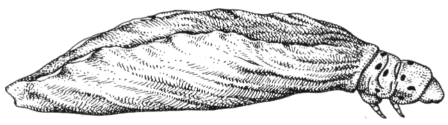
New Pest of Ladino Clover Seed

cultural practices believed best control of clover case bearer now established in certain counties

Ray F. Smith and Lloyd Andres



Clover case bearer larva in its case of withered petals.

The clover case bearer—*Coleophora spissicornis* Haworth—mainly associated with white clover—*Trifolium repens*—but also reported to attack red clover—*T. pratense* and *T. arvense*—seems to be established as a pest of Ladino clover seed in the Sacramento Valley.

First observed on April 30, 1951, in Ladino clover fields near Hamilton City, by 1952 infestations were discovered in Butte, Colusa, Placer, Sacramento, Shasta, Tehama, and Yuba counties.

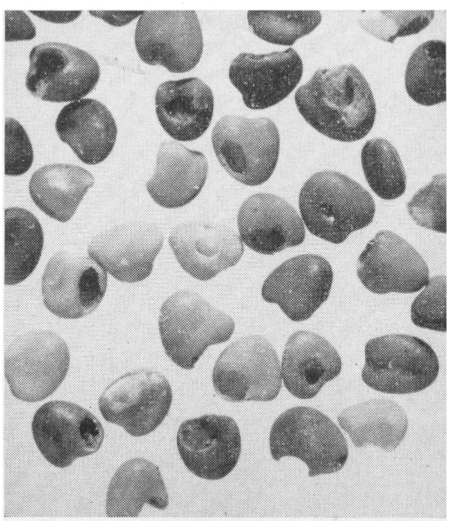
The clover case bearer is found all over Europe, in North Africa, Asia Minor, and North America. In New Zealand and in Denmark it has been recorded as a serious pest. In this country, records indicate that the insect is now found in California, Washington, Oregon, Iowa, District of Columbia, Maryland, Virginia, Tennessee, New Hampshire, Colorado, New York, and South Dakota.

The adults of the clover case bearer are found in Ladino clover fields from as early as May until late August. One peak of abundance occurs in late May. A second peak occurs in mid-July—approximately seven weeks later.

It is not clear whether there are one or two broods of larvae in California. In Denmark and New Zealand there is but one brood a year. The two peaks of adults that occur in late May and July could come from one brood of larvae, with the July peak representing those that develop during the summer and the May peak representing those that went through the winter as larvae before completing their development.

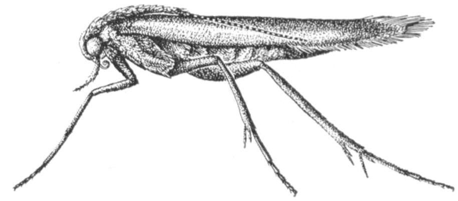
During the 1952 season, samples of clover heads throughout the summer months indicated a peak of larvae—corresponding to the peak of adult flight—in late May, and low larval populations during June and July. Damage to seed was greatest in early July and declined thereafter. The 1953 season was quite different, with a peak of damage to seed in mid-July and another in mid-August. It is not possible to give a clear interpretation of these differences at this time.

Ladino clover flower head with a portion of the florets removed to show dmaage.



Seeds damaged by the clover case bearer.

The per cent of damaged seed in the harvested crop is a poor indication of the total damage from the clover case bearer as most of the damaged seeds and florets are blown out with the threshing. Even so, it is not uncommon to encounter over 2% damaged seed. At such times, the true losses are probably running as high as 20% or more. In one instance, in 1953, a field of Ladino clover was nearly a complete loss from this pest. On the basis of counts of damaged seed threshed from flower heads gathered periodically through the growing season, the seed damage varies considerably. The peaks of damage seem to occur when the larvae are large—at the start of the season and again in mid-July.



Lateral view of the adult clover case bearer.

The shiny, metallic-black adults of the clover case bearer are found most commonly on the flower heads. They are about 1/4" in length, and the antennae have shaggy tufts of scales from the base to the middle, with the remainder ringed with black and white.

The female lays one or two eggs at the base of the wing petal of the fresh open flowers. A single female is recorded as laying 89 eggs in a two-week period. The eggs are oval—0.35 millimeter by 0.25 millimeter—and white, with a yellowish-green iridescence and an irregular network of ribs. During the summer months, the eggs hatch in nine to 11 days and before they hatch, the petals are withered and the florets turned down.

After hatching from the egg, the tiny caterpillar eats its way into a developing seed pod and feeds upon the seeds. The seeds are completely destroyed in some cases, but in others a portion of the seed remains.

After destroying the seeds in one pod, the larva eats its way into an adjacent floret. The characteristic round hole toward the base of the florets is shown in the illustration on this page. The insect fastens the petals of the withered floret together with silk and cuts it off at the base. It then travels about through the seed head carrying this case over its body. When it feeds it extends its head from the case and when disturbed it retreats into the case. Because of these habits, the larvae are difficult to discover in the seed heads.

Concluded on page 10

WIND MACHINES

Continued from preceding page

ously caused by crossdrift. The extent of this erratic behavior in airdrift—March 5, 1954—is shown most clearly in the tables on this page, especially by the highly variable times of arrival of the blast at the 400′ station. Sometimes the crossdrift bent the jet centerline so far that the jet appeared even before the machine directly faced the station—negative time values—and occasionally the blast was not felt at all.

A previous assumption was that a miss meant that the air jet passed by overhead, but the five anemometers up to 65′ above the ground failed to show any velocity spurt whenever there was a miss at 26′. This shows that occasional air eddies at Riverside may be strong enough to telescope a turning jet so that, for instance, only the weakest segment of the jet reaches the station with its velocity indistinguishable from natural airdrift. Because of the uncontrollable variability in natural conditions, model studies are to be undertaken next year to determine the relationships between temperature response in an orchard and the idealized jet pattern represented in the drawing on page 9.

The tests on frost protection by wind machine completed in 1954 pretty well define the results to be expected in citrus orchards near Riverside from single machine and from multiple installations of various power. The desirable variation of spacing distance with power is also fairly evident, so the main lack in the test data is now in variation of cold airdrift velocity and in variation of tree form and spacing. Therefore, next year's tests are planned for deciduous orchards.

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The above article is the sixth annual report of progress in the study of wind machines for frost protection in citrus, published in California Agriculture.

Natural drift velocities—½ minute average—before arrival of blast at 33-foot level, and times of arrival of the peak velocity of successive blasts at each level 200 feet from the machine. Times were measured relative to when the propeller axis pointed directly at the anemometers. The machine was operating at 830 pounds thrust, set at 2° down-pitch and turning 45° per minute.

Blast	Time	Drift velocity (mph) at 33′	Arrival time of blast (seconds) 16′	25′	33′	45′	65′
1	10:49 P	2.17	10	15	11	11	26
2	10:55	2.62	3	7	8	12	21
3	11:00	2.06	10	11	11	7	26
4	11:05½	1.30	4	8	9	8	None
5	11:10½	2.39	3	0	6	5	None
6	11:16	1.72	5	3	5	3	None
7	11:21½	1.67	4	2	4	3	None
8	11:27	1.67	7	6	6	6	None
9	11:32	2.39	4	1	3	2	None
10	11:37	2.06	1	0	0	1	None
Ave. for 10		2.00	5.1	5.3	6.3	5.8	..
11	11:42½	2.39	2	2	0	−5	None
12	11:48	2.73	3	3	3	−2	None
13	11:53	2.95	−16	−20	−8	−7	−17
14	11:58	2.84	−6	−2	−2	−3	None
15	12:03½ A	3.23	3	−1	1	1	None
16	12:09	2.95	4	0	−1	0	None
17	12:14½	2.73	4	−2	−1	−3	None
18	12:20	2.28	−2	−2	−4	−4	None
19	12:25	2.68	2	−2	−1	−2	None
20	12:30½	2.57	3	3	3	8	None
Ave. for 10		2.74	−0.3	−2.1	−1.0	−1.7	..

Natural velocities and jet velocities at 33-foot level 400 feet from wind machine, and times of arrival of peak velocities at five levels with the machine operating at 830 pounds thrust, set at 2° down-pitch and turning 45° per minute.

Blast	Time	Drift velocity at 33′ (mph)	Max. blast velocity mph	Arrival time of blast (seconds) 16′	25′	33′	45′	65′
1	10:36½ P	2.45	9.9	29	21	22	16	7
2	10:42	1.90	..	51	50	62	50	54
3	10:47½	1.78	..		Blast Missing			
4	10:53	3.12	..	43	44	43	43	45
5	10:57½	2.39	8.2	23	22	20	18	35
6	11:03	2.35	8.5	12	12	9	16	21
7	11:08	3.70	7.6	7	3	−3	2	4
8	11:13	3.81	8.8	−2	−2	−3	0	1
9	11:19	4.34	..		Blast Missing			
10	11:24	4.85	8.6	−17	−3	−4	−5	None
11	11:29½	4.40	6.3	33	32	9	10	None
12	11:35	3.81	7.9	37	35	37	36	None
13	11:40	2.00	7.8	34	33	33	40	53
14	11:45½	2.68	5.9	53	54	55	53	42
15	11:51	2.28	9.3	24	21	24	25	35
16	11:57	3.47	9.6	27	26	24	23	26
17	12:01½ A	2.73	6.3	22	28	29	27	31
18	12:07	1.19	5.9	44	49	47	44	52
19	12:12	3.06	..		Blast Missing			
20	12:17	2.11	..		Blast Missing			

LADINO

Continued from page 7

After about six to eight weeks the mature larva drops to the ground, closes the open end of the case, and completes its development. Those larvae which overwinter may feed again in the spring before pupating.

There are very few natural enemies of the clover case bearer. It is inferred that the hymenopterous wasp—*Bracon pygmaeus* (Prov.)—will attack it, but none have been reared in California. Chemical control will also be very difficult because the materials which can be applied to the blooming crop without harming pollinators do not seem to be effective against the case bearer.

Cultural practices seem to be the most important controls. Seed fields should be pastured close in the spring, and the start of the seed crop delayed until May 15. In harvesting, the chaff should not be blown back into the field but should be carried away to be fed or burned. The trash and cleanings at the seed mills do not seem to create any hazard.

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