - Bean leaf beetle</td>
<td>12</td>
</tr>
<tr>
<td>Experiment 2 - Southern green stink bug</td>
<td>13</td>
</tr>
<tr>
<td>Field investigations, 1970</td>
<td>14</td>
</tr>
<tr>
<td>Experiment 3 - Bean leaf beetle</td>
<td>14</td>
</tr>
<tr>
<td>Experiment 4 - Soybean looper</td>
<td>15</td>
</tr>
<tr>
<td>Greenhouse investigations, 1971</td>
<td>16</td>
</tr>
<tr>
<td>Experiment 5 - Soybean looper, non-replicated test</td>
<td>16</td>
</tr>
<tr>
<td>Experiment 6 - Soybean looper, replicated test</td>
<td>17</td>
</tr>
<tr>
<td>Laboratory investigations, 1971</td>
<td>19</td>
</tr>
<tr>
<td>Experiment 7 - Bean leaf beetle</td>
<td>19</td>
</tr>
<tr>
<td>Experiment 8 - Bean leaf beetle</td>
<td>21</td>
</tr>
<tr>
<td>Experiment 9 - Soybean looper</td>
<td>22</td>
</tr>
<tr>
<td>Abbreviations and symbols</td>
<td>22</td>
</tr>
</tbody>
</table>
### Table of Contents (Continued)

<table>
<thead>
<tr>
<th>RESULTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field investigations, 1969</td>
<td>24</td>
</tr>
<tr>
<td>Experiment 1 - Bean leaf beetle</td>
<td>24</td>
</tr>
<tr>
<td>Experiment 2 - Southern green stink bug</td>
<td>24</td>
</tr>
<tr>
<td>Field investigations, 1970</td>
<td>26</td>
</tr>
<tr>
<td>Experiment 3 - Bean leaf beetle</td>
<td>26</td>
</tr>
<tr>
<td>Experiment 4 - Soybean looper</td>
<td>29</td>
</tr>
<tr>
<td>Greenhouse investigations, 1971</td>
<td>29</td>
</tr>
<tr>
<td>Experiment 5 - Soybean looper, non-replicated test</td>
<td>29</td>
</tr>
<tr>
<td>Experiment 6 - Soybean looper, replicated test</td>
<td>30</td>
</tr>
<tr>
<td>Laboratory investigations, 1971</td>
<td>34</td>
</tr>
<tr>
<td>Experiment 7 - Bean leaf beetle</td>
<td>34</td>
</tr>
<tr>
<td>Experiment 8 - Bean leaf beetle</td>
<td>34</td>
</tr>
<tr>
<td>Experiment 9 - Soybean looper</td>
<td>36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISCUSSION</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field investigations, 1969</td>
<td>39</td>
</tr>
<tr>
<td>Experiment 1 - Bean leaf beetle</td>
<td>39</td>
</tr>
<tr>
<td>Experiment 2 - Southern green stink bug</td>
<td>39</td>
</tr>
<tr>
<td>Field investigations, 1970</td>
<td>40</td>
</tr>
<tr>
<td>Experiment 3 - Bean leaf beetle</td>
<td>40</td>
</tr>
<tr>
<td>Experiment 4 - Soybean looper</td>
<td>42</td>
</tr>
<tr>
<td>Greenhouse investigations, 1971</td>
<td>42</td>
</tr>
<tr>
<td>Experiment 5 - Soybean looper, non-replicated test</td>
<td>42</td>
</tr>
<tr>
<td>Experiment 6 - Soybean looper, replicated test</td>
<td>43</td>
</tr>
</tbody>
</table>
# Table of Contents (Continued)

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory investigations, 1971</td>
</tr>
<tr>
<td>Experiment 7 - Bean leaf beetle</td>
</tr>
<tr>
<td>Experiment 8 - Bean leaf beetle</td>
</tr>
<tr>
<td>Experiment 9 - Soybean looper</td>
</tr>
<tr>
<td>CONCLUSIONS</td>
</tr>
<tr>
<td>REFERENCES CITED</td>
</tr>
<tr>
<td>APPENDIX</td>
</tr>
<tr>
<td>VITA</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

I. Plant introduction, source of germ plasm, and maturity class of soybean planted at Baton Rouge, Louisiana; 1970................................. 20

II. Ranked means of the percent defoliation by the bean leaf beetle; 1969 field experiment............... 25

III. Mean number of soybean seeds with no visual stink bug damage; 1969 field test................ 27

IV. Mean percent of leaf damage by the bean leaf beetle; 1970 field experiment.......................... 28

V. Mean numbers of soybean looper eggs oviposited on various soybean entries; 1971 laboratory experiments........ 32

VI. Mean numbers of leaf hairs/16 mm² of leaf surface for various soybean entries; 1971 laboratory experiments.... 33

VII. Comparison of means of the area of leaf consumed by the bean leaf beetle in the 1970 field test and the 1970 laboratory test................................. 35

VIII. Percent survival, larval developmental time, and mean pupal weights of the soybean looper; 1971 laboratory test................................. 38
ABSTRACT

Soybean, *Glycine max* (L.) Merrill, germ plasm was screened for resistance to the bean leaf beetle, *Cerotoma trifurcata* (Forster), the Southern green stink bug, *Nezara viridula* (Linnaeus), and the soybean looper, *Pseudoplusia includens* (Walker). Methods and techniques were developed for screening large amounts of germ plasm for resistance to one or more of the above mentioned species.

Variations in response of the soybean germ plasm screened to one or more species existed. Plant Introduction (PI) 200498 contained moderate levels of resistance to foliage feeding by the bean leaf beetle. PI 229358 showed moderate levels of resistance to foliage feeding by the soybean looper and to seed damage by the Southern green stink bug. PI 227687 was found to be resistant to foliage feeding by the soybean looper but was susceptible to foliage feeding by the bean leaf beetle.

Significant differences were found in pupal weights when larvae of the soybean looper were reared on various sources of soybean germ plasm. The soybean looper habitually preferred to oviposit on the lower surface of soybean leaves. Leaf-hair density, however, did not appear to be a major factor involved in this preference. Lee was found to be one of the more preferred varieties for oviposition by the soybean looper.
PI 171451 and PI 229358 contained moderate levels of resistance, as measured by seed damage, to the Southern green stink bug.
INTRODUCTION

A sharp increase in acreage and production of soybean, *Glycine max* (L.) Merrill, has occurred in Louisiana during the past decade. Most of this increase has been achieved by clearing of woodland located in the hardwood swamps of the alluvial areas along major rivers and streams. However, use of these areas for soybean production is particularly sensitive because they are prime habitats for numerous species of animals.

Unfortunately, damaging insect pest populations which must be controlled with insecticides develop annually in many areas of Louisiana where soybean is grown. Presently the use of insecticides for these purposes is being severely criticized by many because these chemicals are contributing to environmental pollution. However, excessive use of insecticides is restrained because soybean is a comparatively low value crop and growers cannot afford to practice an insect control program based on the repetitive application of insecticides.

The development of varieties of crop plants, particularly soybean, that are resistant to insect attack would serve a dual purpose. Firstly, the decrease in the amounts of insecticides required to control soybean insect pests would reduce the overall cost of production to the grower. Secondly, the control of insects through resistant varieties would be a safe, economical, and a productive step toward the solution of the environmental pollution problem. Unfortunately, development of varieties...
that are resistant to insect attack is expensive and time consuming, because most often resistance is found in species, varieties, or individual plants that have poor agronomic qualities. For example, no commercial soybean variety presently grown in Louisiana exhibits sufficient resistance to insects to escape economic damage. Therefore, other sources of germ plasm must be investigated. If and when resistance is found, it must then be combined with germ plasm that will produce a variety that has good agronomic qualities. Since several insect species attack soybean in Louisiana, the problems associated with developing a resistant variety are further compounded because the changes brought about in developing resistance to one species may result in susceptibility to another.

The studies in this dissertation were undertaken 1) to test plant introductions for resistance to one or more species of the soybean insect complex and 2) to develop methods and techniques for screening large amounts of soybean germ plasm for resistance to insect attack.
REVIEW OF LITERATURE

Variations in responses of plants to insect attack have been recorded as early as 1792 when J. N. Havens recognized that the Underhill wheat variety contained resistance to the Hessian fly, *Mayetiola destructor* (Say) (Snelling, 1941). The Winter Majetin and Siberian Bitter Sweet varieties of apple which were resistant to the wooly apple aphid *Eriosoma lanigerum* (Hausman) and the American grape rootstocks which saved the French wine industry because they were resistant to the grape phylloxera, *Phylloxera vitifoliae* (Fitch) are early classical examples of plant resistance to insect attack (Snelling, 1941; Painter, 1951).

Various definitions of the term resistance occur in the literature. Snelling (1941) defined resistance "to include those characteristics which enable a plant to avoid, tolerate, or recover from the attacks of insects under conditions that would cause greater injury to other plants of the same species." Similarly, Painter (1951) defined resistance as "the relative amount of heritable qualities possessed by a plant which influence the ultimate degree of damage done by the insect." He divided the mechanisms of resistance into three categories: 1) Nonpreference, 2) Antibiosis, and 3) Tolerance. Beck (1965) defined plant resistance "as being the collective heritable characteristics by which a plant species, race, clone, or individual may reduce the probability of successful utilization of that plant as a host by an insect species, race, biotype or individual." He divided the
mechanisms of resistance into nonpreference and antibiosis. Beck
did not include tolerance in his definition of plant resistance
because tolerance "implies a biological relationship between
insects and plants that is quite different from resistance in the
strict sense." However, Painter (1966) stated that these categories
were arbitrary and interrelated and were concerned with effects
rather than causes. Because of the similarities among the definitions
of resistance, the choice of definition is left to the discretion
of the researcher.

Excellent reviews of the literature pertaining to resistance of
plants to insects have been reported by Snelling (1941), Painter (1951,
1958, 1966) and Beck (1965); unfortunately, however, relatively little
of the reported research involved insect resistance in soybean. To
complicate matters further, Painter (1966) stated that the study of
insect resistance was a long term project that usually required
6-10 years from initiation to the release of a new variety. Detailed
reports on these resistance projects generally have been published near
the end of the breeding and testing program. Therefore, much of the
research data prior to the release of the reports has been hidden
from the scientific community in such obscure places as brief notes in
annual reports, newsletters, confidential mimeographed reports and
personal communication among researchers.

Some of the earliest research involving insect resistance in
soybean was conducted by Poos and Smith (1931). They compared
oviposition of the potato leafhopper, *Empoasca fabae* (Harris) on
soybean plants having various types of pubescence and found that more
nymphs hatched from glabrous and appressed-hairy types than from
rough-hairy types. Johnson and Hollowell (1935) stated that resistance to nymphal infestation of *E. fabae* was due to the normal rough-hairy pubescence or to some character in inheritance which was controlled by the same hereditary complex as pubescence. Wolfenbarger (1963), however, reported that a sparse pubescent type soybean (T-240) had far fewer epidermal hairs per unit area than the normal type and yet T-240 was resistant to "hopperburn."

In varietal field trials Coon (1946) reported that 4 varieties (Chief, Viking, Illini, and Wilson 5) were moderately resistant to the Japanese beetle, *Popillia japonica* (Newman).

Genung and Green (1962) evaluated differences in leaf damage caused by the velvetbean caterpillar, *Anticarsia gemmatalis* (Hubner), by randomly sampling 6 trifoliate leaves from each test variety and calculating the leaf area (in.²) consumed. He reported that Jackson was susceptible but Lee was moderately resistant to *A. gemmatalis* damage. Genung and Green (1962) also reported that no variety tested showed any resistance to the Southern green stink bug, *Nezara viridula* (Linnaeus).

Jensen (1968) conducted field experiments during 1966 and 1967 to investigate the potential of varietal resistance for control of insect pests of soybean. Improved Pelican was reported to be highly susceptible to attack by *E. fabae*. Significant differences were also reported in the numbers of the three-cornered alfalfa hopper, *Spissistilus festinus* (Say), the bean leaf beetle, *Cerotoma trifurcata* (Forster), the green cloverworm, *Plathypena scabra* (Fabicius) and *N. viridula* that developed on the 17 varieties tested. Jensen concluded that all of the commercial varieties presently
grown in Louisiana were susceptible to attack by at least one species of the soybean insect complex but that Lee was the most resistant to attack by the insect complex. Curtis, Jackson, Improved Pelican and Hampton 266 were the most susceptible of the varieties tested to attack by the soybean insect complex.

Pedigo (1970) studied the ovipositional response of *P. scabra* to soybean and reported that 20 times more eggs were laid on pubescent than on glabrous types. Jensen (1968) reported that significantly greater numbers of *P. scabra* were recorded on Lee than on all other varieties tested. Lee has been considered to be a variety with normal pubescence (Dr. E. E. Hartwig, Personal communication). It was assumed, therefore, that a relationship existed between the ovipositional response of *P. scabra* and the type of pubescence of the Lee variety.

Todd (1969) reported that 3 plant introductions, PI 171451, PI 200498, and PI 229358, exhibited high degrees of resistance to the Mexican bean beetle, *Epilachna varivestis* (Mulsant). Campbell (1970) reported that plant introductions, PI 229358, PI 285093, PI 229321, PI 171451, PI 85416, and FC 31744 showed high levels of resistance to the Mexican bean beetle and moderate resistance to the bean leaf beetle. Eddy and Nettles (1930) stated that injury to cowpeas by the bean leaf beetle was very similar to that caused by the Mexican bean beetle. From the similarity of injury coupled with the preliminary work by Campbell (1970), it was assumed that certain varieties exhibit multiple resistance to more than one species of insect. However, multiple resistance has not always been the case. Da Costa and Jones (1971) found that the nonpreference and antibiotic mechanisms of resistance were related in cucumber. Cururbitacins, a class of tetracyclic
triterpenoids, attracted cucumber beetles (Chrysomelidae) and stimulated feeding whereas they had an antibiotic effect on the two-spotted mite, *Tetranychus urticae* (Koch.). They concluded that varieties resistant to insects through the nonpreference mechanism may be susceptible to attack by other insects.

Wuensche (1971) thoroughly reviewed the literature of insects associated with soybean. Therefore, literature reviewed in this manuscript for the insect species involved has been limited to biology and life history, type of injury and preferred host plants.

The bean leaf beetle, *Cerotoma trifurcata* (Forster), damages soybean in both the larval and adult stages. Comprehensive studies on its biology and life history have been reported by Eddy and Nettles (1930). Isely (1930) found the preferred hosts of *C. trifurcata* to be soybean, cowpea and snap bean.

Motsinger et al. (1967) stated that the bean leaf beetle was a major pest of soybean in Louisiana and that the adult fed on leaves, stems, young buds, and pods. No detailed description of the type of injury caused by the bean leaf beetle in the larval or adult stage has been published. McConnell (1915) stated that injury by the adult "may consist merely of eating rounded holes in the leaves or may extend to the total destruction, particularly of young plants." Eddy and Nettles (1930) stated that adult injury was typified by the "shot-hole" appearance of the bean foliage. However, they also found that the adult fed around the base of the seedling plants just below the soil level.

Motsinger et al. (1967) stated that pod damage caused by the adult beetle often resembled that of the corn earworm, *Heliothis zea* (Boddie), because both insects would eat directly through the outer hull and feed...
on the bean itself. Frequently, however, only the outer portion of the hull was eaten which exposed the bean to the weather. The larvae damaged the roots and nodules of the soybean plant. Unfortunately, the seriousness of the injury caused by bean leaf beetle larvae has remained virtually unknown.

*Pseudoplusia includens* (Walker) has been referred to in the literature as "the black legged looper" (Hensley et al., 1964) and the "false cabbage looper" (Canerday and Arant, 1967). However, the common name approved by the Entomological Society of America is the soybean looper (Anonymous, 1971). Studies on the biology of *P. includens* were reported by Canerday and Arant (1967), Mitchell (1967), and Burleigh (1970). Predominantly the soybean looper larvae has been defoliators of soybean although the writer has observed the larvae feeding on soybean pods in the greenhouse. Motsinger et al. (1967) stated that the larvae preferred to feed on the more mature leaves near the middle of the plant and destroyed the tissue between the veins and mid-ribs of the leaves, giving them a skeletonized appearance. Canerday and Arant (1966) reported that the preferred hosts of the soybean looper were soybean, peanut, and sweet potato.

The soybean looper was not considered to be a serious pest of soybean in Louisiana until the late 1950's because of 1) misidentification of the larvae, and 2) lack of research on soybean insects because of the relatively low acreage planted to soybean in Louisiana prior to 1960. Hensley et al. (1964) investigated the composition of the looper complex on several crops in Louisiana and found that larvae of *P. includens* were very similar in appearance and habits to those of the cabbage looper, *Trichoplusia ni* (Hübner),
and that these two species occurred in mixed populations on the same host. They further stated that *P. includens* accounted for more than 90% of the looper larvae collected from soybean during 1957-1963. The importance of correct identification of mixed populations of insects concerned in resistance studies has not been overemphasized. Painter (1951) stated that because of inaccurate identifications an appreciable amount of the observations on insect resistance has been open to question. He further stated that "mixtures of species cannot be studied together unless it was first shown that the species concerned were identical in kind of injury done, in food plant varieties preferred, and in effect of different plant varietes on the insect." Crumb (1956) was the first to attempt to classify the larvae of Phalaenidae. However, correct identification of *P. includens* was still precarious because of variations in pigmentation of the head, thoracic legs, and setae-bearing pinaculae of the larvae. Eichlin and Cunningham (1969) alleviated much of the misidentification problem by presenting keys for the differentiation of larvae for 8 of the 11 species of the looper complex that were known to occur in the Southeastern United States.

Concerning the low soybean acreage in Louisiana prior to 1960, Wuensche (1971) stated that throughout the 1950's the acreage planted annually to soybean for seed and other purposes averaged approximately 251,000 acres. According to the Louisiana Crop and Livestock Reporting Service, soybean showed the greatest increase in acreage of any Louisiana field crop and the estimated acreage of soybean to be planted
for all purposes in 1971 is 1,851,000 acres (Anonymous, 1971). Coinciding with the increase in soybean acreage during the 1960's was an increase in research to determine the insect pests of soybean. Because soybean was found to be a preferred host of P. includens (Canerday and Arant, 1966), the tremendous increase in soybean acreage probably enhanced the multiplication and increased the seriousness of this pest of soybean.

The Southern green stink bug has been found to be the major pest of soybean in Louisiana according to Dr. L. D. Newsom (Personal communication). Jones (1918) made a detailed study of the biology of N. viridula and described the Southern green stink bug as a polyphagous insect which fed on numerous cultivated crops including cotton, corn, soybean, rice, and sugar cane. He stated, however, that legumes appeared to be the preferred hosts of N. viridula.

Both the nymphs and adults of N. viridula were found to feed on pods of soybean. Detailed histological studies of stink bug damaged seeds as well as the effect of infestations of N. viridula on quality and yield were described by Miner (1966).

Levels of infestation have played an important role in breeding programs designed to screen for resistance to insects in soybeans. Painter (1951) stated that if the infestation was too light, separation of resistant and susceptible strains was not possible, yet if it was too heavy, strains, with valuable agronomic characters, that were only slightly resistant would be so severely damaged that it would be impossible to recognize their resistance, thus, they would be lost to the breeding program. Duncan and Walker (1967) conducted research
on establishing populations of *N. viridula* in the field. They found that infestations of *N. viridula* maintained at a level of 1 stink bug per 1.32, 3.10, and 4.93 linear feet of row for a 7-week period resulted in 62.1, 45.6, and 33.1% damaged seeds, respectively. However, when large amounts of germ plasm are screened, it is impractical to maintain constant infestation levels for extended periods of time. It appears that several releases of stink bug nymphs at an infestation rate of 1 stink bug/foot of row would be large enough to accomplish adequate separation of any resistant and susceptible strains that might exist among the germ plasm. Secondly, there is a problem of correct recognition and measurement of the damage caused by the species in question. Painter (1951) stated that "the effects of insects with chewing mouthparts is usually only too apparent, but the effects of sucking insects (Hemiptera and Homoptera) may not be measured so easily." Miner (1966) stated that the external signs of stink bug damage to soybean seeds are 1) the seed coat may be sunken or wrinkled in the punctured area with a slight "wart" marking the site where the stylets entered and 2) the discoloration in the punctured area resulting from the injection of histolytic agents into the seed. The correct recognition of these external signs of stink bug damage are irrefragably important in screening soybean germ plasm for resistance to stink bugs.
METHODS AND MATERIALS

Field Investigations, 1969

Twenty-one plant introductions that were known to contain some resistance to foliage feeding by the Mexican bean beetle (Hartwig, 1969) were screened in a small field plot test at Baton Rouge, Louisiana for resistance to 1) the bean leaf beetle, *C. trifurcata*, and 2) the Southern green stink bug, *N. viridula*. Six commonly grown Louisiana soybean varieties were included as controls.

The plant introductions and check varieties were planted by hand at a rate of 36 seeds per plot and covered with ½" to 1" of soil on 5-15-69. Each plot consisted of 1 row, 3 feet long. The experimental design was a randomized block with 3 replications. Five-foot alleys were left between the replications.

**Experiment 1 - Bean leaf beetle:**

Adult bean leaf beetles, collected from soybean fields within 50 miles of Baton Rouge were released in the experiment. These beetles were brought to the laboratory where the left metathoracic wing was clipped from each beetle to prevent migration by flying. In order to eliminate those severely injured or killed during collection or wing clipping, the beetles were held 24 hours on soybean leaves in the laboratory and only those that appeared healthy were released in the experiment. In order to maintain uniformity of infestation conditions
in the experiment the beetles were released in increments of 50/plot on different dates from 6-20-69 to 8-16-69. After all plots had been initially infested with beetles, another increment was released until a total of 250 were released in each plot. Mortality of beetles after release was estimated by confining clip-winged beetles in 5-1 gallon ice cream cartons with screened lids. These cartons were placed in a row of a check plot and soybean leaves of the Semmes variety were supplied daily as food. Mortality counts were made after 72 hours. Defoliation was evaluated by obtaining 6 terminal leaves from plants selected at random in each plot. Two leaves were taken from the lower, middle and upper portions of the plants respectively on 8-30-69. These leaves were pressed for 48 hours and then their outline including that of consumed area traced on 5 squares/centimeter graph paper. Total leaf area and area consumed was determined by counting the numbers of squares outlined in each area respectively. When a large amount of the perimeter area had been consumed or was missing, that area was outlined by comparison to leaves of similar size. The average percent defoliation for each plot was calculated and these data were used as individual observations in the analysis of variance.

Experiment 2 - Southern green stink bug:

The field plots were infested with 20 third and fourth instar Southern green stink bug nymphs during a period from 9-6-69 to 9-17-69. Because of differences in their maturity, all plant introductions and check varieties of the same maturity group, beginning with the earliest maturity group, were infested at the same time. After maturity,
a 100ml core sample of seeds was obtained from each plot and 100 seeds selected at random from the core sample were checked for visual signs of stink bug damage. The number of seeds/100 seed sample that showed no visual damage was used as an individual observation in the analysis of variance to test for differences among the plant introductions with regard to stink bug damage.

Field Investigations, 1970

Experiment 3 - Bean leaf beetle:

Six plant introductions were selected from the 1969 entries and retested for resistance to foliage feeding by the bean leaf beetle. The entries were PI 200498, PI 227687, PI 85490, PI 210353, PI 171451, PI 229358, Bragg and Semmes. The planting procedure was the same as that described for the 1969 experiment except that 5 replications with 10-foot alleys between each replication were employed. The plots were planted at Baton Rouge, Louisiana on 5-19-70.

All plots in 4 replications were infested with bean leaf beetle adults that were collected from soybean fields within a 50-mile radius of Baton Rouge during the period 7-15-70 to 8-27-70. The left metathoracic wing was clipped from each beetle by the same procedure described for the 1969 experiments. Six hundred beetles were released on each plot. The plots in the remaining replication served as controls for measuring the amount of defoliation due to natural insect infestation.

Six terminal leaflets were sampled from each plot on 9-11-70 following the procedure described for the 1969 experiments. The percentage of leaf area consumed due to the natural infestation (control) was subtracted from the percentage of leaf area consumed in plots infested
with 600 bean leaf beetles. These adjusted percentages gave a more accurate estimate of the defoliation caused by the bean leaf beetles. Each adjusted percentage of leaf area consumed was used as an individual observation in the analysis of variance to test for differences among the soybean entries.

Experiment 4 - Soybean looper:

Eighty-two plant introductions, varieties and crosses (Appendix Table 7) were planted in a field plot experiment in a non-replicated test for screening for resistance to the soybean looper. Three-foot single row plots containing 36 seeds were planted by hand at Baton Rouge, Louisiana on 5-20-70. Two rows of the Davis variety were planted to eliminate border effects.

The border rows of Davis were heavily infested during the growing season with first instar soybean looper larvae obtained from a laboratory culture. The total number of larvae per acre was not determined. The soybean looper moths that emerged from the released larvae were supplied with a food source by placing baby food jars equipped with a cellucotton wick and filled with a 10% honey solution at 20-foot intervals through the border rows. The actual number of eggs oviposited was not determined and the larvae were not counted for every entry planted in the screening test. An estimate of the effectiveness of the screening technique was obtained by sampling every tenth entry throughout the experiment by the following procedure: A "catch" net, 30 inches wide by 3 feet long, was placed beside the plot to be sampled. All plants in the plot were shaken over the net and the numbers of soybean looper larvae that fell on the net were recorded. Counts were also made on other
species that defoliate soybeans.

All plots were sprayed with 1/4 pound of actual methyl parathion\(^1\) per acre on 9-12-70 using a 3 gallon sprayer. Since the soybean looper is highly resistant to most insecticides, including methyl parathion, the spraying technique eliminated the majority of the other defoliators of soybean but did not seriously affect the soybean looper population.

The plots were scored on 9-22-70 for leaf damage using a visual rating system. This system consisted of visually estimating damage for each entry and assigning it to 1 of the following numerical categories: 0 for no damage; 1 for less than 10% damage; 2 for 10 to 30% damage; 3 for 30 to 60% damage; and 4 for greater than 60% damage. All entries that were scored 0 or 1 were retested in the greenhouse.

**Greenhouse Investigations, 1971**

**Experiment 5 - Soybean looper, non-replicated test:**

A total of 53 plant introductions, varieties and crosses were screened in the greenhouse during 1971 for ovipositional preference by the soybean looper. The entries listed in Appendix Table 8 were planted in 14" x 20" x 3" metal flats on 1-27-71. The test was not replicated. One hundred pairs of laboratory reared soybean looper adults were released on 2-24-71 into a 30' x 33' section of the greenhouse containing the entries to be screened. The soybean looper adults were supplied with a food source by placing 20 baby food jars equipped with a

\(^{1}\) 0, 0-dimethyl 0-p-nitro-phenyl phosphorothioate
cellucotton wick and filled with a 10% honey solution throughout the section of the greenhouse. The adult loopers were allowed to oviposit for 7 days on the soybean entries. The flats of soybean were removed from the section of 3-2-71 and all looper adults were killed by placing 6 No-Pest® Strips throughout the section for 24 hours. After a 24-hour aeration period, the flats of soybean were returned to the treated section.

The entries were scored for leaf damage by the visual rating system used to score the 1970 field test entries. Entries which were scored in categories 0 or 1 were included in a replicated experiment.

**Experiment 6 - Soybean looper, replicated test:**

The soybean entries included in this greenhouse experiment to test for differences in ovipositional preference by the soybean looper were: La 68-11-6, La 68-14-15, La 68-10-3, La 68-12-1, Lee, PI 227687 and 2 susceptible entries La 68-20-13 and La 68-11-18. The experimental design used was a randomized block with 4 replications. The entries were planted at a rate of 50 seeds per 14" x 20" x 3" metal flat on 4-19-71. One hundred pairs of soybean looper adults were released into the 30' x 33' section of the greenhouse on 5-22-71 and allowed to oviposit for 7 days. The adult loopers were killed on 5-29-71 according to the procedure described in Experiment 5.

The total number of eggs oviposited on 20 leaves chosen at random from the plants in each flat was used as an individual observation in

$12$, 2-dichlorovinyl dimethyl phosphate
the analysis of variance to test for difference in ovipositional preference by the soybean looper.

A laboratory experiment was conducted concurrently with the above described experiment in order to investigate differences in oviposition when the soybean strains were exposed to extremely heavy populations of soybean looper adults. One fully expanded leaf was removed from each entry planted in the replicated greenhouse experiment. The petioles of these leaves were wrapped with moistened cellucotton and inserted into a 5-dram shell vial. These vials were placed at random into a 8" x 14" x 10" glass aquarium covered with 50 gauge cheesecloth\(^1\) containing 50 pairs of soybean looper adults. The adults were allowed to oviposit on the leaves for a period of 24 hours. The leaves were then removed and the numbers of eggs on the upper and lower surfaces of each leaf were recorded.

The leaf-hair density for the upper and lower surfaces of each entry was determined with the aid of a dissecting microscope by counting the number of leaf-hairs per 16mm\(^2\). This procedure was repeated on 10 leaflets that were chosen at random from each soybean entry mentioned above.

The analysis used to test for differences in ovipositional reactions of the looper adults to leaves from different sources of germ plasm was a randomized split-plot design with 4 replications. The analysis used to test for differences in leaf-hair density among the entries was a completely randomized split-plot design. The relationship between

\(^1\)Curity\(^\circledR\) Cheesecloth, Kendall Company: Textile Division, New York.
the leaf-hair density and the ovipositional reactions of the looper adults was tested using simple correlation.

Laboratory Investigations, 1971

Experiment 7 - Bean leaf beetle:

Tests were conducted in screen cages in the laboratory at Baton Rouge, Louisiana during 1971 to determine if the bean leaf beetle exhibited a feeding preference for any of the plant introductions or check varieties listed in Table I. Adult bean leaf beetles were collected from Persian clover, *Trifolium resupinatum* L., in St. Landry Parish on 5-16-71, brought to the laboratory and fed for 48 hours on Lee soybean leaves. After a 24-hour starvation period, 50 beetles were released into a screened cage measuring 32" x 36" x 20", and containing four 14-day old seedlings of each of the 8 entries to be tested. The seedlings were obtained from a supply of plants planted in 14" x 20" x 3" metal greenhouse flats. Before being placed into the cages, the roots of the seedlings were washed free of soil, wrapped in cellucotton, and placed individually into a 5-dram shell vial filled with water. One seedling from each of the 8 entries was placed at random within 1 row; each cage contained 4 rows of seedlings.

The beetles were allowed to feed on the seedlings for 96 hours. All leaves of each seedling were removed and placed into a leafpress for 48 hours. Any consumed area of the leaf was traced on graph paper. The mean area of foliage consumed for the 4 seedlings was used to test for differences among the plant introductions with regard to foliage...
Table I. Plant introduction, source of germ plasm, and maturity class of soybean planted at Baton Rouge, Louisiana; 1970.

<table>
<thead>
<tr>
<th>Plant introduction or variety</th>
<th>Source of germplasm</th>
<th>Maturity group&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI 227687</td>
<td>Okinawa</td>
<td>VI</td>
</tr>
<tr>
<td>PI 210353</td>
<td>Indonesia</td>
<td>VI</td>
</tr>
<tr>
<td>PI 171451</td>
<td>Japan</td>
<td>VII</td>
</tr>
<tr>
<td>PI 85490</td>
<td>Japan</td>
<td>VII</td>
</tr>
<tr>
<td>Bragg</td>
<td>-</td>
<td>VII</td>
</tr>
<tr>
<td>Semmes</td>
<td>-</td>
<td>VII</td>
</tr>
<tr>
<td>PI 200498</td>
<td>Japan</td>
<td>VIII</td>
</tr>
<tr>
<td>PI 229358</td>
<td>Japan</td>
<td>VIII</td>
</tr>
</tbody>
</table>

<sup>a</sup>In Louisiana the average dates of maturity are the following:

- Group V from September 10 to October 5
- Group VI from October 6 to October 20
- Group VII from October 21 to October 28
- Group VIII from October 29 to later
feeding by the bean leaf beetle. The experimental design used was a randomized block with 3 replications.

Experiment 8 - Bean leaf beetle:

A laboratory leaf consumption experiment was conducted during 1971 to determine if differences in feeding rates existed when the bean leaf beetle was confined on leaves from different sources of soybean germ plasm.

Adult bean leaf beetles were collected from Persian clover, brought to the laboratory and allowed to feed on Lee soybean leaves for a period of 48 hours. Following a 24-hour starvation period, the beetles were placed individually into a 5-dram shell vial equipped with a perforated plastic cap and containing a leaflet of a given plant introduction. The leaflets were changed daily during the experiment. In order to reduce variation due to differences in age and texture of the leaflets among the various plant introductions, all leaflets used for food on a given day were obtained by counting a predetermined number of nodes above the unifoliolate leaves on each plant and collecting the next fully expanded trifoliate leaf. Leaflets removed from the vials were pressed for 48 hours after which the consumed areas of the leaflets were traced on graph paper.

Ten beetles were allowed to feed for 14 days on leaflets of each plant introduction and check variety listed in Table I. If a beetle died or escaped during the 14-day period, all data from that particular beetle was discarded and another beetle was fed. The beetles were sexed prior to initiation of the experiment and only females were used. They were held in a temperature cabinet at 80 ± 3°F and a light regimen of
14L:10D during the experiment.

The area of leaflet consumed per day per beetle was used as an individual observation in the analysis of variance to test for differences in feeding by the beetles among the various entries. The experimental design was a completely randomized split-plot.

**Experiment 9 - Soybean looper:**

A laboratory experiment was conducted during 1971 to determine the effect on the developmental rate and size of larvae and pupae of the soybean looper when reared on the plant introductions and check varieties listed in Table I.

First instar soybean looper larvae were placed individually into a 5-dram shell vial equipped with a perforated plastic cap. The larvae were supplied daily with leaflets obtained from a supply of the plant introductions that were planted in 14" x 20" x 3" metal greenhouse flats. All leaflets collected on a given day from the plants were sampled according to the procedure described in the above Experiment 8.

A total of 30 first instar larvae were fed on each plant introduction. Larval mortality counts were recorded for each plant introduction. The insects were reared in a temperature cabinet held at 80 ± 3 F and a light regimen of 14L:10D. After pupation, the pupae were weighed and sexed. Least squares analysis was used to test for differences in pupal weights of larvae that had been reared on the different plant introductions.

**Abbreviations and symbols**

Three abbreviations and 2 symbols are used without explanation.
in some tables of the results. The abbreviation, PI preceding a number indicates plant introduction; FC preceding a number indicates soybean seed from seed lots that had been sent into the Old Forage Crops Division of the United States Department of Agriculture for identification. The abbreviation, ns, indicates that the difference between means was not significant at the 5% level. The single asterisk (*) and double asterisk (**) indicate significance at the 5% and 1% levels of probability, respectively.
RESULTS

Field Investigations, 1969

Experiment 1 - Bean leaf beetle:

There was a significant response to damage among the entries. The percent defoliation by the bean leaf beetle that occurred among the various entries in the 1969 field test is arrayed in decreasing order of severity in Table II.

No 1 entry could be separated from all others with regard to either resistance or susceptibility. No entry tested showed more resistance than the commonly grown Louisiana check varieties, although PI 200498 and PI 230978 had a lower percentage of defoliation than any of the check varieties. The entries PI 200483, PI 175185, PI 174865, PI 165989, PI 166032, PI 229321 and FC 31921 were significantly more susceptible than the check varieties. No conspicuous differences in either resistance or susceptibility were detected among the 4 maturity groups involved.

There was 21% mortality of the beetles that were caged for 72 hours in 1-gallon ice cream cartons and placed in the row of the check plots.

Experiment 2 - Southern green stink bug:

The response of the various entries to stink bug damage as measured by seed damage is given in Appendix Table 3. The means of seed damage
Table II. Ranked means of the percent defoliation by the bean leaf beetle; 1969 field experiments.a

<table>
<thead>
<tr>
<th>Entries</th>
<th>Maturity group</th>
<th>Ranked means</th>
<th>Source of germ plasm</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI 200483</td>
<td>V</td>
<td>11.90 a</td>
<td>Japan</td>
</tr>
<tr>
<td>PI 175185</td>
<td>VII</td>
<td>11.50 ab</td>
<td>India</td>
</tr>
<tr>
<td>PI 174865</td>
<td>VII</td>
<td>10.70 a-c</td>
<td>India</td>
</tr>
<tr>
<td>PI 165989</td>
<td>VI</td>
<td>10.20 a-d</td>
<td>India</td>
</tr>
<tr>
<td>PI 166032</td>
<td>VII</td>
<td>9.55 a-e</td>
<td>India</td>
</tr>
<tr>
<td>FC 31921</td>
<td>VI</td>
<td>7.25 a-f</td>
<td>-</td>
</tr>
<tr>
<td>PI 229321</td>
<td>VIII</td>
<td>7.10 a-f</td>
<td>Japan</td>
</tr>
<tr>
<td>Davis</td>
<td>VI</td>
<td>6.10 b-f</td>
<td>-</td>
</tr>
<tr>
<td>PI 208783</td>
<td>VII</td>
<td>5.75 c-f</td>
<td>Japan</td>
</tr>
<tr>
<td>PI 96354</td>
<td>VI</td>
<td>4.60 d-f</td>
<td>Korea</td>
</tr>
<tr>
<td>Dare</td>
<td>VI</td>
<td>4.60 d-f</td>
<td>-</td>
</tr>
<tr>
<td>Hill</td>
<td>V</td>
<td>4.45 ef</td>
<td>-</td>
</tr>
<tr>
<td>PI 85490</td>
<td>VII</td>
<td>4.45 ef</td>
<td>Japan</td>
</tr>
<tr>
<td>PI 171451</td>
<td>VII</td>
<td>4.40 ef</td>
<td>Japan</td>
</tr>
<tr>
<td>Bragg</td>
<td>VII</td>
<td>4.05 ef</td>
<td>-</td>
</tr>
<tr>
<td>PI 229358</td>
<td>VIII</td>
<td>4.05 ef</td>
<td>Japan</td>
</tr>
<tr>
<td>FC 31665</td>
<td>VI</td>
<td>3.95 ef</td>
<td>-</td>
</tr>
<tr>
<td>PI 210353</td>
<td>VI</td>
<td>3.90 ef</td>
<td>Indonesia</td>
</tr>
<tr>
<td>PI 183930</td>
<td>VII</td>
<td>3.90 ef</td>
<td>India</td>
</tr>
<tr>
<td>Semmes</td>
<td>VII</td>
<td>3.85 ef</td>
<td>-</td>
</tr>
<tr>
<td>PI 227687</td>
<td>VI</td>
<td>3.75 ef</td>
<td>Okinawa</td>
</tr>
<tr>
<td>Hampton</td>
<td>VIII</td>
<td>3.70 ef</td>
<td>-</td>
</tr>
<tr>
<td>PI 208784</td>
<td>VIII</td>
<td>3.70 ef</td>
<td>Japan</td>
</tr>
<tr>
<td>PI 36906</td>
<td>VI</td>
<td>3.65 ef</td>
<td>Manchuria</td>
</tr>
<tr>
<td>FC 31750</td>
<td>VII</td>
<td>3.30 f</td>
<td>-</td>
</tr>
<tr>
<td>Lee</td>
<td>VI</td>
<td>3.30 f</td>
<td>-</td>
</tr>
<tr>
<td>PI 230978</td>
<td>VI</td>
<td>2.95 f</td>
<td>Japan</td>
</tr>
<tr>
<td>PI 200498</td>
<td>VIII</td>
<td>2.65 f</td>
<td>Japan</td>
</tr>
</tbody>
</table>

aAnalysis of variance is given in Appendix Table 3.

bMean numbers not connected by the same letter differ significantly at the 5% level according to Duncan's Multiple Range Test.
in the various entries are arrayed in increasing order of severity in Table III. There were highly significant differences among the soybean entries in the number of seeds damaged by stink bugs. PI 171451, PI 229358, and PI 227687 showed moderate resistance; Hill, Dare, and PI 166032 were the most susceptible varieties. The variation in damage ranged from 23.0 to 88.7%.

Field Investigations, 1970

Experiment 3 - Bean leaf beetle:
The percentage of defoliation caused by the bean leaf beetle on the plant introductions and varieties involved in the 1970 field experiment are analyzed in Appendix Table 5. Significant differences in defoliation existed among the plant introductions; the means are arrayed in decreasing order of severity in Table IV. PI 227687 was significantly more susceptible to damage by the bean leaf beetle than PI 85490 which was significantly more susceptible than all other plant introductions tested. No plant introduction was significantly more resistant than the check varieties but based on percentage PI 200498 had the least amount of damage for the second year. No significant differences were found among the replications. The amount of leaf damage of each plant introduction attributable to natural insect infestations is given in Appendix
Table III. Mean number of soybean seeds with no visual stink bug damage; 1969 field test.$^a$

<table>
<thead>
<tr>
<th>Entries</th>
<th>Mean number seeds with no visual damage$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI 171451</td>
<td>77.0 a</td>
</tr>
<tr>
<td>PI 229358</td>
<td>74.0 ab</td>
</tr>
<tr>
<td>PI 227687</td>
<td>69.3 bc</td>
</tr>
<tr>
<td>PI 229321</td>
<td>66.7 cd</td>
</tr>
<tr>
<td>PI 36906</td>
<td>65.3 c-e</td>
</tr>
<tr>
<td>PI 208783</td>
<td>65.0 c-f</td>
</tr>
<tr>
<td>Semmes</td>
<td>62.7 d-g</td>
</tr>
<tr>
<td>PI 200498</td>
<td>59.3 fg</td>
</tr>
<tr>
<td>PI 183930</td>
<td>59.3 fg</td>
</tr>
<tr>
<td>PI 174865</td>
<td>59.0 gh</td>
</tr>
<tr>
<td>Bragg</td>
<td>58.3 g-i</td>
</tr>
<tr>
<td>PI 210353</td>
<td>53.3 h-j</td>
</tr>
<tr>
<td>FC 31921</td>
<td>51.3 h-k</td>
</tr>
<tr>
<td>FC 31750</td>
<td>51.3 h-k</td>
</tr>
<tr>
<td>PI 96354</td>
<td>50.7 j-l</td>
</tr>
<tr>
<td>PI 230978</td>
<td>50.3 j-m</td>
</tr>
<tr>
<td>PI 208784</td>
<td>50.3 j-m</td>
</tr>
<tr>
<td>Davis</td>
<td>49.7 j-n</td>
</tr>
<tr>
<td>Hampton</td>
<td>48.0 j-o</td>
</tr>
<tr>
<td>PI 175185</td>
<td>47.3 j-p</td>
</tr>
<tr>
<td>FC 31665</td>
<td>47.0 k-q</td>
</tr>
<tr>
<td>Lee</td>
<td>46.7 k-r</td>
</tr>
<tr>
<td>PI 85490</td>
<td>44.7 l-s</td>
</tr>
<tr>
<td>PI 200483</td>
<td>42.0 st</td>
</tr>
<tr>
<td>PI 165989</td>
<td>40.0 s-u</td>
</tr>
<tr>
<td>PI 166032</td>
<td>24.7 v</td>
</tr>
<tr>
<td>Dare</td>
<td>15.3 vw</td>
</tr>
<tr>
<td>Hill</td>
<td>11.3 w</td>
</tr>
</tbody>
</table>

$^a$Analysis of variance is given in Appendix Table 6.

$^b$Mean numbers not connected by the same letter differ significantly at the 5% level according to Duncan's Multiple Range Test.
Table IV. Mean percent of leaf damage by the bean leaf beetle; 1970 field experiment.\(^a\)

<table>
<thead>
<tr>
<th>Entries</th>
<th>Maturity group</th>
<th>Source of germ plasm</th>
<th>Mean leaf area consumed/plot(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI 227687</td>
<td>VI</td>
<td>Okinawa</td>
<td>32.1 a</td>
</tr>
<tr>
<td>PI 85490</td>
<td>VII</td>
<td>Japan</td>
<td>26.7 b</td>
</tr>
<tr>
<td>PI 210353</td>
<td>VI</td>
<td>Indonesia</td>
<td>20.7 c</td>
</tr>
<tr>
<td>PI 171451</td>
<td>VII</td>
<td>Japan</td>
<td>17.9 cd</td>
</tr>
<tr>
<td>Semmes</td>
<td>VII</td>
<td>-</td>
<td>15.3 cde</td>
</tr>
<tr>
<td>Bragg</td>
<td>VII</td>
<td>-</td>
<td>14.1 de</td>
</tr>
<tr>
<td>PI 229358</td>
<td>VIII</td>
<td>Japan</td>
<td>12.7 de</td>
</tr>
<tr>
<td>PI 200498</td>
<td>VIII</td>
<td>Japan</td>
<td>9.7 e</td>
</tr>
</tbody>
</table>

\(^a\)Analysis of variance given in Appendix Table 7.

\(^b\)Means not connected by the same letter differ significantly at the 5% level according to Duncan's Multiple Range Test.
Table 6 and ranged from 1.3 to 4.3%.

**Experiment 4 - Soybean looper:**

The number of soybean looper larvae recorded per 3 feet of row in the 1970 field screening investigations ranged from 6 to 21 with an average of 12.9. The majority of the larvae appeared to be in the third or fourth instar.

The results of the amount of leaf damage for each entry, using the visual rating system, that was caused by the soybean looper larvae during the 1970 field experiment are given in Appendix Table 7. Since the experiment was not replicated, the data were not analyzed statistically. However, there were substantial differences in susceptibility and resistance in some of the germ plasm. PI 205909, PI 274507 and the Yelredo variety were the most susceptible; La 65-13, D 63-4628, Lee and three crosses, Semmes x PI 200492, D 63-6094 x D 61-4269 and Venezuelan Selection x Improved Pelican showed some indications of resistance.

**Greenhouse Investigations, 1971**

**Experiment 5 - Soybean looper, non-replicated test.**

The results of the unreplicated greenhouse study to screen soybean entries for possible resistance to the soybean looper are given in Appendix Table 8. All data obtained on leaf damage was by the visual rating system.
Sixteen entries scored on 3-12-71 had less than 10% foliage damage (rating of 0 or 1) and no entry had more than 60% damage. All entries were scored again on 3-16-71 and the following rated less than 10% damage: Semmes, Lee, La 68-11-6, La 68-14-15, La 68-10-3, La 68-12-1, La 68-15-6, and T-145 Glabrous. Of the entries selected from the 1970 field experiment, Lee was the only entry that still showed promise of some resistance to feeding by the soybean looper. La 68-11-18, La 68-20-13, and the cross D 63-6094 x D 61-4269 rated more than 60% leaf damage. The above mentioned cross was one selected as "resistant" in the 1970 field screening. No data were recorded on PI 208782 because no seeds germinated.

**Experiment 6 - Soybean looper, replicated test:**

The results of the number of eggs oviposited per 20 leaf sample for the various soybean entries screened for resistance to the soybean looper during 1971 are given in Appendix Table 9. No significant differences existed among the entries with regard to oviposition. There was a highly significant ovipositional preference for the lower surface of the leaf exhibited by the looper. No significant interaction between the soybean strain and the surface of the leaf where the eggs were oviposited was detected.

The analysis of the results of the number of eggs oviposited on each soybean entry in the laboratory portion of the ovipositional preference experiment is given in Appendix Table 11. There were significant differences among the entries in the number of eggs oviposited on the leaves. There were significantly more eggs laid on
the lower surface than on the upper surface of the leaves. There was no significant interaction between the entry and the surface of the leaf upon which the eggs were oviposited. The means of the numbers of soybean looper eggs oviposited on the various entries are arrayed in decreasing numbers in Table V. No 1 entry could be separated from all others with regard to the number of eggs oviposited. However, significantly more eggs were laid on La 68-11-6 than on La 68-12-1 or La 68-11-18. Lee was one of the more preferred entries with regard to oviposition.

The analysis of the number of hairs per 16 mm$^2$ of leaf surface on the soybean entries that were tested for the ovipositional reaction of the soybean looper is given in Appendix Table 13. There were highly significant differences among the entries in leaf-hair density. The leaf-hair density was significantly greater on the lower surface of the leaves. There was a highly significant interaction which indicated that leaf-hair density was inconsistent over entry. The means of the leaf-hair density per 16 mm$^2$ of surface for the various entries are compared in Table VI. Although Lee was not significantly different from La 68-14-15 with regard to leaf-hair density, Lee had a significantly greater leaf-hair density than all other entries. The correlation between the leaf-hair density and the number of eggs deposited on the upper surface of the leaves was 0.391 (Appendix Table 15). The correlation between the leaf-hair density and the number of eggs deposited on the lower surface of the leaves was 0.069 (Appendix Table 16).

Considering all varieties together, the mean number of eggs oviposited/entry on the upper and lower surfaces of the leaves was
Table V. Mean numbers of soybean looper eggs oviposited on various soybean entries; 1971 laboratory experiments.a

<table>
<thead>
<tr>
<th>Entries</th>
<th>Ranked means^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>La 68-11-6</td>
<td>85.8 a</td>
</tr>
<tr>
<td>La 68-14-15</td>
<td>74.0 a</td>
</tr>
<tr>
<td>Lee</td>
<td>68.9 ab</td>
</tr>
<tr>
<td>La 68-10-3</td>
<td>61.0 abc</td>
</tr>
<tr>
<td>La 68-20-13</td>
<td>53.2 abc</td>
</tr>
<tr>
<td>PI 227687</td>
<td>47.9 abc</td>
</tr>
<tr>
<td>La 68-12-1</td>
<td>32.0 bc</td>
</tr>
<tr>
<td>La 68-11-18</td>
<td>23.7 c</td>
</tr>
</tbody>
</table>

^aAnalysis of variance shown in Appendix Table 11.

^bMeans not connected by the same letter differ significantly at the 5% level according to Duncan's Multiple Range Test.
Table VI. Mean numbers of leaf hairs/16mm² of leaf surface for various soybean entries; 1971 laboratory experiments.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Ranked means b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>115.1 a</td>
</tr>
<tr>
<td>La 68-14-15</td>
<td>96.4 ab</td>
</tr>
<tr>
<td>La 68-12-1</td>
<td>79.4 bc</td>
</tr>
<tr>
<td>La 68-11-18</td>
<td>72.3 bc</td>
</tr>
<tr>
<td>PI 227687</td>
<td>64.6 bc</td>
</tr>
<tr>
<td>La 68-10-3</td>
<td>63.9 bc</td>
</tr>
<tr>
<td>La 68-20-13</td>
<td>54.5 c</td>
</tr>
<tr>
<td>La 68-11-6</td>
<td>47.8 c</td>
</tr>
</tbody>
</table>

aAnalysis of variance given in Appendix Table 13.

bMeans not connected by the same letter differ significantly at the 5% level according to Duncan's Multiple Range Test.
177.5 and 268.9, respectively. The mean leaf-hair density (16 mm²) for all entries for the upper and lower surfaces of the leaves was 55.5 and 92.2, respectively.

Laboratory Investigations, 1971

Experiment 7 - Bean leaf beetle:
The results of the analysis of the feeding preference test for the bean leaf beetle are given in Appendix Table 17. There were no significant differences among the entries with regard to feeding by the beetles. There was a highly significant degree of variation among the replications.

Experiment 8 - Bean leaf beetle:
The results of the amount of leaf area consumed by the bean leaf beetle when caged individually on various plant introductions for a 14-day feeding period are given in Appendix Table 19. There were highly significant differences among the plant introductions in the amount of leaf consumed. There were highly significant differences in feeding by the beetles on different days throughout the feeding period. There was also a highly significant interaction which indicated that day variations were inconsistent over plant introductions or that the differences in beetle feeding per day on the different plant introductions were not the same.

The means of leaf area consumed by the beetles are compared in Table VII. PI 200498 showed significantly more resistance to feeding by the bean leaf beetle than any of the other entries tested. Excluding PI 200498 the check variety, Bragg, had significantly less leaf area
Table VII. Comparison of means of the area of leaf consumed\(^a\) by the bean leaf beetle in the 1970 field test and 1971 laboratory test.

<table>
<thead>
<tr>
<th>Plant introduction</th>
<th>Mean leaf area consumed/plot(^b)</th>
<th>Ranked means(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI 227687</td>
<td>32.1 a</td>
<td>206 a</td>
</tr>
<tr>
<td>PI 85490</td>
<td>26.7 b</td>
<td>205 a</td>
</tr>
<tr>
<td>Semmes</td>
<td>15.3 cde</td>
<td>163 b</td>
</tr>
<tr>
<td>PI 210353</td>
<td>20.7 c</td>
<td>162 b</td>
</tr>
<tr>
<td>PI 171451</td>
<td>17.9 cd</td>
<td>157 b</td>
</tr>
<tr>
<td>PI 229358</td>
<td>12.7 de</td>
<td>147 c</td>
</tr>
<tr>
<td>Bragg</td>
<td>14.1 de</td>
<td>138 d</td>
</tr>
<tr>
<td>PI 200498</td>
<td>9.7 e</td>
<td>112 e</td>
</tr>
</tbody>
</table>

\(^a\)Figures used to calculate the means represent the numbers of squares of leaf area consumed. Each square is equivalent to 4 mm\(^2\).

\(^b\)Figures are the mean percent of leaf damage caused by the bean leaf beetle in the 1970 field experiments (Table IV).

\(^c\)Means not connected by the same letter differ significant at the 5% level according to Duncan's Multiple Range Test. Analysis of variance is given in Appendix Table 19.
consumed than did any of the other plant introductions. The beetles consumed significantly less foliage on PI 229358 than when caged on the Semmes check variety but conversely PI 229358 was significantly more susceptible than Bragg. PI 227687 and PI 85490 were the most susceptible entries and had significantly greater amounts of leaf area consumed than all other entries tested.

**Experiment 9 - Soybean looper:**

The results of the analysis of pupal weights of the soybean looper are given in Appendix Table 21. There were highly significant differences among the plant introductions in the size of the pupae. No significant differences in pupal weights existed between the sexes of the soybean looper. This feeding agreed with results obtained by Mitchell (1967). Also no significant interaction between sexes and plant introductions was found. The mean pupal weights of looper reared on the various entries are arrayed in order of decreasing weights in Table VIII. Pupae from larvae reared on PI 210353, PI 200498, and PI 171451 were significantly larger than those reared on the check varieties. The pupae from larvae reared on PI 85490 weighed significantly less than pupae of the other plant introductions but were not significantly different from the pupae from the check varieties. Not enough of the 30 larvae reared on PI 229358 and PI 227687 reached the pupal stage to be included in the analysis.

Significant differences in larval mortality (Table VIII) existed among the entries according to the student's t-test ($t=7.23$). PI 200498 had the highest survival rate (73%) and PI 227687 had the lowest (3%).

The analysis to test for differences in development rates of the larvae reared on the various plant introductions is given in Appendix.
Table VIII. Percent survival, larval developmental time, and mean pupal weights of soybean loopers; 1971 laboratory tests.a

<table>
<thead>
<tr>
<th>Entries</th>
<th>Percent survival</th>
<th>Mean larval development (days)b</th>
<th>Mean pupal weights (grams)b</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI 210353</td>
<td>53</td>
<td>14.2 c</td>
<td>.1837 a</td>
</tr>
<tr>
<td>PI 200498</td>
<td>73</td>
<td>13.7 d</td>
<td>.1752 a</td>
</tr>
<tr>
<td>PI 171451</td>
<td>37</td>
<td>18.1 a</td>
<td>.1668 ab</td>
</tr>
<tr>
<td>Semmes</td>
<td>30</td>
<td>15.7 b</td>
<td>.1516 bc</td>
</tr>
<tr>
<td>Bragg</td>
<td>40</td>
<td>15.6 b</td>
<td>.1497 bc</td>
</tr>
<tr>
<td>PI 85490</td>
<td>63</td>
<td>13.3 d</td>
<td>.1319 c</td>
</tr>
</tbody>
</table>

a Percent survival for PI 229358 was 7; for PI 227687 was 3. The mean developmental times for larvae was 17.5 and 22 days for PI 229358 and PI 227687, respectively.

b Means not connected by the same letter differ significantly at the 5% level according to Duncan's Multiple Range Test. Analysis of variance are given in Appendix Table 21 and 23.
Table 23. Highly significant differences among the plant introductions in developmental rates of the larvae were found. The means of the time required for larval development on plant introductions are compared in Table VIII. Larvae reared on PI 171451 required a significantly longer time (18.2 days) to develop than on the other plant introductions. Larvae developed significantly faster when reared on PI 200498 and PI 85490 than on all other entries tested.
DISCUSSION

Field Investigations, 1969

Experiment 1 - Bean leaf beetle:

No entry could be separated from all others with regard to either susceptibility or resistance. An infestation of 250 bean leaf beetles per plot did not cause a great amount of leaf damage to any entry. PI 200483, for example, was one of the most susceptible entries but had only 11.90% leaf damage. In Louisiana insecticidal treatment is not recommended until more than 40% of the entire leaf area in a soybean field has been consumed by all leaf feeding insects of soybean (Insect Control Guide, 1971, LSU Cooperative Extension Service). Therefore, although the differences in leaf damage among the entries were measurable, they were of little practical significance from the standpoint of control.

Experiment 2 - Southern green stink bug:

Since PI 17451 (VII) and PI 229358 (VIII) are later maturing varieties than are Hill (V) and Dare (VI), host evasion, a type of pseudoresistance, may be involved. The effect of differences between early and late maturing soybean varieties was minimized by infesting the plots with stink bug nymphs when the plants were approximately at the same stage of pod development. Entries belonging to maturity groups VII and VIII, therefore, were infested with nymphs at a later date than were
plants in groups V and VI. The possibility that differences in damage was due to differences in plant maturity can be discounted by considering PI 227687 and PI 36906. These plant introductions are both in maturity group VI, yet they had significantly fewer damaged seeds than did the susceptible Dare variety.

PI 200498 which exhibited some degree of resistance to the bean leaf beetle (Table II) also showed some resistance to the Southern green stink bug although it was not significantly different from the Bragg or Semmes check varieties.

Field Investigations, 1970

Experiment 3 - Bean leaf beetle:

Apparently the 250 bean leaf beetles per plot released in 1969 (Table II) did not cause enough leaf damage to separate differences in resistance or susceptibility that might have existed among the entries. But even after infesting with 600 beetles per 3 feet of row (Table IV), the amount of leaf damage (32.1%) to the most susceptible plant introduction was relatively low. As stated previously treatment of soybean is recommended when 40% of the entire leaf area has been consumed by all leaf feeding insects.

Enough beetles should be released per plot to insure that the amount of leaf damage to the check variety will exceed the 40% economic
injury threshold. However, the large number of beetles required seriously restricts the wing clipping technique as a practical method for screening large amounts of soybean germ plasm.

Newsom (1970) found that bean leaf beetle adults that emerge from their overwintering quarters of leaf litter in wooded areas bordering soybean fields are attracted to any soybean plants that have emerged. Considering this habit of the bean leaf beetle, an alternate technique for screening large amounts of soybean germ plasm appears possible. The germ plasm to be screened should be planted in an area with a past history of high populations of bean leaf beetles. The germ plasm could be planted 1) in peat pots in the greenhouse and, after emerging, transplanted into the field or 2) planted directly in the field about two weeks prior to the planting of other soybean. The overwintering generation of bean leaf beetle adults would develop and pupate. The emerging adults could then feed on the foliage. Weekly population counts of the numbers of bean leaf beetles and other soybean insects would given an indication of the effectiveness of the method.

The proposed technique provides a method for screening for preference which was not possible in the wing clipping technique. Lastly, since the bean leaf beetle feeds on all portions of the soybean plant during some stage of its life cycle, the proposed technique would allow testing large amounts of germ plasm for resistance to the beetle larvae which feed on the roots and nodules of soybean.
**Experiment 4 - Soybean looper:**

Since the screening experiment was not replicated or analyzed statistically, conclusions must be made with reservations. A non-replicated experiment does provide a method of screening large amounts of germ plasm in a relatively short period of time. Painter (1951) stated "The results that can be secured in some aspects of resistance studies usually are proportional to the number of plants and strains that can be analyzed." Only through retesting, therefore, can the apparently resistant strains and crosses be proven to be actually resistant.

Greenhouse Investigations, 1971

**Experiment 5 - Soybean looper, non-replicated test:**

That Lee, one of Louisiana's most widely grown varieties, was the only entry that was rated resistant in both screening experiments exemplifies the fact that although no concentrated effort has been advanced to breed specifically for insect resistance in soybean, plant breeders have placed much emphasis on breeding for increased yield. Since loss due to insects is one component involved in total yield, breeding for resistance to insects in soybean has been practiced albeit unconsciously.

T-145 glabrous was the only entry to be rated 0 on 3-12-71 and 1 on 3-16-71. This entry (T-145) was planted on 2-6-71 which was 10 days later than the majority of the entries. The effect of differences in planting dates does not appear to be a significant factor because the cross, F Semmes x PI 200492 was also planted on 2-6-71 but had 30-60% leaf damage on 3-16-71 as compared to less than 10% for T-145 glabrous.
Pedigo (1970) reported that green cloverworm females strongly prefer pubescent surfaces for ovipositing and that smoothness is a characteristic of ovipositional abnegation. Differences in leaf-hair density among the resistant entries should be investigated to determine if pubescence produces an ovipositional response in the adult soybean looper.

**Experiment 6 - Soybean looper, replicated test.**

The extremely low numbers of eggs oviposited on the entries in the replicated greenhouse experiment to test the ovipositional response of the soybean looper might be due to several factors. Shorey (1963) stated that factors that might have a possible influence on the longevity of the cabbage looper adults and the number of eggs deposited by the females are 1) availability of food, 2) suitable substrate for oviposition, 3) frequency and adequacy of mating, 4) weights and ages of the adults, 5) larval nutrition and 6) climatic factors, particularly annual and diurnal fluctuations of temperature, moisture, and light. Of the above factors, the low number of eggs deposited on the plants in the replicated experiment is probably directly related to climatic factors particularly fluctuations in temperature. The greenhouse temperature ranged from 68 to 105°F during the 7-day ovipositional period. The average adult longevity of *P. includens* is 12.0 days and the average ovipositional period is 6.5 days at 80°F (Canerday and Arant, 1967). From observations made during the experiment, no live adults were observed after 2 days of the 7-day ovipositional period. Also, of 10 pairs of adults caged in the greenhouse in a 1-gallon ice cream carton and covered with a screened top, all were
dead after 48 hours. The effects of variations in temperature, light, and moisture on adult longevity and the number of eggs deposited by P. includens needs to be determined.

La 68-11-18 was scored as one of the most susceptible entries in the preliminary screening experiment to test for differences in feeding reactions of the soybean looper larvae. Conversely, in the laboratory experiment, La 68-11-18 was one of the more resistant entries with regard to oviposition. However, no inferences can be made about the relationship of oviposition by the adults and feeding by the larvae. Further research is necessary to test La 68-11-18 in feeding studies to determine if differences in survival and feeding rate of the larvae exist.

There was a habitual preference exhibited by the adult looper to oviposit on the lower surface of the leaf. This preference even existed in the laboratory experiment where the population pressure was probably much higher than would ever occur in the field. Since the correlations between leaf-hair density and number of eggs deposited on the upper surface (r=0.391) and the lower surface (r=0.069) were low, it can be concluded that leaf-hair density is not a major factor involved in the soybean looper preferring to oviposit on the lower surface of the leaves. Pedigo (1970) working with the green cloverworm stated that of the ovipositional factors studied, surface texture was the most important, with rough surfaces being the most favorable. Jones et al. (1970) found that triacetin, a chemical ingredient in felt marking pens, actively induced oviposition in the corn earworm, Heterinthis zea (Boddie). Shorey (1964) reported that oviposition by
I. ni on wax paper increased when the surface was moistened. Therefore, surface texture, moisture, color, and presence of a chemical are some factors, other than leaf-hair density, that may be involved in the soybean looper exhibiting an ovipositional preference for the lower surface of the leaves.

Laboratory Investigations, 1971

Experiment 7 - Bean leaf beetle:

Observations made during the experiment indicated that the bean leaf beetle had a tendency to feed indiscriminately on the soybean germ plasm tested. Since no significant differences were found among entries, feeding preference by the bean leaf beetle does not appear to be a major factor involved in the differences in feeding on the plant introductions.

Experiment 8 - Bean leaf beetle:

The results obtained from the 1970 field tests compare well with the results obtained by caging bean leaf beetles directly on the leaflet. Comparison of the means of the area of foliage consumed by beetles in both experiments (Table VII) show that the two plant introductions (PI 227687 and PI 85490) which were the most susceptible in the field were also the most susceptible in the laboratory experiment. Although PI 200498 was not significantly different from the check varieties in the 1970 field experiment, it did have the lowest percentage of damage. When beetles were caged directly on the plant introductions, however, PI 200498 was significantly more resistant than all other germ plasm tested. The laboratory technique, therefore, offers a useful method
for screening large amounts of soybean germ plasm for responses to feeding by adult bean leaf beetles.

Some of the more obvious advantages of the laboratory screening technique over the field technique are: 1) germ plasm can be screened continuously, 2) time required to screen the same amount of germ plasm is drastically reduced, 3) less variation in the response of the germ plasm to climatic and edaphic factors, 4) the source of the damage is known thereby eliminating variation in foliage damage due to all defoliators, especially the damage caused by other Chrysomelidae which cannot be separated from that of the bean leaf beetle, and 5) the possibility exists of screening for resistance other than to foliage feeding. For example, differences that might occur in mortality or in fecundity of females fed on different soybean germ plasm.

**Experiment 9 - Soybean looper:**

The high mortality of soybean looper larvae when fed on PI 229358 (93%) and PI 227687 (97%) indicates that some form of antibiosis is involved. Painter (1951) stated that the effects of antibiosis on the insect take the form of reduced fecundity, decreased size, abnormal length of life, and increased mortality. He further stated that mortality usually occurs in the first instar or the stages just preceding the adult stage. The majority of the larvae (22 of the 30) reared on PI 227687 died within 2 days after the first instar loopers were placed on the leaves. Further research involving the feeding of looper larvae on the 2 above mentioned plant introductions is needed to determine:
1) the mortality in each larval instar, 2) larval mortality at different stages of growth of the plants (for example, rear larvae on leaves of plants that are one month old or on leaves of plants that are blooming), 3) developmental rate, 4) weight of pupae, and 5) fecundity of the adult loopers.

Conflicting results in survival rate, developmental time and pupal weights were obtained. For example, the pupae from larvae reared on PI 171451 were large (0.1668 gms), the mortality high (73%) and time required for larval development (18.1 days) was significantly longer than the other plant introductions. Conversely, pupae from larvae reared on PI 85490 were small (0.1319 gms), mortality was rather low (37%) and larval development was rapid (13.3 days). Conclusions, therefore, must be drawn with reservations.

What effect does the size of the adults have on fecundity and longevity? What effect does a 26% increase in rate of development of the larvae have on an insect such as the soybean looper which undergoes 3 and possibly 4 generations per year on soybean (Burleigh, 1970)? These are pertinent questions that are at present unanswered.
CONCLUSIONS

Variations in response to one or more insect species were found to exist among the soybean germ plasm tested. The plant introduction PI 200498 contained the highest levels of resistance to foliage feeding by the bean leaf beetle whereas PI 227687 and PI 85490 were the least susceptible. However, high larval mortality, mainly first instars, resulted when soybean looper larvae were reared on PI 227687 and PI 229358. PI 227687, therefore, is resistant to foliage feeding by the soybean looper but is susceptible to foliage feeding by the bean leaf beetle.

Significant differences were found in pupal weights when larvae of the soybean looper were reared on different soybean germ plasm. The soybean looper was also found to habitually prefer to oviposit on the lower surface of soybean leaves. However, leaf-hair density does not appear to be a significant factor involved in the soybean looper moth preferring to oviposit on the lower surface of the leaves.

A laboratory procedure for screening germ plasm for resistance to the bean leaf beetle by caging the beetles directly on a soybean leaflet compared well with results obtained in field tests. The laboratory technique, therefore, offers a useful method for screening large amounts of soybean germ plasm for responses to feeding by adult bean leaf beetles.
Differences in response to feeding by the adult bean leaf beetle existed among the germ plasm. PI 200498 contained moderate resistance to foliage feeding by the bean leaf beetle in field and laboratory tests. However, feeding preference does not appear to be a significant factor involved in the differences in feeding by the bean leaf beetle on the germ plasm.

Differences also existed in the response of soybean germ plasm to attack by the Southern green stink bug as measured by seed damage. Of the germ plasm tested, PI 171451 and PI 229358 were found to contain moderate levels of resistance to the Southern green stink bug. PI 229358, therefore, appears to contain multiple resistance to foliage feeding by the soybean looper and to seed damage by the Southern green stink bug.
REFERENCES CITED
REFERENCES CITED


Wolfenbarger, D. A. 1963. Variation in susceptibility of soybean pubescent types, broad bean and runner bean varieties and plant introductions to the potato leafhopper. J. Econ. Entomol. 56: 895-897.

Wuensche, A. 1971 Unpublished data on file, Department of Entomology. Louisiana State University, Baton Rouge, Louisiana.
Table 1. Analysis of variance of percent of leaf damage by the bean leaf beetle on various soybean entries in 1969 field experiments.

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
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<td>-</td>
</tr>
<tr>
<td>Replications</td>
<td>1</td>
<td>10.92**</td>
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<tr>
<td>Entries</td>
<td>27</td>
<td>15.76*</td>
</tr>
<tr>
<td>Residual</td>
<td>27</td>
<td>6.43</td>
</tr>
</tbody>
</table>

*Figures used in the analysis are given in Appendix Table 2.*
Table 2. Percent leaf damage by the bean leaf beetle on various entries; 1969 field test.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Replications</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Replications</td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>PI 200489</td>
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<td>Hampton</td>
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<td>5.8</td>
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<td>5.1</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>PI 174865</td>
<td>15.4</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Bragg</td>
<td>3.7</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>PI 175185</td>
<td>9.5</td>
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<td></td>
</tr>
<tr>
<td>PI 183930</td>
<td>4.9</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>PI 208783</td>
<td>6.6</td>
<td>4.9</td>
<td></td>
</tr>
<tr>
<td>PI 85490</td>
<td>6.0</td>
<td>2.9</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Davis</td>
<td>9.3</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>PI 210353</td>
<td>4.9</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>PI 227687</td>
<td>5.9</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Lee</td>
<td>3.3</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>FC 31665</td>
<td>3.2</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>PI 36906</td>
<td>5.3</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>PI 230978</td>
<td>3.0</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>PI 96354</td>
<td>4.4</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Dare</td>
<td>5.6</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>PI 200483</td>
<td>14.7</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>Hill</td>
<td>4.6</td>
<td>4.3</td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Analysis of variance\textsuperscript{a} for the number of soybean seeds with no visual signs of Southern green stink bug damage.\textsuperscript{b}

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>83</td>
<td>-</td>
</tr>
<tr>
<td>Replications</td>
<td>2</td>
<td>743.0\textsuperscript{*}</td>
</tr>
<tr>
<td>Entries</td>
<td>27</td>
<td>714.7\textsuperscript{**}</td>
</tr>
<tr>
<td>Residual</td>
<td>54</td>
<td>181.4</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Figures used in the analysis are given in Appendix Table 4.

\textsuperscript{b}Random sample of 100 seeds obtained from soybean entries in the 1969 field experiments.
Table 4. Number of soybean seeds with no visual stink bug damage; 1969 field experiments.

<table>
<thead>
<tr>
<th>Plant introduction or variety</th>
<th>No. of seeds/100 seed sample with no visual stink bug damage</th>
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<tr>
<td>PI 200498</td>
<td>61</td>
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<tr>
<td>FC 31750</td>
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<td>38</td>
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<tr>
<td>Semmes</td>
<td>64</td>
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<tr>
<td>PI 171451</td>
<td>86</td>
</tr>
<tr>
<td>PI 174865</td>
<td>63</td>
</tr>
<tr>
<td>Bragg</td>
<td>31</td>
</tr>
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<td>PI 175185</td>
<td>50</td>
</tr>
<tr>
<td>PI 183930</td>
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</tr>
<tr>
<td>PI 208783</td>
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</tr>
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<td>PI 85490</td>
<td>25</td>
</tr>
<tr>
<td>FC 31921</td>
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</tr>
<tr>
<td>PI 165989</td>
<td>48</td>
</tr>
<tr>
<td>Davis</td>
<td>77</td>
</tr>
<tr>
<td>PI 210353</td>
<td>41</td>
</tr>
<tr>
<td>PI 227687</td>
<td>77</td>
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<tr>
<td>Lee</td>
<td>17</td>
</tr>
<tr>
<td>FC 31665</td>
<td>43</td>
</tr>
<tr>
<td>PI 36906</td>
<td>46</td>
</tr>
<tr>
<td>PI 230978</td>
<td>48</td>
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<td>PI 96354</td>
<td>54</td>
</tr>
<tr>
<td>Dare</td>
<td>19</td>
</tr>
<tr>
<td>PI 200483</td>
<td>38</td>
</tr>
<tr>
<td>H11</td>
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</table>
Table 5. Analysis of variance of the percent leaf damage by the bean leaf beetle; 1970 field experiment.\(^a\)

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
</thead>
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<tr>
<td>Total</td>
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<tr>
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<td>Entries</td>
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<td>Residual</td>
<td>21</td>
<td>12.59</td>
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\(^a\)Figures used in the analysis are given in Appendix Table 6.
Table 6. Percentage of leaf area consumed by the bean leaf beetle; 1970 field plot resistance studies.\(^a\)

<table>
<thead>
<tr>
<th>Entries</th>
<th>Control</th>
<th>Replications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>PI 227687</td>
<td>3.9</td>
<td>30.2</td>
</tr>
<tr>
<td>PI 85490</td>
<td>4.3</td>
<td>22.7</td>
</tr>
<tr>
<td>PI 210353</td>
<td>1.9</td>
<td>20.2</td>
</tr>
<tr>
<td>PI 171451</td>
<td>2.1</td>
<td>16.1</td>
</tr>
<tr>
<td>Semmes</td>
<td>1.6</td>
<td>12.0</td>
</tr>
<tr>
<td>Bragg</td>
<td>3.2</td>
<td>16.1</td>
</tr>
<tr>
<td>PI 229358</td>
<td>1.3</td>
<td>17.6</td>
</tr>
<tr>
<td>PI 200498</td>
<td>1.4</td>
<td>8.4</td>
</tr>
</tbody>
</table>

\(^a\)Control represents percentage of foliage damage to plants due to natural insect infestation.
Table 7. Entries screened for resistance to the soybean looper; 1970 field plot test.\(^a\)

<table>
<thead>
<tr>
<th>Entry numbers</th>
<th>Leaf damage</th>
<th>Entry numbers</th>
<th>Leaf damage</th>
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<tbody>
<tr>
<td>PI 31592</td>
<td>2</td>
<td>PI 208435</td>
<td>3</td>
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<tr>
<td>PI 174859</td>
<td>2</td>
<td>PI 247679</td>
<td>2</td>
</tr>
<tr>
<td>PI 181696</td>
<td>3</td>
<td>PI 259538</td>
<td>2</td>
</tr>
<tr>
<td>PI 181697</td>
<td>2</td>
<td>PI 259542</td>
<td>2</td>
</tr>
<tr>
<td>PI 181698</td>
<td>2</td>
<td>PI 259543</td>
<td>3</td>
</tr>
<tr>
<td>PI 181699</td>
<td>2</td>
<td>PI 262180</td>
<td>3</td>
</tr>
<tr>
<td>PI 174854</td>
<td>2</td>
<td>PI 265498</td>
<td>2</td>
</tr>
<tr>
<td>PI 183485</td>
<td>3</td>
<td>PI 274507</td>
<td>4</td>
</tr>
<tr>
<td>PI 183900</td>
<td>3</td>
<td>PI 281913</td>
<td>2</td>
</tr>
<tr>
<td>PI 184773</td>
<td>2</td>
<td>PI 285096</td>
<td>2</td>
</tr>
<tr>
<td>PI 197182</td>
<td>3</td>
<td>La 65-14</td>
<td>2</td>
</tr>
<tr>
<td>PI 200521</td>
<td>3</td>
<td>La 65-13</td>
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<tr>
<td>PI 200526</td>
<td>3</td>
<td>D 65-8241</td>
<td>3</td>
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<tr>
<td>PI 200550</td>
<td>2</td>
<td>D 63-4628</td>
<td>1</td>
</tr>
<tr>
<td>PI 200551</td>
<td>2</td>
<td>D 65-8232</td>
<td>2</td>
</tr>
<tr>
<td>PI 200832</td>
<td>2</td>
<td>Nanda</td>
<td>2</td>
</tr>
<tr>
<td>PI 204335</td>
<td>2</td>
<td>Neila</td>
<td>2</td>
</tr>
<tr>
<td>PI 204337</td>
<td>2</td>
<td>Ootootan</td>
<td>3</td>
</tr>
<tr>
<td>PI 204338</td>
<td>2</td>
<td>Seminole</td>
<td>2</td>
</tr>
<tr>
<td>PI 204340</td>
<td>2</td>
<td>White Biloxi</td>
<td>3</td>
</tr>
<tr>
<td>PI 204398</td>
<td>2</td>
<td>Yelnanda</td>
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<td>PI 204399</td>
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<td>Yelredo</td>
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<tr>
<td>PI 204400</td>
<td>2</td>
<td>Arisoy</td>
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<td>PI 204402</td>
<td>2</td>
<td>Avoylles</td>
<td>2</td>
</tr>
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<td>PI 204403</td>
<td>2</td>
<td>Barchot</td>
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</tr>
<tr>
<td>PI 205899</td>
<td>3</td>
<td>Biloxi</td>
<td>3</td>
</tr>
<tr>
<td>PI 205901</td>
<td>3</td>
<td>Cherokee</td>
<td>3</td>
</tr>
<tr>
<td>PI 205902</td>
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</tr>
<tr>
<td>PI 205903</td>
<td>3</td>
<td>Mamloxi</td>
<td>3</td>
</tr>
<tr>
<td>PI 205906</td>
<td>3</td>
<td>Mamoton-6640</td>
<td>3</td>
</tr>
<tr>
<td>PI 205907</td>
<td>3</td>
<td>Majos</td>
<td>2</td>
</tr>
<tr>
<td>PI 205908</td>
<td>2</td>
<td>Lee</td>
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</tr>
<tr>
<td>PI 205909</td>
<td>4</td>
<td>La. Green</td>
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</tr>
<tr>
<td>PI 205910</td>
<td>3</td>
<td>J.E.W. 45</td>
<td>3</td>
</tr>
<tr>
<td>PI 205911</td>
<td>2</td>
<td>Acadian</td>
<td>3</td>
</tr>
<tr>
<td>PI 205912</td>
<td>2</td>
<td>Semmes x PI 200492</td>
<td>1</td>
</tr>
<tr>
<td>PI 205913</td>
<td>3</td>
<td>BNVL(^b) x D 58-3358</td>
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<td>PI 205194</td>
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<td>Bragg x PI 200492</td>
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</tr>
<tr>
<td>PI 208430</td>
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<td>D 63-6094 x D 61-4269</td>
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</tr>
<tr>
<td>PI 208434</td>
<td>2</td>
<td>VENZ Sel.(^c) x Imp. Pel.</td>
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</tr>
</tbody>
</table>

\(^a\)Test not replicated. \(^b\)Bienville. \(^c\)Venezuelan selection.
Table 8. Unreplicated test to screen soybean entries for possible resistance to the soybean looper.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Leaf damage Date rated</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>3/12/71</td>
</tr>
<tr>
<td>Tokyo</td>
<td>2</td>
</tr>
<tr>
<td>Missoy</td>
<td>2</td>
</tr>
<tr>
<td>Temm-Nom.Pop.</td>
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</tr>
<tr>
<td>Creole</td>
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</tr>
<tr>
<td>Mammoth Yellow</td>
<td>2</td>
</tr>
<tr>
<td>Pacahontas</td>
<td>2</td>
</tr>
<tr>
<td>PI 208782</td>
<td>-</td>
</tr>
<tr>
<td>PI 82312</td>
<td>2</td>
</tr>
<tr>
<td>PI 166147</td>
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<tr>
<td>PI 200449</td>
<td>2</td>
</tr>
<tr>
<td>PI 221715</td>
<td>1</td>
</tr>
<tr>
<td>PI 229358</td>
<td>1</td>
</tr>
<tr>
<td>Coker 6875</td>
<td>2</td>
</tr>
<tr>
<td>Bragg</td>
<td>3</td>
</tr>
<tr>
<td>PI 210353</td>
<td>2</td>
</tr>
<tr>
<td>PI 85490</td>
<td>2</td>
</tr>
<tr>
<td>Semmes</td>
<td>1,1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Lee</td>
<td>1</td>
</tr>
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<td>2</td>
</tr>
<tr>
<td>La 68-11-18</td>
<td>3</td>
</tr>
<tr>
<td>D63-6094 x D61-4269</td>
<td>3</td>
</tr>
<tr>
<td>La 68-11-14</td>
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</tr>
<tr>
<td>La 68-14-6</td>
<td>2</td>
</tr>
<tr>
<td>La 65-13</td>
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</tr>
<tr>
<td>La 68-11-6</td>
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<tr>
<td>La 68-19-4</td>
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<tr>
<td>VENX. SEL. X IMP. PEL.</td>
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</tr>
<tr>
<td>La 68-14-15</td>
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</tr>
<tr>
<td>La 68-14-2</td>
<td>2</td>
</tr>
<tr>
<td>Dr 63-4628</td>
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</tr>
<tr>
<td>La 68-14-12</td>
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</tr>
<tr>
<td>La 68-10-3</td>
<td>1</td>
</tr>
<tr>
<td>La 68-14-9</td>
<td>1</td>
</tr>
<tr>
<td>Semmes X PI 200492</td>
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<tr>
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<td>La 68-14-8</td>
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<tr>
<td>La 68-11-8</td>
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<tr>
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<td>2</td>
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<tr>
<td>La 68-14-3</td>
<td>2</td>
</tr>
<tr>
<td>La 68-20-13</td>
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</tr>
<tr>
<td>La 68-19-10</td>
<td>3</td>
</tr>
<tr>
<td>La 68-12-1</td>
<td>1</td>
</tr>
<tr>
<td>La 68-15-6</td>
<td>2</td>
</tr>
</tbody>
</table>

<sup>a</sup>Planted on 2-6-71 instead of 1-27-71.
Table 8. (Continued)

<table>
<thead>
<tr>
<th>Entries</th>
<th>Leaf damage Date rated</th>
<th>Date rated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3/12/71</td>
<td>3/16/71</td>
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<tr>
<td>La 68-11-11</td>
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<td>2</td>
</tr>
<tr>
<td>La 68-10-5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>La 68-15-9</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>La 68-14-3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>La 68-15-13</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>La 68-14-7</td>
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<td>3</td>
</tr>
<tr>
<td>T-145 glabrous&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>1</td>
</tr>
<tr>
<td>F&lt;sub&gt;5&lt;/sub&gt; Semmes X PI 200492&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

<sup>a</sup>Planted on 2-6-71 instead of 1-27-71.
Table 9. Analysis of variance of the number of soybean looper eggs and larvae recorded on 20 leaves of various soybean entries; 1971 replicated resistance experiment.\(^a\)

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>63</td>
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<tr>
<td>Replications</td>
<td>3</td>
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<tr>
<td>Entries</td>
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<td>4.6 ns</td>
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<tr>
<td>error a</td>
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<td>6.6</td>
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<tr>
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<td>72.5***</td>
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<td>Entry x Surface</td>
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<td>2.6 ns</td>
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<tr>
<td>error b</td>
<td>24</td>
<td>4.5</td>
</tr>
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</table>

\(^a\)Figures used in the analysis are given in Appendix Table 10.
Table 10. Numbers of eggs and larvae recorded on two areas of 20 leaves of each entry in the 1971 greenhouse experiment to test for ovipositional preference of the soybean looper.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Area of Leaf</th>
<th>Number of eggs and larvae/20 leaf sample Replications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top</td>
<td>I</td>
</tr>
<tr>
<td>La 68-11-6</td>
<td>Top</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bottom</td>
<td>0</td>
</tr>
<tr>
<td>La 68-14-15</td>
<td>Top</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bottom</td>
<td>0</td>
</tr>
<tr>
<td>La 68-10-3</td>
<td>Top</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bottom</td>
<td>3</td>
</tr>
<tr>
<td>Lee</td>
<td>Top</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bottom</td>
<td>0</td>
</tr>
<tr>
<td>La 68-12-1</td>
<td>Top</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bottom</td>
<td>2</td>
</tr>
<tr>
<td>La 68-20-13</td>
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</tr>
<tr>
<td></td>
<td>Bottom</td>
<td>11</td>
</tr>
<tr>
<td>La 68-11-18</td>
<td>Top</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bottom</td>
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<tr>
<td>PI 227687</td>
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</tr>
<tr>
<td></td>
<td>Bottom</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 11. Analysis of variance of the number of soybean looper eggs oviposited on various soybean entries; 1971 laboratory experiments.\(^a\)

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
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<tbody>
<tr>
<td>Total</td>
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<td>-</td>
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<tr>
<td>Replications</td>
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<td>Entries</td>
<td>7</td>
<td>3549(^\ast)</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>Entries X Surfaces</td>
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<td>1817 ns</td>
</tr>
<tr>
<td>error b</td>
<td>24</td>
<td>1216</td>
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</table>

\(^a\)Figures used in the analysis are given in Appendix Table 12.
Table 12. Number of soybean looper eggs oviposited on various soybean entries; 1971 laboratory experiments.

<table>
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<tr>
<th>Entries</th>
<th>Area of leaf</th>
<th>Replications</th>
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<th></th>
<th></th>
<th></th>
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<td>II</td>
<td>III</td>
<td>IV</td>
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<td>La 68-11-6</td>
<td>Upper</td>
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<td>93</td>
<td>34</td>
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<tr>
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<td>73</td>
<td>102</td>
<td>71</td>
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<td>62</td>
<td>61</td>
<td>127</td>
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<tr>
<td></td>
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<td>58</td>
<td>29</td>
<td>98</td>
<td></td>
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<tr>
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<td>Upper</td>
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<td>42</td>
<td>56</td>
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</tr>
<tr>
<td></td>
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<td>77</td>
<td>57</td>
<td>17</td>
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<tr>
<td>Lec</td>
<td>Upper</td>
<td>93</td>
<td>66</td>
<td>11</td>
<td>32</td>
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<tr>
<td></td>
<td>Lower</td>
<td>164</td>
<td>34</td>
<td>115</td>
<td>36</td>
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<tr>
<td>La 68-12-1</td>
<td>Upper</td>
<td>111</td>
<td>18</td>
<td>27</td>
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<tr>
<td></td>
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<td>2</td>
<td>39</td>
<td>18</td>
<td></td>
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<tr>
<td>La 68-20-13</td>
<td>Upper</td>
<td>17</td>
<td>30</td>
<td>34</td>
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<td></td>
<td>Lower</td>
<td>162</td>
<td>73</td>
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<td>28</td>
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<tr>
<td>La 68-11-18</td>
<td>Upper</td>
<td>12</td>
<td>12</td>
<td>14</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>25</td>
<td>28</td>
<td>59</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>PI 227687</td>
<td>Upper</td>
<td>96</td>
<td>30</td>
<td>44</td>
<td>22</td>
<td></td>
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<tr>
<td></td>
<td>Lower</td>
<td>101</td>
<td>43</td>
<td>14</td>
<td>33</td>
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</table>
Table 13. Analysis of variance of the number of hairs per 16 mm² of leaf surface; 1971 soybean looper laboratory test.

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>159</td>
<td>-</td>
</tr>
<tr>
<td>Entries</td>
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<td>9955*</td>
</tr>
<tr>
<td>Error a</td>
<td>72</td>
<td>2524</td>
</tr>
<tr>
<td>Surfaces</td>
<td>1</td>
<td>51732**</td>
</tr>
<tr>
<td>Entries x Surfaces</td>
<td>7</td>
<td>1802**</td>
</tr>
<tr>
<td>Error b</td>
<td>72</td>
<td>393</td>
</tr>
</tbody>
</table>

*Figures used in the analysis are given in Appendix Table 14.*
Table 14. Number of hairs/16 mm\(^2\) of leaf surface for soybean entries that were tested for resistance to the soybean looper.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Area of leaf</th>
<th>Number of hairs/leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>La 68-11-6</td>
<td>Upper</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>63</td>
</tr>
<tr>
<td>La 68-14-15</td>
<td>Upper</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>96</td>
</tr>
<tr>
<td>La 68-10-3</td>
<td>Upper</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>86</td>
</tr>
<tr>
<td>Lee</td>
<td>Upper</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>125</td>
</tr>
<tr>
<td>La 68-12-1</td>
<td>Upper</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>134</td>
</tr>
<tr>
<td>La 68-20-13</td>
<td>Upper</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>74</td>
</tr>
<tr>
<td>La 68-11-18</td>
<td>Upper</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>54</td>
</tr>
<tr>
<td>PI 227687</td>
<td>Upper</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>50</td>
</tr>
</tbody>
</table>
Table 15. Correlation of leaf-hair density and the number of eggs oviposited by the soybean looper on the upper surface of various soybean entries; 1971 laboratory experiments.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Leaf-hair density(^a)</th>
<th>Number(^b) of Eggs</th>
<th>Cross Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>776</td>
<td>202</td>
<td>5112</td>
</tr>
<tr>
<td>La 68-14-15</td>
<td>735</td>
<td>305</td>
<td>21844</td>
</tr>
<tr>
<td>La 68-12-1</td>
<td>602</td>
<td>167</td>
<td>-429</td>
</tr>
<tr>
<td>PI 227687</td>
<td>594</td>
<td>192</td>
<td>434</td>
</tr>
<tr>
<td>La 68-11-18</td>
<td>585</td>
<td>53</td>
<td>-2750</td>
</tr>
<tr>
<td>La 68-10-3</td>
<td>506</td>
<td>192</td>
<td>-798</td>
</tr>
<tr>
<td>La 68-20-13</td>
<td>359</td>
<td>99</td>
<td>16116</td>
</tr>
<tr>
<td>La 68-11-6</td>
<td>343</td>
<td>210</td>
<td>-7040</td>
</tr>
</tbody>
</table>

\(^a\)Figures represent the number of hairs recorded on 160 mm\(^2\) of leaf surface.

\(^b\)Figures are totals of the number of eggs recorded on the upper surface of 4 leaves.
Table 16. Correlation of leaf-hair density and the number of eggs oviposited by the soybean looper on the lower surface various of soybean entries; 1971 laboratory experiments.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Leaf-hair density</th>
<th>Number of eggs</th>
<th>Cross Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>1526</td>
<td>349</td>
<td>48000</td>
</tr>
<tr>
<td>La 68-14-15</td>
<td>1193</td>
<td>287</td>
<td>4806</td>
</tr>
<tr>
<td>La 68-12-1</td>
<td>968</td>
<td>89</td>
<td>10800</td>
</tr>
<tr>
<td>La 68-11-18</td>
<td>860</td>
<td>136</td>
<td>8778</td>
</tr>
<tr>
<td>PI 227687</td>
<td>698</td>
<td>191</td>
<td>17786</td>
</tr>
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<td>La 68-10-3</td>
<td>772</td>
<td>296</td>
<td>-4158</td>
</tr>
<tr>
<td>La 68-20-13</td>
<td>730</td>
<td>326</td>
<td>-11172</td>
</tr>
<tr>
<td>La 68-11-6</td>
<td>642</td>
<td>447</td>
<td>59072</td>
</tr>
</tbody>
</table>

\[ r = 0.069 \]

\textsuperscript{a}Figures represent the number of hairs recorded on 16 mm\(^2\) of leaf surface.

\textsuperscript{b}Figures are totals of the numbers of eggs recorded on the lower surface of 4 leaves.
Table 17. Analysis of variance for the mean area of leaf surface consumed by the bean leaf beetle after 96 hours of exposure to various soybean entries; 1971 laboratory tests.a

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>Replications</td>
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<td>8161**</td>
</tr>
<tr>
<td>Entries</td>
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<td>912 ns</td>
</tr>
<tr>
<td>Residual</td>
<td>14</td>
<td>717</td>
</tr>
</tbody>
</table>

aFigures used in the analysis are given in Appendix Table 18.
Table 18. Mean area of leaf surface consumed by the bean leaf beetle after 96 hours of exposure to soybean entries; 1971 laboratory cage tests.

<table>
<thead>
<tr>
<th>Entries</th>
<th>Replications (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>PI 171451</td>
<td>239.2</td>
</tr>
<tr>
<td>PI 200498</td>
<td>587.2</td>
</tr>
<tr>
<td>PI 229358</td>
<td>305.2</td>
</tr>
<tr>
<td>PI 227687</td>
<td>192.0</td>
</tr>
<tr>
<td>PI 85490</td>
<td>324.0</td>
</tr>
<tr>
<td>PI 210353</td>
<td>345.2</td>
</tr>
<tr>
<td>Bragg</td>
<td>688.0</td>
</tr>
<tr>
<td>Semmes</td>
<td>334.0</td>
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</table>
Table 19. Analysis of variance for the leaf area consumed in a 14 day feeding period by the bean leaf beetle; 1971 laboratory experiments.

<table>
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<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
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<tr>
<td>Plant Introductions</td>
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<td>Plant Introduction x Day</td>
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<td>256.49***</td>
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<td>Error b</td>
<td>936</td>
<td>121.88</td>
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</table>

*Figures used in the analysis are given in Appendix Table 20.*
Table 20. Area of leaf consumed by the bean leaf beetle when confined for 14 days on
leaflets of various entries; 1971 laboratory experiment.

PI 171451

<table>
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<th>Number of squares consumed/day^a</th>
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<tr>
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<tr>
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<td>0</td>
</tr>
<tr>
<td>4</td>
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<td>14</td>
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</tr>
<tr>
<td>7</td>
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<td>9</td>
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<tr>
<td>10</td>
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</table>

PI 200498

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<td>16</td>
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<td>2</td>
<td>5</td>
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Table 20. (Continued)

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<tr>
<td>5</td>
<td>0 2 7 0 12 1 5 9 10 11 17 12 19 18</td>
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</tr>
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<td>18 26 23 19 27 0 32 0 8 9 9 1 3 12</td>
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<td>3</td>
<td>27 3 10 16 22 5 26 3 26 19 21 12 15 23</td>
</tr>
<tr>
<td>4</td>
<td>1 0 2 24 43 6 29 30 24 23 20 28 5 10</td>
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</table>
Table 20. (Continued)

PI 85490

<table>
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<td>18</td>
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<td>27</td>
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</tbody>
</table>

PI 210353

| Insect |           |
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*a Figures represent the number of squares (5 squares/centimeter) of leaf material consumed by an individual bean leaf beetle/day/plant introduction. Each square is equivalent to 4 mm²."
Table 21. Least squares analysis of variance for pupal weights of the soybean looper; 1971 laboratory experiments.

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\(^a\)Figures used in the analysis are given in Appendix Table 22.
Table 22. Weights and sex of soybean looper pupae; 1971 laboratory experiments.\(^a\)

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\(^a\)PI 229358 and PI 227687 were not included in analysis because of high larval mortality.
Table 23. Analysis of variance of development rate of soybean looper larvae; 1971 laboratory tests.  

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*Figures used in the analysis are given in Appendix Table 24.*
Table 24. Developmental time (hatch to prepupa) for soybean looper larvae reared on various soybean entries; 1971 laboratory test.

Days required for larval development

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aNot included in the analysis because of high larval mortality.
VITA

Richard Leland Jensen was born in Stanton, Nebraska, June 1, 1937. He was graduated from Stanton High School in May, 1955. He was active in farming until 1959. He married Susanne Maria Dienhart of Beckingen, West Germany in 1959. He is the father of two sons, Markus M. and Christof M.

From September, 1959 to January, 1963, he attended Southeastern Louisiana College, Hammond, Louisiana, where he received a Bachelor of Science degree in Zoology. Until 1965, he was employed as a quality control chemist at Solvay Chemical Corporation. In September, 1965, he entered Louisiana State University as a graduate assistant in the Department of Entomology and received the Master of Science Degree in January, 1968. Since June, 1968, he has been employed full-time as an Associate in the Department of Entomology. He is currently a candidate for the Doctor of Philosophy Degree.
EXAMINATION AND THESIS REPORT

Candidate: Richard Leland Jensen

Major Field: Entomology

Title of Thesis: Evaluation of Soybean Germ Plasm for Resistance to the Bean Leaf Beetle, Cerotoma trifurcata (Forster), the Southern Green Stink Bug, Nezara viridula (Linnaeus), and the Soybean Looper, Pseudoplusia includens Walker

Approved:

[Signatures and positions]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination: