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Bean and cowpea seed are often rendered worthless by weevils. In Arkansas the cowpea weevil *Callosobruchus maculatus* (F.) and the bean weevil *Acanthoscelides obtectus* (Say) are the insects usually blamable for this damage. The infestations usually originate in the field, but reproduction of the weevil continues in stored seed as long as temperature is sufficiently high until the entire lot of seed is completely without value.

In 1950 and 1951, insecticidal dusts were applied to cowpeas at Clarksville to determine whether infestation in the field could be prevented, and in 1951 and 1952 infestation counts were made on different varieties of cowpeas at Van Buren to determine whether there were varietal differences in susceptibility to infestation. During this period, some rearing work with the cowpea weevil was done at Fayetteville. Dry seeds also were treated with insecticidal dusts to determine their effectiveness in checking an infestation after it was started.

DURATION OF STAGES

Duration of the immature stages of *C. maculatus* varies with temperature, humidity, and the type of seed in which they develop. At a mean temperature of 80° F, Williams (3) found the developmental period of the immature stages ranged from 27 to 47 days, an average of 32 days. At temperatures around 68° F the author found the duration of the immature stages varied from 29 to 91 days. Records were obtained for a total of 1,180 individuals. Uninfested dry cowpeas were exposed to adults for one day, then held for emergence of adult weevils. Emergence was irregular. More than 80 per cent of the weevils emerged between the 30th and the 55th day, with an average of 40 days required for this group. From the 56th to the 70th day very few weevils emerged. The rate of emergence accelerated at this point, reaching another peak on the 80th day. The reason for this pattern of emergence was not ascertained. It should be noted that the presence of adults over a long period might be useful in helping the species survive unfavorable periods when food was not available. The pattern of emergence should be helpful also in insuring the presence of both sexes at the same time.

Duration of the adult stage varies greatly with temperature. At low temperatures, unmated females may live as long as 69 days while mated females may live 50 days (2). At a mean temperature of 81° F Williams (3) found that unmated females lived a maximum of 13 days while the life span for mated females was 10 days. Duration of the adult stage might be of considerable importance when weevils move out of infested seed to start an infestation in the field.

The factors which affect oviposition by adult weevils have been studied by a number of investigators. Williams (3) found that females having access to several dry peas deposited significantly more eggs than those exposed to only one pea. He also found that more eggs were deposited when peas were available every day than when they were available only every other day. The availability of water to the females did not appreciably affect the number of eggs deposited, according to Williams (3), although Larson and Fisher (1) obtained almost twice as many eggs when water was available.

Practically no oviposition occurs on pods of ripe or roasting-ear cowpeas when dry pods also are available. This was determined by caging pairs of weevils in the laboratory with both kinds of peas available, and recording oviposition throughout the life of the females. However, females, confined to ripe pods only deposited as many eggs as did another series on dry pods. The number of eggs deposited on ripe shelled peas also was very small when dry shelled peas were available. These data are shown in Table 1.

Different varieties of cowpeas vary considerably in attractiveness to weevils as a place for oviposition. The number of eggs on ripe and the number on dry peas was recorded for several varieties at Van Buren in 1951. Puffy-pod, with 64 per cent of the pods infested, was the most susceptible, while Cream-10, with 7 per cent, showed the lowest infestation. The following year some of the same varieties were included in counts of the number of eggs found on a 25-pea sample. The same varieties that had a high percentage of the pods infested tended to have the largest number of eggs per sample. Infested samples were held both years for emergence of adults. Those varieties having the heavier infestations also gave rise to the largest number of weevils. The data on infestation of different varieties are shown in Table 2.

In general, there did not appear to be any difference in susceptibility to infestations of cowpeas that could be related to type. The one exception was that the cream peas showed the least infestation. It is sometimes believed that purple-hull peas are less likely to be injured by weevils than are other varieties. In these observations, purple-hull peas were similar to most other varieties both in susceptibility to infestation and to injury. In practically all varieties the amount of injury appeared to be closely associated with the extent of infestation.

Infestation of cowpeas in the field was not entirely eliminated by the application of insecticidal dusts in the experiments of either 1950 or 1951. The dusts were applied with a hand duster, using approximately 20 pounds to the acre. All the ripe and dry peas were removed from the vines before the dusts were applied, then samples of peas were collected at intervals and held to determine emergence of adult weevils therefrom. Two applications of dust were made in 1950, but the plots in 1951 received only one application. In 1951, infested dry peas were placed in the center of the plots as a source of infestation. The insecticides used and the number of adult weevils emerging from the pea samples are shown in Tables 3 and 4.

The severity of infestation in the check plots undoubtedly was reduced by the use of insecticides. This is indicated by the fact that only half as many adults were obtained from samples taken from the check plots after two dust applications as had been obtained after one application. However, none of the insecticides entirely eliminated the infestation. As the samples taken three days after the second dust applications were infested, it appears unlikely that a complete kill of adult weevils present was accomplished.

In 1950 the source of adult weevils was unknown, but presumably it was some distance from the treated area. During the 1951 experiment adults continued to emerge from the infested peas placed in the middle of the plot layout. Each treatment was applied to two plots. The proximity of the plots to the source of weevils appeared to be a much more important factor in determining the extent of infestation than was the insecticide used. None of the plots were located more than 75 yards from the source of infestation.

Exposure to high temperature has been recommended as a control measure for a variety of insects. A temperature of 130° F for three hours is generally considered to be lethal to insects in stored grains. Beans infested with bean weevil and cowpeas infested with cowpea weevil were exposed at 130° F for three hours in small lots in an electric oven where the variation in temperature was plus/minus one degree. Samples thus treated were held for emergence of adult weevils. No emergence occurred from the cowpeas. Several bean weevils emerged from the bean samples. These weevils were given access to beans, and a few eggs were deposited by them.

Insecticidal dusts have been applied successfully to beans and cowpeas as well as to other types of seeds to protect them from insect damage. This type of control has several advantages over the use of fumigants. Probably the most important advantages are that no special tight containers are required, and the danger of immediate reinfestation is not nearly so great. Ordinarily, infestation present at the time seed is harvested is so light that little harm will be done, providing another generation of weevils can be prevented. A coating of insecticide does this successfully by killing adults by contact before they can deposit eggs.

SUMMARY

Cowpea and bean weevils often completely destroy cowpea and bean seed in storage. Infestation originates in the field before harvest. When a number of varieties are present in a field, some varieties are much more heavily infested

than others. Insecticidal dusts applied in the field did not give satisfactory control of weevils. When dry seed were treated with an insecticide prior to storage, weevils were effectively controlled.

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Table I. Number of eggs deposited by cowpea weevil when given a choice of oviposition sites.

Oviposition site	Number eggs
Dry pods	126.0
Green pods *	1.5
Dry peas	113.0
Green peas *	9.0
Dry peas	112.0
Green pods *	2.0
Green peas *	71.0
Dry peas	66.0
Green pods	67.0

(*) These were at stage of maturity for eating as ripe fresh cowpeas.

Table II. Varietal differences in susceptibility to infestation by cowpea weevil at Van Buren, Arkansas, 1951-1952.

Variety	Per cent 1951 Infested	Number eggs per pod 1952
Puffy-Pod	64.3	2.27
California Blackeye No. 5	48.1	
Brown-Sugar Crowder	45.4	3.04
Purple-Hull 49	39.0	1.27
Blue Goose	33.3	
Calva-No. 3 Blackeye	31.2	1.03
Ramshorn Blackeye	31.0	2.41
Red-speckled Crowder	25.9	
Conch Early-Bunch	22.9	
Calhoun Crowder	19.4	0.68
Cream-40	16.1	0.60
Cream-14	8.7	
Cream-10	7.1	

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Table III. Number of adult weevils bred from cowpeas harvested from plots dusted with different insecticides in 1950.

Treatment	Dusted Once	Dusted Twice
Check	150	75
DDT	79	10
Methoxychlor	117	31
Chlordane	76	20

Table IV. Number of adult weevils bred from cowpeas harvested from plots dusted with different insecticides in 1951.

Treatment	Number Adults
Check	53
Aldrin	39
DDT	78
Toxaphene	56

Table V. Percentage of dry seed damaged by weevils after treatment with insecticides.

Material	Dosage	Peas	Beans
g-BHC	1-50,000	0	0
	1-200,000	0	0
	1-1,000,000	0	0
	1-4,000,000	0	-
DDT	1-2,500	0	0
	1-10,000	0	0
	1-25,000	0	0
	1-75,000	0	0
Arasan	-	25	0
Check	-	100	100