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Rice Briefs

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Tadpole Shrimp Research Update

Luis Espino, Rice Farming Systems Advisor, UCCE

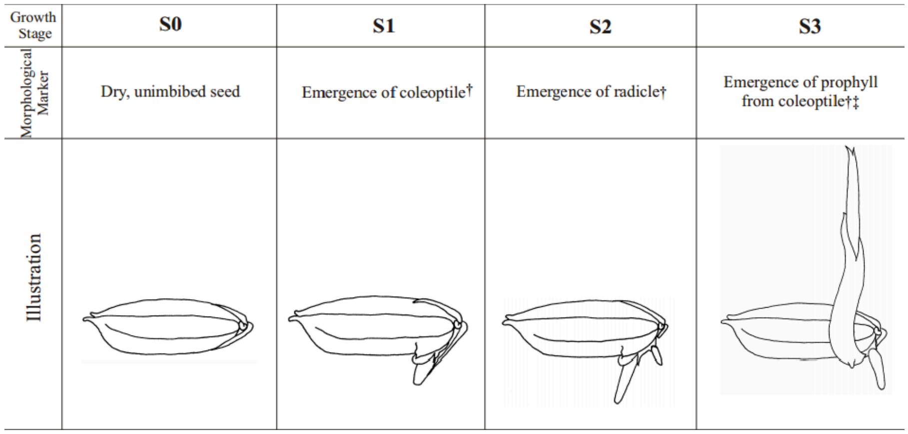
In the past few years, it seems tadpole shrimp (TPS) has been gaining importance as a pest in rice. This crustacean has been present in rice fields since rice cultivation began in California but it wasn't recognized as a pest until 1946. Over the years, the severity of this problem has had its ups and downs, and it seems we are going through one of the "up" periods.

Growers and PCAs know this pest well. Eggs overwinter in the soil, and they are capable of surviving there for many years. After flooding, eggs take two or three days to hatch. TPS grow fast, and after 10 days or so, they start laying eggs. Adults live 30-40 days, and after they die, TPS seem to disappear from the field. Eggs need a desiccation period to hatch. This explains why eggs laid during the season will not hatch until the following season, after the field has dried up and is reflooded for seeding.

We know quite a bit about the biology and ecology of this pest. However, there are still some details we don't know that might help us improve management of this pest. It is well known that small seedlings are more susceptible to TPS injury than larger seedlings. And we also know that large TPS are more injurious than small TPS. However, the specific stages of rice or TPS sizes and how they relate to injury have not been totally figured out.

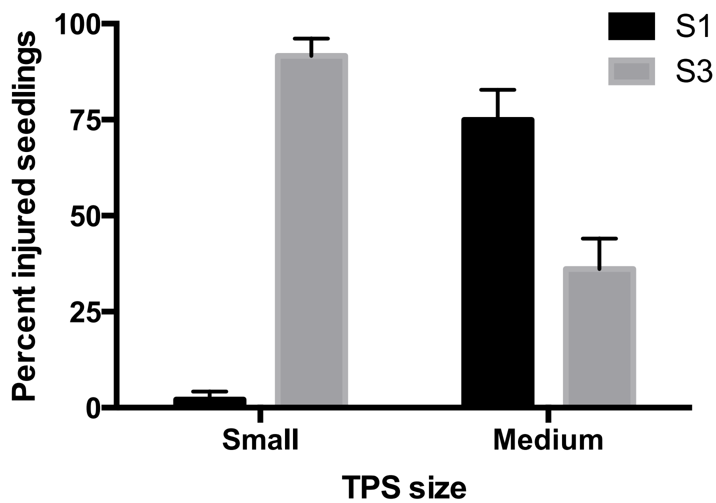
Last year, I conducted an experiment to try to address this need. I used two stages of seedling development, S1 (when just the coleoptile, the first structure to emerge from the seed, is present, 2-4 days after seeding) and S3 (when the primordial leaf and root are present, 5-7 days after seeding), and two TPS sizes, small and medium. Small TPS were 6 days old and their shell averaged 4.25 mm in length (about half the size of a rice seed); medium TPS were 14 days old and their shell averaged 7 mm in length (about the size of a rice seed).

Combinations of three small or two medium TPS and six rice seedlings of each stage were put in a container for 24 h, during which the TPS were allowed to feed on the seedlings. After this time, the TPS were removed and the number of seedlings with cut structures were counted.



Stages of seedling development. From Counce, P., T. Keisling, and A. Mitchell. 2000. A uniform, objective, and adaptive system for expressing rice development. Crop Science 40: 436-443.

On S1 seedlings, small TPS did very little injury. On the other hand, small TPS were able to injure a large proportion of the S3 seedlings. Medium TPS injured both S1 and S3 seedlings, between 30 and 75%.



Percent injured seedlings by small (4 mm shell) and large (7 mm shell) TPS. S1, seedlings with only coleoptile present; S3, seedlings with primordial leaf and root present.

The small TPS were not able to feed on the coleoptile during the S1 stage because the coleoptile is short and stubby. During S3, the coleoptile elongates and the primordial leaf and root are present. Small TPS preferred to feed on the thinner primordial root during this stage, probably because it is easier for them to chew with their small mandibles. I observed small TPS trying to feed on the coleoptile and primordial leaf, but it seemed that all they could do was scrape their surface.

Medium TPS were able to feed on the coleoptile, primordial leaf and root. Injured seedlings showed clipped structures, and in some cases the structures were missing altogether.

What do these results mean in practical terms? If TPS are present in the field when rice is seeded, the likelihood of injury is going to depend on the size of TPS.

- If TPS are small (their shell it's about half the size of a rice seed), they won't be able to injure the germinating seeds until roots start emerging. This can give the grower the opportunity to wait 2 or 3 days days before a treatment is made in that field without fear of loosing stand.
- If the TPS are larger (their shell is about the size of a rice seed), they will be able to feed on the rice seed as soon as they start germinating, and therefore a treatment is needed right away.

Arthropod Management Update

Luis Espino, Rice Farming Systems Advisor, UCCE

We are lucky that in California we don't have as many insect pests as in other parts of the Country or the world. Rice seed midge, rice water weevil and tadpole shrimp (not an insect but a crustacean) can infest rice early after planting. Later on, armyworms may infest rice fields mid season. Following are a few recent updates on arthropod management in California rice.

The rice water weevil infests fields soon after flooding. Larvae feed on the roots and cause symptoms similar to N deficiency. Usually, infestations are limited to the first 20 to 30 feet next to field borders or levees, and this is where damage occurs. Recent research indicates that the variety M-206, planted in roughly half the acreage, is more tolerant to rice water weevil injury than older varieties, even though weevils tend to prefer it. This may explain why the relative importance of rice water weevil as a pest has decreased. At the same time, M-202, an older, more susceptible variety, is on its way out; it is only planted in 10% of acreage. Another recent research find indicates that seeding rate does not have an effect on weevil infestation or damage, meaning that in areas where weevil is a problem, increasing the seeding rate will not reduce infestations or compensate for weevil injury.

Tadpole shrimp seems to be a re-emerging pest in rice. This was an important pest during the 80s. Back then, organophosphate insecticides were used intensively to control several pests in rice, including tadpole shrimp, and as a result tadpole shrimp developed resistance. Currently, tadpole shrimp management relies on pyrethroid insecticides. The acreage treated with pyrethroids has increased from 11% in 2005 to more than 30% in 2013. Although some of these applications are also directed at rice water weevil, the increase is most likely due to tadpole shrimp. The use of a single insecticide mode of action against this pest raises the risk of resistance development, as experienced before. Recently, a suspect pyrethroid resistant population had been causing problems for several years in one field in Colusa County; fortunately, this population was confirmed as not resistant last year.

In the past decade or so, there have been several instances in which growers reported their grain quality being reduced from Grade 1 to Grade 2 because of an increase in proportion of damaged kernels. Lodged rice or early fall rains, common causes of damaged kernels, were not the issue. Larry Godfrey, UC Davis Extension Entomologist, and I conducted a survey of one of these fields to determine if an insect may be causing the problem. We found a redshouldered stink bug. I had collected this stink bug from rice fields in Colusa and Yolo counties in the past, but thought they were just "visiting". After a valley-wide search, we found this stink at low densities in several fields, especially weedy ones. After going through some historical documents, I found a handout in my office from 1965 that referred to an outbreak of this stink bug injuring rice kernels in 1939. We have conducted experiments in which we caged redshouldered stink bugs in rice plants, and found that their feeding can damage kernels, causing "peck", a discoloration of the kernel. Pecky kernels are considered damaged kernels, and therefore can cause the reduction of the grade. Addtionally, pecky grains are more prone to break during milling, and can result in lower head rice yield. At this time we are asking growers and pest control advisers to be aware of this insect and report any finds in rice fields (635-6234, laespino@ucanr.edu). We are not sure if the redshouldered stink bug is the cause of the downgraded rice, but we will continue to investigate. For pictures of this stink bug, visit the UC Rice Blog.