Research Updates: **Taro Pocket Rot**

Taro Festival
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Hanalei, Kauai

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Background:

Although people have observed pocket rots for many years, this problem has become extremely severe in the last 2-3 years. The pocket rots are characterized by the formation of small to medium sized cavities on the taro corm. These cavities or pockets sometimes form a ring around the taro, indicating that something happened environmentally to foster pocket rot formation. On other corms however, pockets are distributed over the entire corm. Pocket rots reduce corm quality and yields are poor.

Pocket rot samples have been received from Oahu, the Big Isle, Maui, and Kauai. Severity of the problem varies with the location and farm. This summary represents the work conducted with the samples from these farms.

Hypotheses for the cause of pocket rots:

Several theories have been suggested for the cause of pocket rots: these include the following:

1) Micro-organisms are causing the pockets.

2) Fertilizer toxicity (bums from the fertilizer or toxic substances in the fertilizer).

3) Snail damage.

4) Insects, crayfish, or birds.

5) Environmental pollution (e.g. herbicide damage, high salt, etc.) I

We worked on the pocket rot problem until June of 1998, when funding ended. We have continued to work on this problem but at a slower place, without funding. Hundreds of pocket rot samples were studied, especially from Hanalei.

Insects: From this we determined that at least for the samples we received from Oahu and Kauai, insects were not the cause of wounding and subsequent pocket rots. Only 2 insects were found in corms and these caterpillar types seemed to be feeding on the dead organic matter in the corm.

Apple snails: Samples from several farms with damage from large apple snails indicate that these snails create broad corm damage that do not resemble pocket rots. Large areas of the corm is eaten away. Many of the wounds caused by the feeding activity of large snails are healed with only one or two layers in the wound periderm. Thus it is different from pocket rot. Small snails however, create smaller holes that maybe infected by micro-organisms and develop into pocket rots.

Microorganisms: Most of the corms we studied support the hypothesis that microorganisms are the cause of pocket rots. The lines of evidence that support this hypothesis is are follows:

1) **Root rots are associated with pocket rots.** The area on the corm with pocket rots have numerous rotted rots.

2) **Root rots lead to tiny corm rots.** Tiny corm rots are found where the root joins to the corm.

3) **Small corm rots are filled with dead tissue.** Fungi can be observed in this dead tissue.

4) **Multilayered wound periderm formed.** This wide wound periderm is produced by the taro plants and is a defensive mechanism against microbial attack.

5) **Fungal pathogens that attack other plants have been isolated from pockets.** These need to be tested on clean taro to determine which will produce pocket rots. Fungi that have been isolated include: *Phytophthora colocasiae, Pythium spp., Rhizoctonia, Fusarium* species, *Sclerotium, Curvularia, Cladosporium, Colletotrichum, Acremonium, Myrothecium, Acremonium, Geotrichum, Cylindrocarpon,* and *Rhizopus.*

Fungi that cause diseases on taro are well known. **What is the role of these microorganisms in pocket rot formation?**

1) **Pathogenic.** Some fungi will attack the corm directly. These primary pathogens attack the corm rapidly and a wound periderm is generally not present.

2) **Some fungi attack the corm when the environment is conducive.**

* **High relative humidity or rainy periods.** Leaf bight is severe during periods of wet weather. The fungus, *Phytophthora colocasiae,* grows rapidly, infects plants easily, and produces many spores in high relative humidity. When wet, the spores release swimming spores, called zoospores, which travel to different parts of the paddy or splash to healthy leaves and cause new rots.

* **Decrease in temperature.** Pathogens such as *Phytophthora* are more active during cooler periods (68 F). Zoospore release is enhanced by a drop in temperature.

* **Increase in temperature.** Other primary or secondary pathogens such as *Pythium* species increase in activity in warmer waters (80 F).

* **Increase or decrease of oxygen in the water.**

* **Other changes in water quality** (high salt, pH, pollution, etc.)

* **Decreased sunlight levels.**

* **Reduced number of leaves.** When leaf numbers are reduced, the plant is unable to make sugars and other biochemical molecules. Yield decreased or the size of corm will decrease.

3) **Some fungi attack the taro corm during** *Phytophthora* **epidemics when the plant is weakened.** Sugars that are produced by leaves are converted to cell membranes and cell walls for the wound periderm. If

the number of leaves are few during an epidemic, there is only a little sugar formed and not enough to make a good wound periderm. Or it may take too long to develop the wound periderm. The fungus can then cause a rot that expands slowly.

4) ***Phytophthora colocasiae*** **can also cause corm rots during leaf epidemics.** Then, the small lesions caused by *Phytophthora* can be invaded by secondary fungi. If sunny days resume and lots of photosynthesis occurs the plant can then create enough wound periderm to inhibit the growth of *Phytophthora.* Secondary fungi continue to slowly feed on the wound originally caused by *Phytophthora.* The slow growth of these fungi and additional wound periderm formation causes pockets to form.

5) New ***Phytophthora:*** During a leaf blight epidemic in 1998, corms sent to our lab had rots which did not have wound periderm. These are active rots and not pocket rots. All of the corms with active rots yielded a new *Phytophthora* in isolation plates. This fungus is homothallic and makes oospores or sexual spores without mating. These oospores have thick walls and can survive in soil for long periods. This new *Phytophthora* is very difficult to isolate and grows very 'slowly. A lot of work is needed to determine how much of a role it plays in pocket rot formation.

Future Research:

Pathology:

1) Test fungi collected from pocket rot on healthy taro to identify pocket rotting fungi; determine what conditions are needed for pocket rot to form;

2) Test the new *Phytophthora* and determine its role in taro diseases.

3) Test new environmentally friendly fungicides to protect taro.

4) Test crop rotation, fallow, composting as methods to improve taro health.

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