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Effect of 43 Foreign and Domestic Cotton Cultivars and Strains on Growth of Tobacco Budworm Larvae[1]

Lavone Lambert[2], Johnie N. Jenkins, William L. Parrott, and Jack C. McCarty[3]

ABSTRACT

Weights were determined for tobacco budworm, *Heliothis virescens* F., larvae grown from hatching to 5 days of age on excised terminal leaves from a selected set of 35 foreign and eight 8 USA cotton, *Gossypium hirsutum* L., cultivars and strains. These data supplement previously published information from our laboratory for these cultivars and strains on resistance to three other insect pests and on agronomic, fiber property, morphological, and disease resistance measurements from Oklahoma. Larvae reared on 'BJA 592', 'Laxmi', 'SATU 65', MO-HG, and HG-BR-8-N were significantly (P = 0.5) smaller than those on 'Deltapine 16'. Larvae reared on Laxmi were also significantly smaller than those on 'Stoneville 213'.

***Additional index words:* Lepidoptera, Noctuidae, *Heliothis virescens* F., *Gossypium hirsutum* L., Antibiosis.**

THIRTY-NINE foreign and domestic cotton, *Gossypium hirsutum* L., cultivars from 12 countries and four continents were characterized by Samayoa-Armienta (1974) in Oklahoma for their agronomic and fiber properties, disease resistance, and morphological characteristics. He measured 53 characters on each cultivar and established that this was indeed a diverse group of cottons. We evaluated the same 32 foreign cultivars he studied plus one additional foreign cultivar and two foreign lines (plus eight domestic cultivars and lines) for their responses to the boll weevil, *Anthonomus grandis* Boh.; tarnished plant bug, *Lygus lineolaris* Palisot de Beauvois; bandedwing whitefly, *Trialeurodes abutilonea* Haldeman; and tobacco budworm, *Heliothis virescens* F.

These evaluations for four major cotton pests supplement the information gathered by Samayoa-Armienta (1974) and would have proven useful whether or not new sources of insect resistance were detected. The combined results of these studies will characterize the 35 foreign cultivars and strains more fully and serve as a guide to cotton breeders considering them for use in breeding programs. Resistance to tarnished plant bug was reported in five cultivars from Bulgaria and in two cultivars from Russia (Lambert et al., 1980b). A reduction in boll weevil oviposition compared to that on 'Deltapine 16' was obtained in four cultivars and one line when weevils were caged on squares from this group of foreign germplasm (Lambert et al., 1980a). One foreign cultivar from Russia had fewer bandedwing whiteflies than did Deltapine 16 (Lambert, 1977).

Parrott et al. (1978) reported a technique for the evaluation of growth rate of *H. virescens* larvae on cotton strains. Newly hatched larvae were placed on excised terminal cotton leaves and held in the laboratory for 5 days, at which time the weight of each larva was determined. They evaluated 34 cotton entries and reported that after 5 days, *H. virescens* larvae reared on 14 of them weighed significantly less than did those reared on Deltapine 16. Thirty of those tested were photoperiodic race stocks of *G. hirsutum,* two were cultivars, one was a glandless line, and another was a high gossypol line. Their data on weight of larvae at 5 days was stratified with the largest larvae being those reared on the Deltapine experimental, smoothleaf, glandless line and very small larvae being reared on the high gossypol line. The rationale upon which the technique is based was discussed by the authors. Because the technique appeared useful, we employed it in our evaluations of the 35 foreign and eight domestic cotton cultivars and breeding lines reported herein.

The objective of this research was to characterize growth of *H. virescens* larvae on the 43 cultivars and strains from hatching to Day 5.

MATERIALS AND METHODS

The 35 foreign cultivars and lines, plus two USA Delta-type cultivars (i.e., 'Stoneville 213' and Deltapine 16), two day-neutral selections from crosses with races of *G. hirsutum,* two experimental strains with *G. hirsutum* nuclear genes and cytoplasm from *G. arboreum* L. and *G. herbaceum* L., plus two lines (MO-HG and HG-BR-8-N) which have exhibited field resistance to tobacco budworm in our unpublished studies, were planted on the Plant Science Farm at Mississippi State, Miss., on 29 April in single-row plots on 1 m centers × 6 m long in a randomized, complete block design with four replications. Seed were from unselected self-pollinated stock grown in Iguala, Mexico. The plant population was established at 15/m. Soil type was a Leeper silty clay loam, a member of the fine, montmorrillonitic, nonacid, thermic Vertic Haplaquepts. All strains and cultivars with their origins are listed in Table 1.

The bioassay technique of Parrott et al. (1978) was used beginning 30 June on 20 plants from each line (five/replication) and continued every week thereafter for a total of 5 weeks. Briefly, the technique requires that a terminal leaf from each plant be inserted into a plastic cup and deposition of a newly hatched *H. virescens* larva on the leaf. The cups are then placed in an incubator and held for 5 days at 30 C with constant light. After 5 days, the larvae are removed and weighed to the nearest 0.01 mg.

RESULTS AND DISCUSSION

The experiment was of a randomized, complete block design and was analyzed as a split plot in time with cotton entries as whole plots and weeks of testing as subplots. The week and week × entry interaction mean squares were not

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[2]Former graduate research assistant, Entomology Dep., Mississippi State, Univ. (now research entomologist, ARS, USDA, Delta States Res. Center, Stoneville, MS 38776).

[3]Research geneticist, research entomologist, and research agronomist, respectively, ARS, USDA, Crop Sci. and Eng. Res. Lab., Mississippi State, MS 39762.

Table 1. Cultivars and strains, plant introduction numbers, countries of origin, and mean weights of *H. virescens* larvae.

Cultivars and strains	P.I. nos.	Countries of origin	Mean wts. 5-day-old larvae
			mg
6111	362156	Bulgaria	24.4 a†
138-F	274466	USSR	22.8 ab
G002-7-1‡	356811	Australia	21.8 a-c
AC 307	365528	Pakistan	21.4 a-d
Pak 51	365532	Pakistan	20.8 a-d
SK 14	365544	Thailand	19.9 b-e
152-F	324469	USSR	17.9 c-f
73	362154	Bulgaria	17.6 d-f
LSS	365530	Pakistan	17.5 d-f
10E	361150	Greece	17.3 d-g
CX 349	324467	USSR	17.0 e-h
3279	365542	Bulgaria	15.7 f-i
BC_2F_6 DPL-16 × T-25‡	–	USA, Miss. (J. N. Jenkins)	15.1 f-j
BC_2F_4 DPL-16 × T-80‡	–	USA, Miss. (J. N. Jenkins)	14.5 f-k
SK 32	365545	Thailand	14.3 f-l
4521	362155	Bulgaria	14.2 f-l
3996	365543	Bulgaria	13.8 f-l
137-F	274465	USSR	13.8 f-l
DES-ARB-16‡	–	USA, Miss. (V. G. Meyer)	13.1 g-m
Lasani 11	365529	Pakistan	13.1 g-m
G077-2‡	356812	Australia	12.9 h-m
108-F	324468	USSR	12.9 h-m
AC 134	365527	Pakistan	12.8 h-m
M4 (N. T. Sind)	365531	Pakistan	12.6 h-m
DES-HERB-16‡	–	USA, Miss. (V. G. Meyer)	12.4 i-o
Allen 333-61	365535	Mali	11.8 i-p
Deltapine 16	–	USA, Miss. (Delta and Pine Land Co.)	11.3 j-p
AH(67)M	365536	Uganda	10.8 j-q
4S 180	361151	Greece	10.5 k-q
Stoneville 213	–	USA, Miss. (Stoneville Pedigreed Seed Co.)	9.9 l-r
HL-1	365534	Cameroon	9.9 l-r
Albar 627	–§	Zambia	9.2 m-r
CA(68)36	365539	Uganda	9.0 m-r
BP 52/NC 63	365537	Uganda	9.0 m-r
C-1211	324466	USSR	8.8 m-r
CA(68)41	365540	Uganda	8.5 n-r
BPA 68	365538	Uganda	8.0 o-r
HG 9	362157	Chad	7.9 p-r
MO-HG‡	–	USA, Mo. (W. P. Sappenfield)	6.6 q-s
SATU 65	365541	Uganda	6.4 q-s
HG-BR-8-N‡	–	USA, Texas (M. D. Lukefahr)	6.0 r-s
BJA 592	362158	Chad	6.0 r-s
Laxmi	367241	India	3.8 s

† Mean of almost 100 larvae. Means followed by the same letter do not differ significantly at the 0.05 probability level (as determined by Duncan's Multiple Range Test).
‡ A strain, not a cultivar.
§ Number unavailable.

significant (P = 0.05); therefore, the effects of cotton entries on larval weights could be considered over weeks. As a consequence, we had mean larval weights for each entry over almost 100 observations. Very little mortality occurred, and analyses indicated that it was not concentrated on certain entries. This suggested healthy insects, consistency in the conduct of the test across entries and weeks, and that no entry had a lethal effect on the larvae.

Larval weights ranged from 3.8 mg on 'Laxmi' to 24.4 mg on '6111' (Table 1). The weights in the range of 20 to 24 mg correspond to those normally found on a group of lines which do not contain glandless or high-gossypol types and on which larval growth is good. The two USA cultivars produced larvae in the 10 to 11 mg range. Parrott et al. (1978) found a 9 to 16 mg range on his two cultivars. Two lines known to cause small larval size are MO-HG (Parrott et al., 1978) and HG-BR-8-N (unpublished field research). In these experiments both of those lines produced larvae toward the lower end of the weight range. Their weights of 6.6 and 6.0 mg, respectively, agree with the 6.4 mg size of larvae on MO-HG in the data of Parrott et al. (1978). These data suggested that we had conducted an experiment comparable to those of Parrott et al. (1978).

There was a considerable range in larval weights (3.8 to 24.4 mg) among entries (Table 1). The two USA cultivars produced larvae of 9.9 mg for Stoneville 213 and 11.3 mg for Deltapine 16, which is near the midpoint of the range. Data from this test (and other unpublished data of ours) indicate that commercial breeders have developed cultivars which, even though susceptible to *H. virescens,* are not as susceptible as others. That is, there are obsolete cultivars, breeding lines, and (as this report indicates) numerous foreign cultivars, which if grown, would produce larvae larger than those produced on Stoneville 213 and Deltapine 16. Conversely, they may be smaller as well. Larvae produced on 'Laxmi' were significantly smaller than those on Stoneville 213 or Deltapine 16. Larvae produced on 'BJA 592', 'SATU 65', HB-BR-8-N, and MO-HG were also significantly smaller than those on Deltapine 16. In unpublished data, we have shown that both HG-BR-8-N and MO-HG have exhibited field resistance to *H. virescens.*

Many of the relationships between larval size and plant resistance in the field are not known. However, it is well known that under a given set of conditions, insecticide toxicity is directly related to larval size up to 30 mg. Mullins (1980) found that when *H. virescens* larvae were grown on cotton lines which produced various sizes of larvae, their susceptibility to permethrin was primarily related to weight and not age. Thus, the variations we found in larval size on this group of 43 cultivars and strains are important.

The evaluation of these 35 foreign cultivars and strains (plus eight entries from the USA) for their effect on *H. virescens* larval growth [plus the evaluations for tarnished plant bug resistance (Lambert et al., 1980b), boll weevil resistance (Lambert et al., 1980a), and bandedwing whitefly (Lambert, 1977)] should be a useful companion to the agronomic, fiber property, morphological, and disease evaluations made by Samayoa-Armienta (1974). The evaluations show a great range of diversity for most of the 57 traits investigated.

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