Micronesica Suppl. 6: 29–33, 2002

Microscopic Aliens Threatening the Pacific Region

George C. Wall

College of Agriculture and Life Sciences,
University of Guam
Mangilao, GU 96923
gwall@uog.edu

Abstract—Exotic agricultural pests are constantly finding their way into new geographic locations. In the Pacific region, island nations have enjoyed the benefit of being isolated until the last couple of centuries. The advent of air travel has really accelerated the rate of spread of exotic pests, and this is causing new pest outbreaks in the region even today. One part of this paper is dedicated to considering how existing pest information could be used to reduce this spread of exotic pests into the Pacific region, and more specifically, into the island of Guam. The second part looks at Tinangaja, a unique coconut disease occurring only on Guam, and how it could be prevented from spreading elsewhere.

Introduction

This paper is composed of 2 parts, the first one addressing the general problem posed by all alien pests of agriculture not present yet in our Pacific region, but more particularly with those not present on the island of Guam. The second part deals specifically with the threat of Tinangaja, a coconut disease unique to the island of Guam at present, and constituting a threat to the rest of the region.

It is almost impossible to keep all exotic pests away from our island and at the same time allow trade and tourism to go on unimpeded. Yet, if we don't try to do just that, we are doomed. Pest management, when available, comes at a cost in multiple levels. It costs money to hire laborers who can apply control measures to our crops. It costs time and energy when we attempt to do this personally. And there is usually a cost to the environment. Is there any way to come out ahead in this situation?

Perhaps the only way to come out ahead is to think ahead. A simple mathematical equation shows the resulting danger that we are talking about with regard to exotic pests. The total list of pests known to affect a given crop, minus the list of all pests already present at home gives us a list of pests to be excluded. We do this for all crops we want to protect, and we have a list of all exotic pests to be excluded. In theory, it is a very simple and straightforward affair. But theory belongs in textbooks. The real world is riddled with a lack of information, conflicting interests, and other obstacles and pitfalls that take our textbook theory and give it a different color, until it looks and sounds like a fairy tale.

Let us consider the mathematical statement above. Since it hasn't been proven yet, it is at best a hypothesis. At face value, it seems sound. Could it actually provide us with the magical solution to our dilemma, that of keeping exotic pests out while allowing free travel and trade?

If we go a step further now and try to put our hypothesis to a test, we will need that total list of pests, from which we will subtract the list of pests already present at home. Is it possible to compile such lists? Perhaps if we try to break this up into manageable pieces, then maybe we can actually achieve our goal and come up with some applicable results.

For the island of Guam, we have a list of plant pathogens that are known to be present. It was compiled as a result of several efforts put together at different times. Initially lists specific to Guam of yearly plant disease sightings appeared in the 70's and 80's (Anon.1979, 1988). Other publications also contained information pertinent to Guam (Anon. 1978, Firman 1978, O'Connor 1967, Trujillo 1971). Then in 1985 another list was compiled and published (Russo et al. 1985). This was the product of previous reports plus those identifications made by the authors, the last of which worked for USDA-APHIS PPQ. Reviewing some of the old files, it is evident that some specimens were sent to taxonomists for identification. However, the list of pathogens in that publication is riddled with typographical errors, making it somewhat inaccurate. Furthermore, the authors noted themselves that it was not to be considered as a complete listing of all plant pathogens present up to that date.

Another addition was made to this list in 1989 (Wall 1989). These were identified by the author. A few other reports exist, some of which were identified by authorities abroad. Even the most updated compilation of plant pathogens reported on Guam will not include all pathogens present to date, simply because it is safe to assume that not all plant species have been assayed.

But, incomplete and inaccurate as it may be, we can come up with a list of plant pathogens reported on Guam as of this date. That takes care of one of the components of our mathematical equation. The other factor is another challenge altogether. Several databases are available, which contain perhaps not all pathogens in the world, or even the Pacific region, but again, a fair number of those reported by the different institutions working in this area. PPPIS, now incorporated into www.ecoport.org from FAO and the University of Florida, is one such database, to which the Guam list has been incorporated already. Supposing we can manipulate the above database to make our subtraction, we would end up with this difference, which we originally referred to as the list "to be excluded".

This list to be excluded would contain some inherent flaws. It would name the same pathogens by their various synonyms, perhaps. And depending on whether the subtractions were made at a species level, or at a genus level, those inaccuracies would also be incorporated. Right away, then, we see that to come up with the least number of these flaws, we would have to fine-tune our two lists before we could even do the simple math. We'd have to decide what to do with those cases where only genus is mentioned, such as *Cercospora sp. on Dracaena fragrans*, for example.

The problem of synonymity extends also to host species, not only to pathogens, and of course, so does the question of genus and species, or only genus. The reader already sees the level of complication actually involved in this “simple” mathematical equation.

So then, what shall we do, call this an impossible endeavour? Shall we try another approach? There are certainly other approaches. One, for example, consists of focusing quarantine efforts on major targets only. The first step in this direction involves making a list of important plant species, and then making a list of important exotic pests for each of these. We can even prioritize these. This, as you can imagine, is a much more feasible task. On the other hand, the price to be payed for this convenience is the risk of inadvertently allowing in potentially destructive new pests that are not on the above lists, either as pests or for their hosts.

A combination of these two approaches could be tried. While a list of important exotic pests for each major crop is in place, we could work towards the first approach, slowly but surely. A standardized format could be chosen, to include the same number and types of fields per record for each database (the general and the local one). Perhaps the local database, which would most likely be the smallest one, would have to be adapted and modified to the standards of the larger one. Formulae could be devised to account for synonyms. Once you have these two databases, a global or regional one and a local one, they could be updated periodically, and when one is subtracted from the other, we would have an updated list of all pests to be excluded.

Part II: Guam’s Own Microscopic Menace for the Region

Known to occur on Guam since 1917 (Weston 1918), Coconut Tinangaja is, as far as we know to date, unique to the island of Guam. Being caused by a viroid, it has been extremely difficult to study the disease, its cause, epidemiology and disease cycle. It wasn’t until molecular biology techniques were developed that its viroid nature became known. Before that time, it was suspected that the causal agent was a virus. Viroids were first reported in potato, causing the potato spindle tuber disease (Diener 1971).

Guam’s Tinangaja viroid may have jumped to another island once before. It has been suggested that the Cadang-cadang epidemic in the Philippines, which was first reported in 1937, may have been a consequence of transporting coconut planting material from Guam (K. Maramorosch personal communication). Although the two diseases have been shown to be different, the suggestion that one was derived from the other cannot be overlooked (Maramorosch 1996). The causal agent of Cadang-cadang is also a viroid, and is very similar in molecular sequence to the Coconut Tinangaja Viroid (CTiVd), causal agent of Tinangaja (Hanold & Randles 1991).

In hopes that this is not permitted to occur (or to occur again, as the case may be), our studies on the CTiVd continue. The major obstacle in discovering the details of its epidemiology and disease cycle is our ability to detect the viroid in small amounts. However, newer techniques are making it possible for us to detect ever-lower amounts. In the last decade this sensitivity has gone from being able to detect only the highest concentrations of viroid in plant extracts at first by electrophoresis, to increasing the sensitivity some 500-1,000 times by molecular hybridization techniques. Now we can detect it 100,000 times more sensitively by reverse transcriptase conversion of the viroid RNA to a complementary DNA copy, which is then amplified by the polymerase chain reaction, or RT-PCR (Hodgson et al. 1998).

References

Anon. 1978. Agreed Report. UNDP/FAO-SPC Agricultural Pests and Diseases Survey. Meeting of Coordinating Committee and Tripartite Review. SPC Headquarters, Suva.

Anon.1979. Annual Report. Guam Agricultural Experiment Station.

Anon. 1988. Annual Report. Plant Pathology. Guam Agricultural Experiment Station, pp. 18–20.

Diener, T. O. 1971. A plant virus with properties of a free ribonucleic acid: potato spindle tuber virus. pp. 433–478. *In* K. Maramorosch & E. Kurstak. (eds.) Comparative Virology. Academic Press, NY.

Firman, I. D. 1978. Bibliography of Plant Pathology and Mycology in the area of the South Pacific Commission, 1820-1976. SPC Technical Paper no. 176.

Hanold, D. & J. W. Randles. 1991. Detection of coconut cadang-cadang viroid-like sequences in oil and coconut palm in the south-west Pacific. Annals of Applied Biology 118: 139–151.

Hodgson, R. A. J., G. C. Wall & J. W. Randles. 1998. Specific identification of coconut tinangaja viroid for differential field diagnosis of viroids in coconut palm. Phytopathology 88: 774–781.

Maramorosch, K. 1996. The cadang-cadang disease of palms. pp. 309–318. *In* S.P.Raychaudhuri & K. Maramorosch. (eds.). Forest Trees and Palms Diseases and Control. Science Publishers, Lebanon, NH.

O'Connor, B. A. 1967. Exotic Plant Pests and Diseases. South Pacific Commission, Noumea, New Caledonia.

Trujillo, E. E. 1971. A list of diseases of economic plants in the Trust Territory of the Pacific Islands. Depatment of Resources & Development, Division of Agriculture.

Russo, V., G. Beaver, F. Cruz & H. Rubin. 1985. Plant pathogens and associated hosts on Guam. Technical report, Guam AES Publication no. 36.

Wall, G. C. 1989. Plant diseases reported on Guam. AES, Plant Pathology Laboratory, University of Guam. 19 pp.

Weston, W. H. 1918. Report on the plant disease situation in Guam. pp. 45–62. *In* Guam Agricultural Experiment Station Report for 1917. Guam Agricultural Experiment Station.