GROUP DISCUSSION I

Research Needs on the Pathogens

Discussion Leaders :
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Agenda

1) Mating reaction.
   a. Diploid or haploid mycelial stage?
   b. Mating responses—what are they?
   c. Can a single conidium give oospores?
   d. Can crossing be accomplished?

2) Host ranges and physiologic specialization as verified by cross-inoculations.
   a. Artificial inoculations.
   b. The need and choice of trap species in nurseries.
   c. Testing isolates from all over the world under controlled conditions on various hosts at one or two institutions for morphological differences.

3) Oospores.
   a. The role of oospore morphology in species differentiation.
   b. Electron microscope, scanning electron microscope and organic stains on oospores as an aid to understanding and cataloging oospores according to morphology.
   c. What are the extremes in morphological variation that can be induced by external or internal factors - *in vivo* and *in vitro*?
   d. Germination—methods, such as stimulation by root exudates, alcohol vapors, ethylene, NaOCl and passage through insects and other animals, cellulolytic and glucanolytic agents, "brighteners", etc. Why should Hiura's method sometimes work?
   e. How to tell whether an oospore is alive or dead? Tetrazolium, etc.
   f. Morphological distinction between oospores of Peronosporaceae and Pythiaceae.

4) Conidia and conidiophores.
   a. Time-lapse photography studies.
      To demonstrate the development of conidiophores and conidia.
      To ascertain the true mechanism of conidia ejection.
   b. Viability of conidia of various species under various conditions of temperature, humidity, light, deposition surface, and host matrix.

5) Developing methods for observing and preserving morphological structures.
   a. Standardization of mounting media.
   b. Selective stains and phase microscopy for best demonstrating wall structure of conidia and sporangia.

6) International permanent repository and availability service.
   a. Slide preparations and photographs.
   b. Herbarium material.
   c. Literature.

7) Descriptive illustrated account of graminicolous downy mildews.

8) Up-dating the bibliography.

9) An annotated review (as the soybean one).

10) DM sub-group of the ISPP.

11) Monograph on graminicolous downy mildews.

Discussion Session I - The Pathogen

Shaw: I will lead off by discussing mating reaction - item 1. There is uncertainty as to where

meiosis occurs in the life cycles of Oomycetes. For years in fungi like the downy mildews (DMs) the nucleus in the oospore was considered diploid (2n) and meiosis was reported to occur during oospore germination. However, Sansome (Chromosomes Today, V, i: 77-83. 1966) has hypothesized that *all* the oomycetes, including the DMs, may be diploid in their vegetative state. This would mean that meiosis does *not* occur in the first divisions of the oospore nucleus but occurs in the formation of gamete nuclei-i.e. during the last two nuclear divisions in the antheridium and oogonium respectively. The genetic basis for pathogenicity is entirely different if we are dealing with diploid (2n) vegetative mycelium instead of haploid (1n) mycelium. We must clarify the chromosomal and nuclear content of the mycelium of DMs.

What happens if you inoculate with a single conidium, a single zoosporangium or even a single zoospore? First, it depends on the chromosomal content of the nuclei present (1n or 2n) and on the number of nuclei in these structures. *S. graminicola* is much more likely to have a single nucleus in a zoospore than are the conidia of other species. What pathogenic effects are possible if we have heterokaryosis and multiple nuclei in conidia? How do we ascertain if we have compatible mating types? Can a single conidium give oospores, and if it does, what does it mean if the conidium was multinucleate to begin with?

Finally if we can ascertain what is a haploid structure in the DMs, can we cross DMs in the typical sense of that word? Are we dealing with homo- or heterothallic organisms? Or, as you will find in the literature, are we dealing with homothallic organisms with heterothallic tendencies? Those exact words have been used to describe certain DMs.

Kenneth: Can a single conidium give oospores? At least three people have inoculated plants with single conidia. Drs. J. J. Dogma and O. R. Exconde are not here, but Paul M. H. Sun has succeeded frequently and they have also succeeded here in Thailand. Dr. Sun, have you found oospores from inoculations where plants were held under isolated conditions?

Sun: No, we have not found oospores in corn.

Kenneth: How about mono-conidial inoculations of sugarcane?

Sun: We have not attempted that.

Kenneth: While there has been no reported success, this would be a good area of research and might have later application.

If one attempts to cross isolates of a *Sclerospora* species or two species on corn (item 1), there is always the chance of obtaining double infection without having obtained anastomosis; and, of it occurring in the field and to be the cause of strange or abnormal symptoms we sometimes see. We could prove the existence of double or triple infections by inoculating a plant with isolates of a number of species at one time and see what results. True crossing might possibly be demonstrated by mixing the fungi grown in axenic culture.

To study host range and specialization we must undertake artificial inoculations on many host species, especially wild plants. If done in various lands, we can likely develop a chart to show the amplitude of each isolate and of a species as a whole. Past studies have been carried out only as half measures.

Concerning trap species in nurseries (2b) some sorghums should be included in corn nurseries, even in a country which does not grow sorghum or have DM on sorghum. The same should be true for corn in sorghum DM nurseries. The results would help identify the pathogens and, furthermore, would provide an early-warning signal of a potential hazard. The trap species should be sown a few days after the other plants to assure that they receive conidial inoculum. Other gramineae such as pearl millet, sugarcane, teosinte, *Setaria*, *Echinochloa*, *Heteropogon*, *Panicum*, *Eleusine*, *Sorghum halepense*, etc. should also be included in the DM nurseries. Whenever possible, susceptible varieties or lines should be chosen; e.g., not *S. halepense* from

Israel where most are highly resistant, but from Venezuela where it is susceptible to *S. sorghi*. Popcorn would be a good trap species for *S. graminicola*. It was shown many years ago to be particularly susceptible to *S. graminicola* and is still a mere curiousity on corn. Perhaps this trap species would prove the potential of this DM species. Let us decide if the idea is feasible and which species should be used. Some may pose difficulties as noxious weeds and not be allowed into a country. Perhaps the person who sows the nursery will have to take the responsibility of eliminating the noxious plants after the data is collected. Someone has to organize this International DM Nursery, together with the ancillary species just mentioned.

Renfro: Concerning other host species being included in the DM nursery, I would much prefer to have these added locally if possible. It is difficult enough to get phytosanitary clearance for one crop without complicating the situation with other crop and wild species. At present sorghum, pearl millet and sugarcane are implicated in the dissemination of DM inciting species to new areas. I am quite concerned with having seed of the complete nursery restricted from entrance to a country because of the inclusion of one or more host species appearing on the plant quarantine officers' restricted list. With corn we are quite safe in not presenting a hazard to another area with seed shipment even though many countries do have quarantine law restricting its entry.

Kenneth: I think it is possible for people to add their own trap species in certain cases.

De Leon: We could test particular lines or varieties which have already proven to be worthy candidates somewhere; e.g. Dr. Malaguti's, in which oospores have appeared. We do not know whether or not oospores would form in other varieties or in other kinds of corn material.

Frederiksen: Carlos, in conjunction with collateral hosts, one of the progenitors of maize is teosinte. I wonder if it would not be appropriate to evaluate some teosinte collections to ascertain susceptibility and perhaps to different reaction to the different DMs. I believe you have a good collection of teosintes at CIMMYT. Could we obtain about 20 collections of teosintes and evaluate them in areas like Zaire, Thailand, Northern Mexico, Texas and South America?

De Leon: The whole range of teosinte varieties are in the CIMMYT bank. We can even expand the effort, but lets keep this in reasonable limits. *Tripsacum* would be another host genus worth challenging. There are several species which are also in the CIMMYT bank and maybe I could send seed of these, but let us remember these are weeds.

Frederiksen: In Texas *Tripsacum* was an old native grass that did not compete favorably with some of our other weed species. It was a native forage grass but was grazed out. We have not seen DM on it. I am particularly interested in testing these two host genera and can offer our laboratory as a test site for these related species against sorghum DM to both conidial and oospore infection.

Kenneth: As I understand it, those interested will have to add their own test host species which they may be able to obtain locally or though their Plant Introduction Service. Another way would be to test DM isolates from all over the world under controlled conditions at one location to study morphological, as well as host range, differences. I suppose this could be done at Frederick, Maryland (USDA containment laboratory) or at TARC which has displayed interest. Many of us would be willing to send our isolates so that they could test all of the DM species possible in their growth cabinets under controlled conditions. No representative from Frederick is present, but I would like to know if we can send species of DM from both wild and cultivated plants to TARC for this purpose.

Kimigafukuro: We offered a service yesterday, but our containment facility is not yet complete. Its completion will take much money and time. We want to work only with *S. sacchari*, *S. philippinensis*, *S. maydis* and *S. sorghi* from SE-Asia. I would like to conduct a comparison of different corn varieties and of pathogenicity of

these fungi on the same variety of corn under the same conditions.

Payak: Dr. Kimigafukuro, yesterday you mentioned that you. or another staff member from TARC, would visit the countries concerned to collect material and local staff are not to send you material. Is that right?

Kimigafukuro: Yes, I will collect material myself.

Kenneth: What about oospores which can be shipped in the mail? Do you still prefer to collect those yourself or can we send oospore materials?

Kimigafukuro: Of course I want to get the species to be inoculated by oospores from each country. But, I already have most species which produce oospores. It is very difficult to germinate and inoculate with oospores so maybe I will go to every country to get our own DM fungi and inoculate with conidia.

Renfro: I was at Frederick, Maryland about six weeks ago. Their main interest with the corn DMs is in protecting the agriculture of USA. They would like to have a collection of all the DM species and certain strains attacking corn although there is a limit to the number of collections they can handle. They, in-turn, will provide information on the comparisons made. They have expressed an interest in having Gardner Shaw collaborate with them, particularly for taxonomic reasons. To date they have not obtained a culture of *S. maydis* from Indonesia.

Kenneth: Do you think it would be worthwhile to contact Dr. Bonde at Frederick to ask if they would be interesting in testing all of these host genera and species we have mentioned, including weed hosts, and whether they would be willing to accept oospore material?

Shaw and Renfro: That is quite in order.

Frederiksen: At a meeting in 1975 it was suggested that the program at Frederick, Maryland would have several objectives. They would place less emphasis on DMs, and several other items, and instead of having one full-time person devoted to the DMs they would now have a part-time person who would divide time between two diseases considered threatening. One reason they are less concerned with DM is because they have not spread or caused much damage in the US corn belt. I suspect that a recommendation from this group would encourage this group to remain as active as they are. We have continually encouraged them and have written them officially from the Experiment Station in Texas asking them to continue this work. We have a vested interest in their research because DM poses a major threat to corn and sorghum in Southern USA.

Shaw: While Chris Schmitt was organizing his work he corresponded with me, and I gave him numerous suggestions and names of individuals to contact for material. I am not sure how much material they have now, but I intend to follow-up and work closely with them.

Sujin: As plant breeders we are worried about the variability in size and shape of spores we saw from the slides shown by Udom yesterday. We are particularly worried about the variance in *S. sorghi* in our progeny screening work. Different species occur in different countries and apparently there is a lot of variability here in Thailand. Do we need to send DM isolates from one country to another?

Renfro: We have a choice of moving the host or the pathogen around, or both. The containment laboratories are our "islands of isolation" for assembling all of the species and pathotypes to one place.

Sujin: There is no problem in moving the host around; but, if you are thinking of moving pathogen isolates around the world it is going to be a burden to the recipient institution. We have good pathologists and facilities in each country so why not establish a study on the variance already existing in different species?

Renfro: We have little evidence of variance in virulence existing among the DM species in corn. Neither is there evidence that pathogenicity varies in the morphologic types Udom showed.

Frederiksen: I might add that it has not been tried.

Sujin: Correct, and we are not so sure of this.

Frederiksen: What Sujin is saying is that if you can have genes for variability of morphological characters, you can just as easily have variability for pathogenicity.

Shaw: In fact I would say you have to have some pathogenic variability before you ever get nay morphologic variability.

Renfro: We know there is pathoginic variability as based on our knowledge from host genera.

Frederiksen: Correct. The question is what is the species concept in the Sclerosporas? A species is what a reasonably competent taxonomist can differentiate one from another, which really does not tell us very much. We are asking for a lot more and consider it quite important. In our experience, we believe that it is really not appropriate to look for physiological specialization in an organism until you have provided it with an opportunity to differentiate. This really means one needs to distribute resistance genes. We have had an almost continuous monoculture, a single source of DM resistance, in one environment for six consecutive years. We have not, to date, seen any evidence in a breakdown in resistance. There is some indication that it is a broad based resistance; we hope it is stable.

Kenneth: Is it possible to send a letter to Frederick to ask if they would take the responsibility for testing the host range of the *Sclerospora* species and isolates from all over the world?

Shaw: I suggest Bob Renfro write in view of the fact that he has been in correspondence with them. It should state that this group deems it desirable that work of the type and currently underway be continued.

Renfro: I will also contact responsible persons in India, including at ICRISAT, for supplying seeds of the millets to those wanting them. India has all of the millet species.

Sujin: I would recommend that each national program participate on this point. If you send us the hosts we can test the reaction under our conditions.

Sun: We can also test the reaction to *S. sacchari* in Taiwan.

Renfro: This would apparently be an adjunct to the corn DM nursery. Some may want to test under controlled conditions if potentially troublesome plant species such as *Tripsacum* are included.

Shaw: In regard to oospores, let me remind you of the diagram I drew on the black board yesterday to highlight some of the unusual aspects of the specimen Dr. Dange had. This is the type of study we need. We need careful, critical examination of the oospores, not only of those species that we think we know well, but also as they occur on hosts where they are not normally found. I mentioned the tremendous complex in *S. macrospora*. If we are to get a descriptive illustrated account for the graminicolous DMs these are the types of studies needed.

Electron microscopy, especially scanning EM, and use of organic stains on oospores will help accomplish morphologic studies. I do not think oospores vary as much morphologically as structures produced externally such as sporangia and conidia or sporangiophores and conidiophores. Concerning the extremes in morphologic variation, the oospores that pass through grasshoppers are still viable according to the literature. However, I do not know of any work done with the ruminants, but it certainly needs investigation. Oospores are one of my great interests. I have a much greater opportunity to work on them than to work on the asexual stage. Safeeulla is also interested in this and I will volunteer him along with myself; I think safely so in view of the recent discussions we have had in regard to going forward in joint preparation of a graminicolous DM monograph.

I will be glad to receive specimens from anywhere in the world. If they are dry specimens there is no problem whatsoever. And, I have indicated how one can get good sporangial and conidial material if you will just get up early enough in the morning and collect it and dry it fairly quickly. I could probably get a quarantine permit for introducing DM-infected plant ma-

terial, probably easier than anywhere else in the USA. As I said, we do not have any graminicolous DM that occurs there natually. We grow a lot of wheat, but we do not have a record of *S. macrospora* attacking it in the state of Washington. So, I do not foresee any problem of introduction, but initially I prefer to work with dry specimens.

Payak: On oospore germination, I recommend the use of tetrazolium chloride or bromide which is used for testing the viability of seed. This chemical might be able to differentiate between live and dead oospores. Dr. Shaw mentioned that there can be three types of oospore germination: (1) germ tubes, (2) germ sporangium and (3) the possibility of a vesicle in which the zoospores would be delimited. We should keep all three types of germination in view and not overlook an *Albugo* type of germination.

Kenneth: A number of possibilities have been mentioned on germination of oospores and how to determine if they are alive or dead. Some of us have tried almost everything to germinate oospores and seen one or two which have possibly germinated. We must continue research work until there is a break-through. We mentioned alcohol vapors simply because there was a breakthrough with alcohol vapors in the Entomophthorales 3 years ago. With regard to cellulolytic and glucanolytic agents, what is the make-up of the oospore wall? According to Lippman *et al.* (1947, J. Gen. Microbiol. 80:131-141) the oospore wall of *Phytophthora* has no more than 10% cellulose and the main constituent is B-1, 3-glucan. Possibly glucanolytic or cellulolytic agents, such as certain fungi and bacteria, can break them down. They either wear away the wall, permitting germination, or kill the spore. Either event would be good and work along these lines would likely produce interesting results. These "brighteners" I mentioned, [Darken and Swift (1974) "Effect of Brightener on spore germination. Mycologia 56:158-163] were tried with success on spores of all sorts of fungi, but not on Oomycetes although these agents might work for us.

A few words on Hiura's method of germinating oospores [Hiura, 1930. A simple method for the germination of oospores of *Sclerospora graminicola*, Science 72 (1856):95]. Many people, including Dr. Exconde, have used this simple method with success for germinating oospores of various DM. In short, one places crumpled filter paper in a petri dish lined with wet cotton wool and adds oospores to the partly wet paper. Now, why should this method sometimes succeed when all others tried seldom have? One possibility is that the oospores are almost always dirty. There might be cellulolytic bacteria on them which utilize the cellulose of the filter paper and cotton wool and these increase in number and then affect the oospore wall.

We do not yet know how to tell it an oospore is alive, dormant or dead although it is extremely important. There are numerous reports which have' 'proven" viability or non-viability by sowing them with seed in the soil and either getting infection or not. If no disease developed they decided that they were dead, but perhaps they were dormant and be alive even 20 years hence. A few recent articles describe the use of tetrazolium chloride to tell if fungal organisms are alive. Our committee put morphological distinction between oospores of Peronosporaceae and Pythiaceae on the agenda because there has been some people looking at oospores of *Pythium* and not *Sclerospora*, particularly when leaves were placed in soil for a while, after which they are full of oospores. I personally know that you can very easily pick up *Pythium*. We must be able to tell oospores of the DM's from those of *Pythium*.

Concerning conidia and conidiophores(No.4), the idea is to work with time-lapse photography. It would demonstrate the development of conidiophores and conidia. The periodic flashes of light might disturb conidiophore production so perhaps you could employ instead some monochromatic light which is equal to darkness as far as the fungus is concerned to show the actual development of the conidiophore under various conditions. Also, you could follow sterigmata development, as they are sometimes used as

morphological characters in delimitation of species, and what happens to them after the spore falls off. In addition, time-lapse study would reveal the true nature of conidial release. Weston actually proved 50 years ago that conidia are actively ejected. Ingold decided they are ejected by rounding-off, something that I am very doubtful about considering the very narrow point of attachment and the large size of the spores.

Payak: I would like for this group to discuss item 4b, the "viability of conidia under various conditions". Moin Shah said he used glycerine for the preservation of *S. sorghi* and got enhancement of viability when stored at fairly low temperatures. We should try liquid nitrogen and DMSO as published by Chris Schmitt. We know DMSO is a very useful product and that the medical profession used it to treat burns. However, it has some carcinogenic effects so perhaps they have stopped using it. DMSO is a carrier which spreads rapidly through the whole plant system. It could be used both for preserving the viability of conidia as well as a carrier to test chemicals for control.

We have some data on temperature, humidity and light, but there is a gamut of factors for study which, to synchronize properly, requires controlled laboratory conditions. A few studies, such as the electric charge on the host surface, may not require elaborate equipment. Similarly Dr. Semangoen in Indonesia showed that leaf exudates stimulate conidial germination even though for large scale inoculations we may not be able to collect enough exudate to provide stimulation.

Shaw: I will comment on item 5, "methods for observing morphological structures". These must be standardized, e.g. significant differences occur for measurements of conidia mounted in different media. Conidia mounted in either water or lactophenol and examined within an hour will be smaller than the same specimen mounted in KOH. It takes up to 24 hours for spores mounted in water to swell to the extent spores in KOH will swell in about 5 minutes. This is just one of the reasons that examinations from the same herbarium specimens by different workers often result in differences of 20% for spore measurements whether its DMs or ascospores. However, the DMs are worse to work with than ascospores in this regard. So, the standardization of mounting media is important and one should at least define the conditions under which the measurements being presented were made.

It is only a matter of finding time to work with different selective stains and phase microscropy to be able to easily demonstrate the aspects of wall structure of conidia and sporangia that I have mentioned so frequently over the last three conferences. By discussing these topics we hope to stimulate interest and are not implying that any one person has to do them all. Each of you has a different group of DMs that attack the gramineae and could choose one or more species for you and student work.

This brings us to "descriptive, illustrated account of graminicolous DMs" (7). Dr. Safeeulla wants to start work on a monograph and this is what we would like to work toward. But, from what I have seen the past 2 days I would prefer a short delay to determine how much more information should be available before a good, comprehensive monograph is put together. A good monograph treatment stands as a monument and a reference work for many years. Hopefully, some of the aspects we have mentioned here can be resolved during the next 2-3 years. When a monograph is prepared I prefer that it cover all graminicolous DMs rather than the narrower group of maize DMs that have been the major subject of this conference.

Payak: I feel we can aim at a more modest summary than a formal monograph. People already have data on various morphologic characters from several countries and a modest booklet containing illustrations—at least form a base from which to proceed—is needed. Right now we feel the lack of information. I suggest we assemble the information now.

Shaw: An annotated review is one possibility; ours would be limited to the DMs on maize rather than attempting to cover all diseases of a single crop. We would have the DMs of a group of crops and then under item 11 is a monograph in a classical sense. And, I am glad Dr. Payak made the point, that the descriptive illustrative account could serve a very useful purpose right now; just as soon as we can get something of that kind out. I ask Dr. Kenneth to make any additional comments in regard to publication of such a summary and also to analyze what we have said.

Kenneth: An international permanent repository and availability service (item 6), including slide preparations and photographs (6a), herbarium (6b) and literature bank (6c). It demands an institution willing to take the responsibility and our cooperation in sending material. We have made a start here by bringing microscopic slide preparations and having photographs taken. Dr. Exconde announced that UPLB is starting a herbarium, with its own curator. Its preparation will take about a year and he said they would agree to store the DM material received. This would be our central repository. It is understood that this repository would provide material upon request; some would be sent on loan and some material could be dispersed on a permanent basis.

Literature is a sore point. The lack of a single relevant article can mean a big set-back in research. Today large repositories exist with copying services, e.g. USDA library and British Council; but, one may often have to wait 3 months with "rush service", and even then learn that they do not have the paper. Now is the time to make a repository for every article on DMs that might be relevant for our work. Dr. De Leon just informed us that CIMMYT would be interested in setting up a library of this sort, and I hope we all will quickly contribute to it reprints of our own efforts and others we have that are difficult to obtain. I stress the difficult-to-obtain articles, such as those anonymous reprints from Ivory Coast, etc. we heard about this morning, or by someone deceased 30 years ago. Workers of many years ago were not as restricted in words as we are today, and among the verbiage one can find many interesting details we have lost sight of today. It is envisaged as a kind of service with reprints sent out on loan or material xeroxed and sent out, preferably the latter, if possible (unfortunately, however, xeroxed photographs usually are poor). A start was made in 1969 at Nainital, when Drs. Shaw and Safeeulla volunteered to multilith a bibliography of the DMs.

De Leon: As start, I think I can take the responsibility from CIMMYT to provide the service to people involved in the general interest of maize improvement. One request is that if you people have originals, please have copies made and sent to us so we can begin distributing photo copies of the papers you want. I also state that some of the interesting DM work is written in reports and remains unpublished.

Shaw: If you go back to 1920 you have to make the best photocopy you can from the original.

Renfro: Can you handle the herbarium and slide repository at CIMMYT also?

De Leon: No, we would prefer not to handle the herbarium or the slides at CIMMYT. Laboratories in Asia, for example, are well set-up to handle these.

Kenneth: A great contribution from CIMMYT would be the literature storage and service facility. There are two further problems with the literature. One is what Renfro added on updating the bibliography. A lot has been written since and furthermore, they skipped some materials they probably never knew existed. Certain old articles may be really valuable, but few know about them. Some articles will need to translated into English, which obviously is the lingua franca. For instance a paper written in Hebrew it is not of much use to anyone in another country. Therefore, it is encumbent upon individuals to write a translation or at least an abstract that is attached to it. I have no present solution to the problem of translating from German, Russian or Italian into English. Translation ser-

vices exist, but who will assume the financial burden?

Payak: We now have in Bangkok a basic collection of microscopic slide preparations brought by delegates. We could have the slide repository right here in Thailand.

Kenneth: Yes, we have a start in its establishment and I think it is best to leave it here. And, if someone wishes to work here on this collection or ask for a loan in order to write a monograph, it would probably be made available.

Udom: I think Kasetsart University would be very glad to accept the responsibility.

Kenneth: Well, the Thai group is well prepared to handle this. The microscopic slides now present here are excellent. So, I think we are now all agreed to locate the slide repository here at KU. This information should be announced to the outside world because other scientists will be working with this group of graminicolous DMs some day. There are international journals of plant pathology and mycology that should learn that there will be a herbarium at UPLB in another year, a slide repository here at KU and a reprint service for those actively working on DM at CIMMYT.

Payak: We could make a draft of our decision and send to the ISPP Newsletter for wider circulation.

Shaw: Actually this brings us to item 10 "DM sub-group of ISPP". Dr. Safeeulla has had some correspondence with Dr. R. K. S. Wood, who is just completing the presidency of ISPP. The response was that any group that desires to organize informally within ISPP may do so. I think it is appropriate, if there are no objections, for us to formally request recognition as a "graminicolous DM sub-group" within ISPP and, as Dr. Payak indicated, we very briefly state our objectives and intentions. The following group can prepare the formal request: Kenneth, Shaw, Safeeulla, Frederiksen and Renfro.

Renfro: This will provide our group formal recognition by the International Society. Furthermore, it will provide an opportunity to meet at the congress site each 5 years and to obtain travel approval and support. In the intervening years regional meeting could be held if desired. Drs. Shaw, Safeeulla and I also agreed that the sub-group should be inclusive. We will be benefitted from association with other DM workers and the formation of a larger group will be to mutual advantage. This group of graminicolous DM workers is in position to take the initiative.

Payak: I think no one has objection to the ISPP sub-group being DMs as a group.

Shaw: For up-dating the bibliography I assume Drs. Kenneth and Safeeulla will be willing to help. I would like a volunteer from Japan, not necessarily one of you, who would have the time and be willing to cover the Japanese literature, because this was an area of neglect in the bibliography distributed in 1970. Another was Russia, where I had no contact whatsoever. You might say that Russia is away north of where the graminicolous DMs are of any importance. Nevertheless, in the Russian literature there are lots of records which have at least reported *S. graminicola* on various hosts from different Republics. So, if anybody has a colleague whom you think might cooperate give me the name. It will be helpful even if those references in Russian are identified that have reference to *S. graminicola* and, possibly, *Sclerophthora macrospora*. There should be a reference to the latter fungus in Russia although I have not found one for it.

Secondly, we need a Japanese colleague to volunteer to assemble Japanese titles on the graminicolous DMs and provide English translations. For general utility we should have the titles translated into English in the bibliography followed by the notation written in Japanese. I had some of them in the original bibliography, but I know I missed a tremendous number. Could I have a response from a TARC man?

Kimigafukuro: Yes, we will be able to identify a responsible person and inform you.

Sujin: Who is taking care of publishing the monograph? What is the resolution on that?

Shaw: I will follow through on this with Safeeulla. The more I think of it the more I like Dr. Payak's suggestion that we get something out on the basis of the very good photographs we have assembled here.

Payak: De Leon has prepared a small pictorial booklet on maize diseases. Now something like that should definitely be put together, come out quickly, and it would involve low publication cost.

Kenneth: For the information of the group Frederiksen and Renfro are writing a review article of the DM of corn for the 1977 Annual Review of Phytopathology. You can be alert for the appearance of that publication.

Renfro: Our article will only partially fulfill purposes this group has in mind. The title the APS review given us is the "Global Status of Maize Downy Mildew". It will involve geographic distribution, economic importance, potential treat to new areas, work in progress, etc. The article will not primarily involve descriptive pathology or mycology, nor will it be a monograph.

Payak: Dr. Kenneth, this reminds me of the descriptions of the DM pathogens you prepared and which appeared in CMI. Descriptions of Pathogenic Fungi and Bacteria, Set 46, Nos. 4, 51 and 452, 1975. This is the type of taxonomic description we now need to provide quick identification.

Kenneth: Yes, last year we described four *Sclerospora* spp. I wrote on *S. graminicola* and *S. sorghi* and the CMI staff member wrote on *S. sacchari* and *S. philippinensis*. They are short and leave much to be desired. And, as I stated before, as soon something is written its already passe. However, these will be of value to some people. Reprints are not available. One must buy the complete folio, which is inexpensive, to obtain them.

Shaw: Keep in mind we have one other reference. This is the APS Compendium of Corn Diseases. The photographs of DMs there are pretty good. So if we are going to put something together it has to be better and more up-to-date than that.