Rice Water Weevil

beetle pest in rice growing areas of southern states discovered in California

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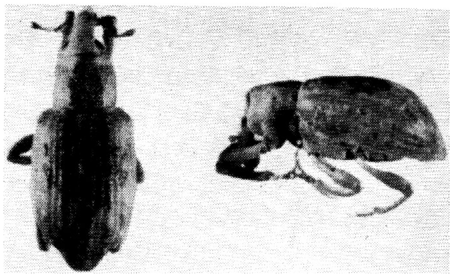


Adults of the rice water weevil, *Lissorhoptrus oryzophilus* Kuschel. Greatly magnified.

Young rice plants damaged by the rice water weevil—*Lissorhoptrus oryzophilus* Kuschel—were found in fields near Biggs on June 1, 1959.

The weevil is widely distributed in the rice growing states of the south, and ranges through the Atlantic states into Canada feeding on grasses in swampy areas. Judging from the abundance of the weevil at the Rice Experiment Station and in an adjacent field it is assumed that the pest was introduced prior to 1959, although the June discovery apparently is the first record of the weevil in California.

Larvae of the weevil—commonly called root-maggots—feed on the roots of the rice plants causing a characteristic pruning of the roots. This type of feeding prevents the development of new roots—until the peak of larval feeding is over—resulting in yellowing of plants, delayed growth, and decreased yields. Adults leave slitlike feeding scars on the leaves.

Although the rice water weevil is a potential pest of California rice its severity will depend upon its ability to reproduce and spread under California conditions. Losses reported in the southern states vary from 1% to 75% depending upon the area, cultural practices, and populations of the weevil present.

The adult is a small, grayish brown weevil with a dark, indistinct area on the back, and is about ⅛" long. The dark, dorsal area is more distinct in the female and in moist specimens. In the water, the weevil appears darker and may assume a greenish tinge. The beak or snout is wide. All specimens observed at Biggs were females suggesting that just females were introduced.

Rice plants showing larvae and pruning of roots left. Undamaged plants on right.

Eggs laid in the laboratory were white, elongate, slightly curved inwardly on one side, with rounded ends and were about 1/28" long and one third as wide. The larvae are about ½" long when mature, are long for weevil larvae, milky white in color, legless, and with a light brown head. There are paired dorsal hooks—modified spiracles—on each of the dorsal aspects of abdominal segments two to seven. The hooks project forward and arise from ridges on the folds of each segment. The large tracheal branches inside the body can be seen in live specimens. It is believed that larvae can tap air spaces in or about the roots and obtain oxygen even though submerged. The aquatic habitat, elongate body, and dorsal hooks, and crescent-shaped appearance will usually serve to differentiate larvae of the rice water weevil.

Close-up of larvae and damage to rice plant.

The pupa is found in an oval cell of mud attached to roots of rice or grasses. The pupa is white in color and the size of the adult.

The life history has not been worked out for California conditions. At Biggs adults were active on June 1 and by July 1 in the same checks mature larvae were found on the roots of rice and water grasses. Adults lived in cages about three weeks. Observations made by several investigators in the southern states give a range in the life history from egg to adult of 35–80 days. In Arkansas, rearings indicated an egg stage of 7–8 days; larval feeding period of 28–35 days; and pupal period of 5–14 days; for a total range of 40–57 days.

The adult weevil when ready to deposit eggs crawls down the rice stem and inserts the ovipositor in one of the principal roots forcing the ovipositor through the epidermis of the root. The egg is placed longitudinally just inside the epidermis. One investigator reports that the female chews on the root prior to oviposition thus affording an opening for the ovipositor. Several eggs may be laid in one spot.

The larvae feed for awhile inside the roots then move out to attack other roots making a series of holes. The larger, third instar larvae feed externally among the roots often pruning off the roots and sometimes feed up into the crowns. Often several larvae are found among the roots of a single plant.

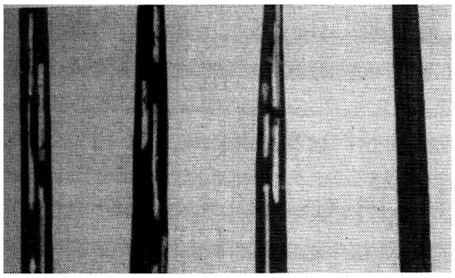
The mature larva gathers about itself an egg-shaped mass of soil which it attaches to a root. The oval pupal cell is water tight and the larva spins a silken sac about itself.

In the southern states two generations

Incidence of Feeding of Rice Water Weevil in Relation to Distance from Bank. Plants 11.5"–14" high—Biggs, June 6, 1959.

Distance from bank (feet)	No. Leaves examined (25 plants)	No. leaves and total number feeding scars at designated levels of attack (Scars) 0		1–4		5–10		11–20		Total no. feeding scars
		L	S	L	S	L	S	L	S	
0–5	73	11	0	28	56	21	136	13	170	362
5–10	74	56	0	11	21	7	37	0	0	58
10–20	73	62	0	10	23	1	5	0	0	28

L = leaves; S = feeding scars.



Longitudinal feeding scars of adults on leaves of rice. Undamaged leaf on right.

occur a year, with adults over-wintering in matted grass or Spanish moss. When rice is flooded in these areas the adult beetles move into the fields. The beetles fly at night and are often attracted to lights.

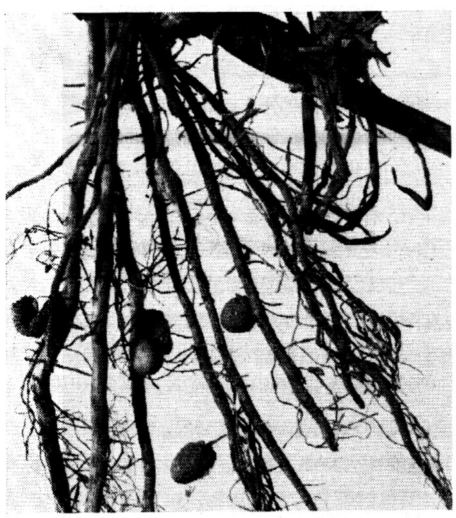
In California, it was apparent that the first feeding occurred on water grasses and sedges about the edges of the fields and then the adults moved out to feed on the rice as it emerged. More activity and beetles were found about the edges of the fields than in the rice checks 10′–20′ from the banks.

The weevil is at home above or below the water surface. Adults at Biggs were able to swim under or on the surface, and readily moved up and down the stems of the plants. Adults rested during the day in shady spots on grasses or on rice blades lying prostrate on the surface of the water. Weevils were usually easy to collect as they rested on the leaves and often remained motionless once an attempt was made to collect them.

Adults feed on the leaves—particularly those lying on the surface of the water—causing slits the width of the beak. Unlike the feeding of midges, adults fed from the top leaving the lower epidermis. The epidermis disappears leaving characteristic open slits. Adult feeding caused some drying up of the leaves, but did not seem to interfere with normal growth of the new leaves. On June 1 at Biggs populations of adults varied from 3–4 per square foot along the edges of the fields to 1/25 beetle per square foot out in the rice checks.

The rice water weevil is reported to feed on many grasses and aquatic plants and to breed on many grasses. It is considered a native species feeding naturally on grasses growing in swampy areas. At Biggs, observations on July 1 indicated that the weevil was able to breed on several species of grasses and sedges as larvae were collected about the roots of these plants. In addition to rice the observed hosts include: *Echinochloa crus-galli*, watergrass or barnyard grass; *Polypogon monspeliensis*, rabbitfoot grass; *Agrostis avenacea*, a bentgrass; *Setaria geniculata*, knotroot bristle grass; *Eleocharis palustris*, spike-rush; and *Scirpus mucronatus*, rough-seed bulrush. Adults were found to feed on jointgrass, *Paspalum distichum*, but no larvae were found on the roots. Watergrass seemed to be the most favorable host at Biggs, with as many as 6–8 larvae on the roots of individual plants. However, it is assumed that the watergrass was present around the edges of the fields prior to rice and allowed an earlier build-up.

Pupal cells of rice water weevil attached to roots of a sedge.



In the southern states control has been accomplished by drainage of rice fields and by insecticide applications. A drainage period of about two weeks is necessary for control; a method not too practical in California due to a possible increase in weed problems. Work in the southern states gave control with 4–16 ounces of dieldrin per acre applied prior to flooding. Usually, rice is not drilled in California, but dieldrin is commonly applied for control of the rice leaf miner; a treatment which should be fairly effective against adults of the rice weevil if applied at the time they are active on the foliage. Texas investigations have demonstrated the value of seed treatments with lindane, aldrin, and dieldrin. In experimental plots four to eight ounces of toxicant per 100 pounds of seed gave 90% control—and dieldrin at one ounce per 100 pounds gave an 80%–90% reduction of larvae in a field trial. The mode of action of seed treatments in controlling the rice water weevil is unknown.

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The identification of the weevil was made by R. I. Sailer, Acting Chief Insect Identification and Parasite Introduction Research Branch, U.S.D.A., and Miss Rose Ella Warner, United States National Museum.

Grasses were identified by Beecher Crampton, Senior Herbarium Botanist, Department of Agronomy, University of California, Davis.

On July 16, 1959 the California State Department of Agriculture reported that a 400 square mile area in Butte, Glenn, and Yuba counties was infested by the rice water weevil—Ed.

DISTRICTS

Continued from page 2

consolidation of the district's water rights tends to be advanced by the use of the assessment. Moreover, during this stage, the development objective frequently is espoused by the entire district constituency—urban and rural, irrigating and dry-farming alike. Equity problems arising within districts during this early phase of irrigation development generally have emphasized the inequity of a high water toll to the irrigating member rather than the cost incidence on nonirrigators resulting from assessments. Because of frequent parallelism in the two sets of criteria during the early stage of development, pricing practices could satisfy both types to a reasonably full extent.

The two sets of criteria tend to diverge, once relatively full irrigation development has occurred within the district, and the compromise manifest in actual pricing behavior becomes more pronounced. The developmental transition is marked by changes in the functions of district management. The large initial district outlays for distribution systems no longer obtain once the development phase is passed. Similarly, bonded district debt becomes less burdensome, and the degree and urgency of district solvency is not so pressing as during the earlier stage of development.

This transition likewise holds implications for district members. The relatively high outlays required for converting to irrigated agriculture are no longer facing the majority of members. Continued use of district assessments at the developmental level may be less justified economically, if the principal impact of secondary benefits has been capitalized into district land.

The efficiency of pricing practices—in most districts—may be predicated upon the extent to which those practices render district production reflective of the external economy of California irrigated agriculture. With increased competition in irrigated production, a continuation of pricing practices used during the early period of district development—characterized by relatively high assessments and a low variable cost for district water—tends to shield member irrigators from secular economic change, and thus may cause stickiness in the responsive-

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