

General Discussion

Chairman: I. N. OKA
H. KITAJIMA
H. FUJII

General Discussion

Chairman: According to discussions made in these 3 days, the topics of the discussion would be reviewed into 4 or 5 to our convenience. The first would be virus diseases on rice which comprised dwarf, tungro, mosaic and necrosis mosaic. As the spot speaker, we would like to invite Dr. Ling who will lead the talk for about 10 minutes and then somebody will give review on it. The second would be virus diseases on citrus, and the spot speaker will be Dr. Tanaka. The third would be virus diseases on legumes for which Dr. Inouye would be the spot speaker. If there would be time left, we would like to search for some highlights on virus diseases on coconut and oil palm, and Dr. Benigno would be the speaker in this case. The last topic would be international cooperation program as a follow-up of this Symposium. This could be talked about by Dr. Kitajima. If there is no comment on it, we invite Dr. Ling to be the first spot speaker.

Ling (IRRI): We may say that this symposium is very much emphasized on the rice virus diseases. The reasons are; there are 25 reports, 7 country reports and 18 technical reports. Among these 25 reports, 16 reports, 5 country reports and 11 technical reports, are talking about rice virus diseases. The second, this symposium has very well covered all rice virus diseases. They are 5 rice virus diseases, grassy stunt, hoja blanca, orange leaf, tungro and yellow dwarf in the country report, 7 virus diseases, black streaked dwarf, dwarf, necrosis mosaic, stripe, tungro, waika and yellow dwarf in the technical report, and transitory yellowing in the discussion. To the best of my knowledge, there are altogether 14 rice virus diseases in the whole world, and in this symposium we have not covered only 4 rice virus diseases, gialume in Europe, yellow mottle disease in Africa, transitory yellowing in Taiwan and yellow stunt in Mainland China.

Also, in this symposium we covered all the fields of study, on symptom, history, distribution, losses, transmission, strain, epidemiology, electron microscopy, purification, resistance and breeding. It seems that all the papers are very well prepared and organized seemingly given intention to cover all of such wide range of fields by the organizing committee headed by Dr. Kitajima.

As compared with the last symposium held in 1967 at IRRI, I would say that this symposium emphasized not only on rice but also all others. When we organized the 1967 symposium we had particularly a little difficulty to get the technical reports from the countries other than the United States and Japan. The Second International Conference on Plant Pathology held in 1974 met difficulty of gathering money to support participants. During last ten years we have increased our knowledge especially on rice virus diseases. The success was due not only to a contribution of every one of participants but also to a field of organization such as IRRI in the Philippines and TARC in Japan. We can see and do realize the reputation and the contribution of TARC, and TARC made not only a scientific contribution but also a large "personal diplomacy" to subtropical and tropical countries.

All of participants agreed to express their sincere thanks to the organizing committee to provide them the opportunity to be here and for the Japanese hospitality. Thank you very much.

Chairman: Thank you Dr. Ling. I hope that all of us can give some comments and review your ideas. Now, the discussion will be opened.

Benigno (Philippines): I heard from technical reports that there are at least 2 types of virus particles, spherical and bacilliform shaped ones. I would like to know whether tungro is spherical or bacilliform shaped particle. As we have learned on a new virus morphology, I would like to project as one of the highlights in this symposium,

simply because this is something new, will stimulate deeper study in the field of electron microscopy and will create some controversy.

Ling (IRRI): It is a practical problem that those who are very good in electron microscopy are not located on the spot where the disease occurs. In the case of tungro, inoculation technique is pretty difficult even we have tried very hard because it can't be transmitted by mechanical means. I would agree that it is very confusing, so far as electron microscopy is concerned, because electron microscopy can only tell you the picture but cannot tell you whether this is causal agent or not. In fact in the case of tungro, first, second and third report said that it is spherical, bullet shaped and bacilli-form particles, respectively. Anyway, we will try to clear up what is the real cause of tungro disease. I think this may include in the discussion in the section of international cooperation program as the chairman pointed out.

Mishra (India): There are various names of strains, and probably Dr. Ling will clarify the position and suggest how we should systematize these studies. In my report, I have tried to give the key and to summarize the differentials that Dr. Ling and Dr. John have used. Should we have some sort of indicator for some strains?

Ling (IRRI): We accept your suggestion very much. In fact, we are already working on this line since 1974. Now, the difficulty is due to the plant quarantine. We can not introduce all of the virus strains to study them under the same condition. The more important thing is to have a resistant variety. For instance, one is very resistant in one year and then becomes very susceptible in another year. As for the key, I agree fundamentally and scientifically, we should have clear-cut key system in order to classify all the strains. We should have to work hard in order to gather more information and to specify what are the major characteristics of these strains, as well, because such study is pretty difficult mainly due to no available purification technique.

Mishra (India): I have a proposal to build up some kind of collection on the basis of which I have suggested. If we have such collection from different countries where some specific strains are existed, we will be able to say, for instance, how the Indian strain is or how the Malaysian strain is, so and so, then we can further clarify our understanding on that and even work on this type of things.

Ling (IRRI): More than 7 years ago, Dr. Ishii had an idea to set up a Disease Research Center somewhere in southern islands in the Pacific so as to be able to introduce all diseases and to compare them under the same condition. I think the most qualified place in the world to make such study is Sapporo, Hokkaido. Because Sapporo is a good place to study. Therefore, if the Japanese Government could allow the Sapporo people to work on, we can shift all the tungro virus diseases from everywhere to Sapporo. However, I do not know what would be exactly.

Chairman: Well, classification, identification and strain of tungro are becoming a very hot discussion, we will come to the conclusion sometime. Please give your comments anybody who wants to do so.

Iida (Japan): I agree with Dr. Mishra in basing standard on the difference of variability in pathogenicity of various virus isolates as far as we deal with what we call strain of the virus. I also agree that tungro by now seems to be the most important virus. In that respect, we may have to standardize our experimental material that is the various rice varieties with which we have to work. Fortunately, IRRI can provide good material for this purpose and probably we can ask Dr. Ling to work out some systems by which we can compare various isolates from different countries and localities on various rice test varieties.

Kitajima (Brazil): I am sitting here really like an outsider because I am from a Latin American country where rice virus is currently not a problem. I knew something from literatures but not as close as you. I would like to ask a question to put a little

bit of order for puzzled diseases in my mind. I learned that several of Southeast Asian countries have the same virus, tungro, yellow orange leaf and so on. Is there anything to consider that they are the same virus or are really considered as different virus or strain?

Ling (IRRI): To prove that 2 diseases are different is very easy but to prove that 2 diseases are identical is very difficult. Because we are not able to cover all the aspects, such as symptomatology, vector species, virus-vector interaction, electron microscopy and some degree of varietal resistance. However, Penyakit merah in Malaysia, Penyakit habang in Indonesia, leaf yellowing in India, and yellow orange leaf in Thailand are seemingly not different.

Saito (Japan): As far as electron microscopic observation is concerned a typical disease in each country maybe the same with some differences in each particle.

Chairman: Do you mean to say that different names of virus that you have been studying on have practically no difference in particles?

Saito (Japan): I examined Penyakit merah, Penyakit habang, tungro in the Philippines, yellow orange leaf and waika, and they were the same. But I have no chance to examine tungro in India.

Ling (IRRI): When I read a report from Kyushu, I thought the waika disease was very much related to tungro. But after I went over Kyushu I found that it is very difficult to say on the symptomatology whether waika is identical with tungro or not. For instance, we can get the symptom of Penyakit merah at the seedling stage. This is not the case of waika. We can notice waika only in advanced conditions. If waika occurs in the Philippines, I would think probably either due to impurity of seeds, or due to uneven distribution of fertilizer and fertile soil in the field. Therefore, even if electron microscopic particles are very much alike, so far as the symptom is concerned, it is not able to say that they are very similar.

Shinkai (Japan): We can not observe any distinct symptom of waika at the young seedling stage. This is quite different from tungro. It seems to be fact that waika symptom, in general, is much slighter compared to the case of tungro.

Benigno (Philippines): I would like to follow up the question of Dr. Kitajima and the comment of Dr. Ling regarding the different names of virus from different countries which are apparently quite similar by electron microscopy. Many virus with similar morphology are not necessary the same, and that, similar viruses sometimes induce different type of symptom in different plant species. Therefore, probably the best solution would be antiserum of each specific virus. The antiserum can transport from one country to another and can test against the antigen of that particular virus. For technological difficulty of virus purification, cooperative work between serologist and electron-microscopist can help to dissolve.

Saito (Japan): I have antiserum of waika and of spherical particles of Penyakit habang, but the antiserum reacted against both of waika and Penyakit habang.

Chairman: Anybody else wants to comment so as to make conclusions?

Iida (Japan): It is quite legitimate that we have concentrated more or less on tungro but at the same time we would not forget about other kinds of virus which may become sometimes as tungro. We have surprisingly limited knowledge and information about virus which we already know and we have not been able to identify in this area. For example, orange leaf transmitted by *Recilia dorsalis* is not yellow orange leaf and has not been characterized as fully as tungro or grassy stunt. Transitory yellowing has been studied intensively in Taiwan with possible distribution in other area, but still no one has found it there. Black streaked dwarf has no evidence of close relationship to maize rough dwarf in Southern Europe and Mediterranean area. Things go like that, and we suspect that the disease which should be closely related to either or both of

these, maybe found somewhere in our area.

So, it is all right to study more on the tungro or grassy stunt but at the same time we hope that we should put some more attention to those virus diseases which have relatively been neglected.

Saito (Japan): Under the cooperation with Thailand and Malaysia, we published in Plant Disease Report, that orange leaf has a close relationship with mycoplasma.

Chairman: If there are no comments, I will try to summarize what we have been talking in the discussion. Firstly, the importance of rice virus is well recognized and deserved further attention in near future. Secondary, tungro virus which seems to have more relationship with other virus needs further investigation with regard to standardization. All the virus mentioned have very close similarity based on electron microscopy studies as well as serological ones. Thus, further international cooperation is needed to improve methodology. Thirdly, other rice virus like black streaked dwarf and some others also should not be forgotten.

Yamada (Japan): Mr. Chairman, permit me to talk about some different matters but related to the rice virus disease. Several control measures; genetic control by the use of the resistant genes against the virus, vaccination, and therapy, were reported to the symposium. But it seems to me that attempts to control the virus itself is a kind of race against continuous changing state of the virus which is highly variable. For example, a resistant variety developed has become susceptible within several years. Chemical control will be successful in early stage but later on it becomes ineffective because the virus could be changed. From the practical point of view, paying attention to the control of vector insect is an easier way to control virus disease rather than to control directly the virus itself as far as the insect transmits the virus.

Chairman: We have one participant from the entomology field. Dr. Kisimoto, do you have some comments on the control of vector insects?

Kisimoto (Japan): I quite agree with Dr. Yamada's idea. Many pathologists prefer the resistance to virus rather than that to insects even they argued difference between virus resistance and insect resistance. In all cases of outbreaks of epidemic virus in Japan, they are preceded by outbreaks of vector insects. Green rice leafhopper transmits rice dwarf and yellow dwarf diseases so far as unsuccessful control of the vector insect was recorded. In the case of black streaked dwarf transmitted by smaller brown planthopper, this vector insect prefers wheat rather than rice, and acreage of wheat in Japan has decreased considerably due to our economical situation. Therefore, the density of smaller brown planthopper decreased, and consequently, causal virus transmitted by the vector disappeared in the western half of Japan. Insecticidal control of vector insects introduces resistant vectors against insecticide and such building-up of resistance can be expected easily in tropical and subtropical regions, because there are more generations of vectors and more host plants throughout a year. So far, I am not so reliable upon resistant rice variety mainly because the resistant one often changes into susceptible within a few year. Accordingly, I recommend you to control the vector population by means of practical cultural measures to keep the population level as low as possible.

Chairman: Regarding the control method of rice virus, the latest idea is integrated control, and the best management would be a good solution especially in the developing nations. Of course, resistant variety should be included, if it is possible, polygenic resistance can last longer than monogenic one. Cultural control method is feasible in tropical countries, too. Chemical control is the final measure due to its risk of insect resistance against chemicals.

Chairman: Let us discuss on the second topic on virus diseases of citrus. I would like to invite Dr. Tanaka as the spot speaker.

Tanaka (Japan): I would like to speak on problems of 2 citrus virus-mycoplasmal diseases, greening and tristeza. Citrus greening disease has been reported in almost all the countries in Southeast Asia by different names, they are citrus vein phloem degeneration in Indonesia, leaf mottling or leaf mottle yellows in the Philippines, likubin in Taiwan, yellow shoot in mainland China and citrus die-back or citrus decline in India. In 1968, Dr. Catling from Swaziland, entomologist, surveyed these countries and found citrus psylla, *Diaphorina citri*, as one of a vector of greening in orchards. He also found greening disease in everywhere. We made survey in southern part of Kyushu and the Ryukyu Islands with expectation of infestation of greening which was very serious in Taiwan on ponkan and tankan. We found *Diaphorina citri* in these areas, but fortunately, we could not find greening. In 1975, Dr. Kitajima and I found many greening affected citrus trees in almost all citrus growing areas in Thailand, as follows. Mandarin showed yellowing of veins or whole leaves which are similar to the general deficiency. But sweet orange showed leaf symptoms which are very similar to manganese or zinc deficiency. We found some differences in greening leaf symptoms by variety of citrus tree. Pummelo trees such as Kao panne and Kao phung showed no or very mild symptoms which seemed not susceptible. Now, I would like to ask you whether the varietal resistance of citrus tree against greening disease is common or not in Southeast Asia.

The next comment is on citrus tristeza reported by almost all participants in this symposium. I understand that tristeza is a synonym of quick decline reported in California which is a combination disease of root stock/scion. Trees with sour orange root are not susceptible. It has never been found on own root trees such as seedlings and marcotings. Tristeza has not yet been reported in Japan, because almost all citrus trees are grafted on trifoliate oranges. However, stem-pitting disease, firstly reported in South Africa on grape fruit, is now found on many citrus varieties in Japan as an important disease. It is not influenced by the difference of root stock varieties. In general, pummelo grape fruits, their hybrids and some sweet oranges are susceptible to stem-pitting disease. And many of sweet oranges and mandarins are resistant with no severe symptom. Therefore, I think we should differentiate stem pitting disease from tristeza.

Chairman: Thank you very much for your excellent presentation on citrus virus diseases. Now, this is open for discussion.

Soelaeman (Indonesia): Before, we had collections of citrus species in Jakarta, Bogor and several other places in Indonesia. All these collections are no more now, because they were destroyed by greening disease. It is very difficult to have resistant variety against greening and evidence of such resistance. It was apparent not only from our field survey but also from our operation trials. There is no resistant variety or species of citrus tree against our diseases. Susceptible reaction is the same on cuttings or marcotings. But tristeza is quite different. Tristeza distributed widely only in Indonesia seemingly because there are *Aphis citricidus* or *Toxoptera citricidus* abundantly. If you plant *Citrus aurantifolia* or lime between citrus trees, you can see symptoms of tristeza on leaves and pitting on stems. Our disease, citrus vein phloem degeneration was found in 1964 just before a paper on greening in South Africa was published. Then, we compared it with tristeza in reaction among several species of citrus. CVPD was so different from tristeza in reaction to these species. Now, stem pitting is serious in South Kalimantan as I have mentioned in the paper. Stem pitting on root stock are also common.

Kitajima (Brazil): In my country, we do not make a sharp distinction between tristeza and stem pitting which are called tristeza too. We call all of them tristeza whether including stem pitting or not. As I mentioned in the country report, tristeza is apparently not a serious problem. One of the danger we had was a new strain of tristeza appeared in the southern part of the state which induced very severe pitting and then

it was assumed that if this strain reached the main citrus growing area, we would have a repetition of the disaster in the 1940's when we lost all the citrus tree. Losta or Muler and Costa succeeded their program for pre-immunization in these 15 years, and I was glad to learn that similar program is being considered in Japan and already started. I know that tristeza is not the only problem as in Brazil. You have also these greening-like problems which are very serious. But I would like to suggest strongly that countries in Southeast Asia which are having the same problem and considering this possibility, should be interested in the trip to Brazil to take a look at the program and learn more details. Because it worked well and it might be unique and one of the possible solutions to consider.

Benigno (Philippines): Some ten years ago, citrus industry was very profitable in the Philippines, but lately many citrus orchards have abandoned due to virus diseases, particularly greening, tristeza, xyloporosis, and psorosis A and B. Thus, sugarcane took the place of citrus orchard, so far. This stimulates the establishment of the National Crop Protection Center and started this January, 1976. One of the tasks of this Center is to revive the citrus industry and I am very happy to learn that Brazil has done it already. The problem of researches on citrus is on identification of the different types of virus. Nursery-men are not certified yet by the government, then anybody can buy anything of planting materials and they can sell it anytime they want to, so much so that, we do not have such control program like in Brazil. Now, I will be very happy if you could give your guidelines or procedures on how to help our citrus industry, and I am throwing this through TARC.

Kitajima (Brazil): As far as I know on virus diseases except tristeza and greening, there is no known vector. Psorosis might be vector-borne, but not clear yet. Therefore, the other virus diseases are easy to control just by using nucellar clones, for example, if you have a diseased tree you get a seed plant and if you get a nucellar plant, then you get rid of virus diseases. As for tristeza, even if virus free plant is obtained, it will catch the disease soon after introduced into the field because of efficient vectors. So, the first step would be getting rid of the virus which is only bud-transmitted. Then, consider the other diseases.

Tanaka (Japan): I agree with Dr. Kitajima.

Kitajima (Brazil): When I have been in Argentina and Uruguay in last April, I heard that there are some substantial evidence of existence of vector transmitting psorosis virus. The reason was that they imported some budwoods, supposed to be psorosis free, from US, but a couple of years later the plant showed symptom. So, they had to assume some vector even not identified yet. Fortunately in Brazil, psorosis is not important.

Soelaeman (Indonesia): While Wallace said tristeza and stem pitting are the same, Fraser said they are different as were mentioned in my paper. Now, I have a question to Dr. Tanaka, whether we can differentiate tristeza from stem pitting.

Tanaka (Japan): I understand that there are 3 diseases, stem pitting, tristeza in narrow means and seedling-yellows. Dr. Fraser and Dr. Wallace discussed a relationship between stem pitting and seedling-yellows. As I explained already, stem pitting and tristeza are different diseases caused by different strains of tristeza virus, then I think you confused the distinct tristeza and seedling-yellows.

Soelaeman (Indonesia): It might be so but tristeza usually refers to the symptom of combinations. Therefore, I think it is better not to use tristeza for stem pitting because it is a specific combination of tristeza.

Chairman: Thank you Dr. Soelaeman. It is almost time. From the discussion I may conclude certain topics that come into light regarding the citrus virus diseases. The first, 2 virus diseases, greening and tristeza, are regarded as the most important ones.

The second, other citrus virus diseases, such as psorosis, xyloporosis and stem pitting, are also important in various parts of citrus growing countries. The third, the right identification of the virus to set up appropriate control methods is seemingly one of the important problems. The fourth, further researches on virus identification and virus vector-relationship with regard to control are needed. One other thing is that TARC is expected to offer assistance to further research in various aspects of citrus virus diseases in order to revive citrus industry in various Asian countries.

Now, the discussion on citrus virus diseases is over, and to save time, we will straight go to virus diseases on legumes in which Dr. Inouye will be the spot speaker.

Inouye (Japan): We have more than 20 viruses of leguminous plants in Japan. Among them, about 10 viruses are transmitted through seed. They are soybean mosaic virus, soybean stunt virus, mild mosaic virus and southern bean mosaic virus which is most widely distributed in all parts of Japan. Soybean stunt virus reported recently in Indonesia is widely found in northern part of Japan. Southern bean mild mosaic virus causes appreciable yield loss in soybean. Azuki-bean mosaic virus and cowpea aphid-borne mosaic virus are common in all parts of Japan. Pea seed borne mosaic virus has a limited distribution only in pea growing area in Wakayama Prefecture and causes great yield reduction. It may be an international virus which has been reported in North America and Europe.

We have 2 soil-borne viruses, broad bean necrosis and pea stem necrosis viruses. Broad bean necrosis is not so common but is found in Shikoku and Kyushu areas. Pea stem necrosis found recently in Wakayama Prefecture, is a destructive disease in peas with restricted distribution. Symptoms caused by the 2 soil-borne viruses appear only in cool, early spring season but their vectors are not known.

We have several viruses transmitted by aphids in a non-persistent manner. There are cucumber mosaic virus in peas, beans, azuki-beans, clovers and so on. Alfalfa mosaic virus in soybeans, clovers and so on, lettuce mosaic virus in peas, turnip mosaic virus in peanuts, and watermelon mosaic virus in peas and beans. Broad bean wilt virus is not only an important virus of broad beans and peas especially in the western part of Japan, but also important virus of spinach and some other vegetables in some localities. Bean yellow mosaic virus, including several strains, is widespread and serious on many legumes in the western part of Japan.

International Working Group on Legume Virus (IWGLV) is now working actively for international standardization of differential hosts, and trying to make a key for the identification of sap-transmissible viruses distributed in temperate zone. I hope this activity will extend to cover the viruses in tropics and also I hope some of the persons who are interested in this problem, will take part in the IWGLV. As I am not familiar in legume viruses in tropics, I would like to ask Dr. Iwaki to have some comments who knows about those in Indonesia.

Iwaki (Japan): I was able to isolate 10 kinds of viruses from legumes in Indonesia. Three of them were found to be aphid-borne virus and transmitted in a persistent manner, one was found to be leafhopper-borne in the same manner, and 4 were found to be seed-borne.

In this symposium there have been shown several virus diseases of legumes, some of which look very much alike but called by different names or considered to be different because of different vector and other characteristics. Already there were some confusion about names, for example, peanut mosaic virus was firstly used in 1947 by Toone in Indonesia and Dr. Ting reported to this symposium with the same name but considered to belong to the peanut mottle virus. So that we have to reconsider naming of many viruses. IWGLV are now working hard for the standardization, therefore, if we can work alone some standard procedure, it would be very nice to characterize and identify

more strictly.

Benigno (Philippines): My suggestion is that we should have at least one center, a bank of legume virus, which is responsible for keeping or giving indicator test plants so that we could have a similarity of this kind of study and will be able to get antiserum from such center.

Kitajima (Brazil): Bean golden mosaic virus which is transmitted by white-fly was not important a couple of years in Brazil, but is becoming very important being associated with the quick growth of soybean production. So far a lot of people in Central America including CIAT in Colombia are now involved in this problem and we could not find source of resistance among them. As I mentioned a pound of beans is worth a pound of meat in Brazil, we would appreciate very much if we could have some information from other tropical countries which have similar problem to test possibilities of controlling these virus diseases.

Mishra (India): I agree with Dr. Kitajima regarding virus diseases transmitted by white-fly. It is very important virus in India, too, particularly the disease is a limiting factor to the yield of soybean and other legumes. The vector is *Bemisia tabaci*. We are looking for information on the identification of the vector whether it is only one species or is including a number of other species. Vector is not only for yellow-mosaic virus disease (=golden mosaic virus disease) but also for leaf-curl virus disease which is very important for some vegetables in India. Situation might be the same in many other Southeast Asian countries.

Chairman: If there is nobody to give some more comments, I immediately have to summarize, here. The first, various legume viruses which is transmissible through seeds, soil-borne, insects in persistent or non-persistent manner, are recognized. The second, needs are felt to standardize all procedures for identification of legume viruses. The third, virus-vector relationship is important to be studied further. The fourth, it is expected to set up one center which has responsibility for giving indicator test plants and antiserum to various countries.

Because of time limitation, we have to skip the topic on virus diseases on coconut and oil palm, and have to be in a hurry to proceed further, into international cooperation program.

The most important thing is that what kind of cooperation is possible in order to be most beneficial to countries concerned. The cooperative work should not be a burden to countries but to be helpful to each other, then cooperative work is meaningful. Therefore, points of interest and problem which should be brought up here are in order to give fruitful results of cooperation. Now, I question you which point in cooperation work would be most fruitful for all of us.

Mishra (India): I think we have here a very clear idea of the extent of virus disease in the country report from most of the tropical countries. Is it possible that we can make a list of the common diseases? After combining all information which has now been given, then this will give us an idea what is the extent of the spread of new viruses like white-fly transmitted ones, what we know and what we do not know on virus diseases.

Nualchan (Thailand): We have tried to treat citrus trees with antibiotic like tetracycline to control greening and this treatment seems to be effective under laboratory condition but does not work at all under field condition. As citrus greening disease is a serious problem in Thailand, I would like to know how to control it.

Ting (Malaysia): As I have mentioned in my country report, something that we can consider are as follows. The first, setting up a center for type culture collection. The second, possibility of organizing also, a center for indicator test plants, seed and antiserum. The third, possibility of training and exchanging visit on citrus virus program. And the fourth, circulation of a newsletter regarding virus disease information possibly

operated by TARC or the like. Finally, we hope that we could have more conferences of this nature.

Kitajima (Brazil): Making a compliment to Dr. Ting on exchange of information. Seeing and talking with the people is quite different from reading the published papers, so that interchange of personnel is very important. I also agree with the newsletter as the best way of exchanging information. We have some periodicals in Brazil which can be exchanged. Something like an international organization, TARC could organize that, because TARC has necessary facilities, personnel, technical knowledge and particularly fund for that purpose. I think we should have more participating countries, if possible, at least Mexico, Costa Rica, Colombia, Venezuela, Nigeria and Kenya.

Benigno (Philippines): I would like firstly to put to this body the creation of some sort of an association of plant virologists in tropical countries, as there are world-wide associations of nematologists and plant pathologists. The second comment is that the most countries in Southeast Asia lack necessary funds to purchase equipments for basic researches. So, I hope that Japan perhaps can really help developing tropical countries. The third, I would like to suggest that it seems worthwhile if we have a summary on distribution, identification, vector and morphology of all the virus by crops to make the point at a glance. There are so many technical papers and country reports in this symposium that it is difficult to know the contents of the proceedings at a glance. This will be a follow-up of the newsletter.

Kitajima (Brazil): One more point is to have a sort of catalogue of each virus, research personnels, facilities, so as to be able to know what we can expect from other countries at a glance. I am an editor of the Journal of Brazilian Pathology Society which is opened to public and I would like to use this journal as a means of devoting to what is done here. So, I also would like very much for everybody to send me information so that I can promote in Latin American countries.

Chairman: Well, thank you very much. Because of limited time, I have to review all your ideas as follows:

With respect to international cooperation program, there are many things of common interests. The first is setting up of a center for type collection, seed bank, identification, and antiserum. The problem is that who is going to carry out the work. The second, of course, it depends upon the reaction of the host country, we should provide everything if this proposal is realized. The third is training and exchange of scientists and experts which have done already, not only to the host country but also to another country. The problem is funding. The fourth is newsletter on virus diseases of any crop. As for the conference related on the matter of virus, I believe that this is not the last conference but the beginning one and we hope to come together again to discuss on virus. Of course, everybody is willing to participate.

With respect to Dr. Kitajima's suggestion to include some more Latin American and African countries, it seems to be reasonable for me, because they have the same problem as we do and there are quite a number of people working on that. Creation of an association of plant virologists in tropical countries is a good idea, if it can include countries like Japan and Brazil which are not totally belong to tropical and subtropical. However, how far we can materialize this good idea is still a question. Of course one of the limiting factor for developing nations is financing of facilities and training of man-powers. We expect not only an intra-cooperation from TARC but also anything which is within ability of the developing country to promote activity on virus diseases.

In addition, Dr. Kitajima seemingly has some comments on this. Dr. Kitajima, please.

Kitajima (Brazil): Thank you very much for your discussion in this symposium. It is very important to cooperate among countries in standardizing techniques, such as in electron microscopy, in bioassay, and so on. I hope that discussions in this symposium

will greatly contribute to clarify virus problems in tropical agriculture. Thank you.

Chairman: Thank you very much Dr. Kitajima. Since time is running up, there is a closing remark from Dr. Murakami before we depart for our journey.