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ESCOLA SUPERIOR DE AGRICULTURA «LUIZ DE QUEIROZ»
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Dear Dr. McClintock,

I am very disappointed about the way our plans on meeting here ended up. I was prepared and had several things to show and discuss with you and Dr. Brown; I need some advises and probably some help also. When we meet again I will tell you about the way our planed meeting was handled. I am not very happy with the things around here; not the things directly linked to our research program but the general ones. Dr. Brieger has already time for retiring and looks like he is preparing his retirement for a date not far from now. I am not liking the way this preparation has been done. Now he took the enchange of organizing the Biology Dept. at the University of Brasilia and this is taking more than half of the time he should devote to Piracicaba.

The Symposium developed smoothly here. Since I was the only one who had no specific program during the meetings, most of the job was put on my shoulders. Dr. Stephens was here and I could show him my results and get his impressions and advises.

I got preoccupied about the last paragraph of your last letter, where you asked about the pictures you sent me after the meeting in Mexico. I am sorry, however I received them and I thanked you in a letter sent a week later. In the same letter I enclosed some knobs pictures I took here asking your opinion about them. Unfortunately the plates I brought from Mexico were all defective. ^{When I} take the pictures ~~and~~ part of the plates are impressed but others not. The non impressed spots are irregular in shape. It looks like the problem is with the distribution of the gely on the surface of the plate. I tried to buy new ones in Brasil, but they are not found. The Kodak people here promised me to importe some samples from the States but so far I got nothing. I am using the 35 mm high contrast film I brought from Mexico. I had some trouble with the focus of my microscope; it was fixed and now, although I am not completely satisfied, the quality of my pictures, I think, was improved.

I also sent you copy of a letter of our School to The Rockefeller Foundation, asking urgency for the material and equipment destined to the maize program. The freezer already arrived in Brasil and probably next week it will be at Piracicaba. The purchase of the Pollaroid equipment is in development and I expect to have it in use by November or December. The same is true for the seed storage chamber.

The knob analysis is going not as fast as I would like. Last semester I had to give two courses (on cytogenetics and evolution of cultivated plants) and this took great part of my time. However I got new data

from the north of Argentina, finished the samples of Cateto, started the examen of the material collected last year in northeastern Brasil and on dent types from São Paulo. I organized my data in percentages and in diagrams. The comparisons seems to me easier in this way. I am sending to you, enclosed, a copy of the diagrams obtained. Each diagram corresponds to a knob (Nódulo). In the horizontal axe I displayed the regions from where the samples came; in the vertical axe the percentage of plants, in each region, showing the presence of knob in the position of the chromosome considered. The solid lines corresponds to small knobs, dotted lines to large knobs and broken off lines to medium knob. As you can see in the horizontal axe, I disposed the regions following the sense north-south, along the coast until Parana and than I went west through Mato Grosso (south), Paraguai, Mato Grosso (north), north of Argentina and then I came back to Rio Grande do Sul and Uruguai in the coast. I did not considered the data from 5 plants of pop corn from Buenos Aires and I divided Mato Grosso only in two regions. Sao Paulo was considered as a whole and not divided according the Paraná River. In Mexico we considered the data from Buenos Aires, divided Mato Grosso in four regions and divided São Paulo and Minas Gerais accordingly the river and not the political divisions.

In the north of Mato Grosso, North of Argentina, Paraguai and south of Mato Grosso (I am calling this area, Paraguai area), the Andean complex is strongly represented. In the north of Mato Grosso and north of Argentina almost 100% of the plants have a small knob in position 7L. To the left and to the right of these regions, on the diagram, the frequency of plants carrying this knob goes down gradually and the frequency of plants carrying medium and large knobs in the same position, goes up. The medium knob in this position, according your data, does occur in Chile but not in Bolivia. According my data it does not occur in north of Argentina. Probably it was introduced in Paraguai and south of Mato Grosso from the east or the south (unfortunatelly we have no data from Argentina). The gradient showed by this diagram impressed me. The situation of the knob in the position 6L3 is also interesting. The frequency of the small knob is very high in plants from all the regions. However if the diagram of the knob in position 6L2 is examined one can see that it is almost absent in the North Mato Grosso and North Argentina, but it is highly frequent in the regions far from these areas. Thus if the diagrams for 6L3 and 6L2 are examined together one has the impression that in the North of Argentina and Mato Grosso the 6L3 was introduced or originated alone while in the other regions it was introduced or originated together with 6L2. If the data are analysed as we did in Mexico separating the frequency of 6L3, 6L2 and both together, the situation is clear. Probably 6L3 in Paraguai area originated from the Andean complex and in other areas originated from other complex.

In the Paraguai area (south of Mato Grosso, north of Mato Grosso, Paraguai, north of Argentina) besides the Andean Complex, other knobs are found, probably introduced from other areas. A small knob in position 1S

is found in Paraguai and North of Argentina. It is absent in Mato Grosso, in Chile and Bolivia (according your maps). Thus it seems it was introduced from the south. A medium knob in position 2L has low frequency in South of Mato Grosso and a large knob has very low frequency in Paraguai. These knobs are not found in Bolivia and Chile. A small knob in position 3L was found in about 25% of the plants in Paraguai and south of Mato Grosso, it was also found in North of Argentina. Medium and large knob in this position was found in Paraguai. The small knob was absent in Bolivia. The small-medium (your classification) knob is found in Chile and the large in Bolivia. It seems to me this knob was introduced in Paraguai from the east.

The medium knob was found in Paraguai, south of Mato Grosso, and looks to me it was introduced from the east, more precisely from Paraná. In about 3% of the plants from Paraguai was found a large knob in this position. This knob was also found in Bolivia and in Chile. A medium knob in this position was found in Chile. It seems to me the medium knob is characteristic of a race found in Paraná and cultivated by the Caingang Indians. It is a white floury dent.

The small knob in position 5L seems characteristic of Mato Grosso and Paraná. It is found in Chile together with the medium knob and is absent in Bolivia where in this position only a large knob appears.

The situation in relation the long arm of chromosome 8 is still a little confuse to me and I am trying to dissect it.

The small knob in position 9S is interesting. It was found in all Paraguai area being a little more frequent in the North of Mato Grosso. It was also found in Chile and Bolivia. In the long arm of the same chromosome a small knob is found at low frequency in the Paraguai area. In Chile and Bolivia a large knob is found in this position.

Knobs are absent in positions 1L, 3S, 4S, 5S, 6L1, and in chromosome 10, in the plants I have so far examined.

Although I made not diagram for position 7S, in the Guianas, a small knob was found in 5 plants out of 9 and a large knob in 1 plant out of 9. Also in Uruguai, a large knob was found in 4 plants out of 18.

Looking the diagrams I have the impression that the Paraná region has a characteristic complex formed by a medium knob in position 4L, small knob in 5L, probably a medium knob in 7L and a medium knob in 8L1.

It seems clear the relation between Guianas and Uruguai, however this relation is more qualitative than quantitative. This means that one find in one region most of the knobs found in the another, however the percentage of plants carrying the knobs are different. This can be well illustrated by the situation related to the small knob in position 9L. This knob is found in approximately 90% of the plants from the Guianas but in only 25% of plants from Uruguai. The inclusion of data from Ceará and

northeast Brasil brought some interesting new aspects. It can be seen now some continuity along the coast from Guianas to Uruguai with an interruption in Paraná and probably Santa Catarina from where nothing was so far examined. The situation along the coast is certainly complicated by the several ancient and recent introductions mainly from Mexico and the United States. I have just received some samples from the region of Pará in north of Brasil, where introduction has been little or almost nothing. The examen of this material will give probably the knob constitution of the coastal maize and will be possible to get an idea of the introductions.

In summary, I am seeing four or three areas in our region. The Paraguai area, characterized by the Andean complex of knobs with some introgression mainly in Paraguai and south of Mato Grosso. These introgressions came mainly from the south, and in lesser degree from the west, north and east. A second area is the Paraná area, characterized by a medium knob in 4L, a small knob in 5L, a medium knob in 8L1 and a medium knob in 7L. The third area is the Guianas and Uruguai area characterized by large and medium knobs, and the fourth area is the coastal region from Ceara to São Paulo, characterized by medium and large knobs. There is possibility that Guianas and Uruguai are extensions of the coastal area.

Tuxpeños have been introduced in Brasil since long ago and this can be the origin of the medium size knobs along the coast. I am sure that more data will clarify more on the general situation.

I separated my data by races and looked the correlation with geographical areas. In some regions as Guianas (Cateto), north of Mato Grosso (Interlocked), south of Mato Grosso (Avati Djakaira), Paraná (Cain-gang Dent), only one race occurs, however in the other areas plants from two or more races were examined. From the north of Argentina was included about 8 morfological races. What is interesting is that the knob constitution of the races change with the area. For example, let me mention the race "Avati Tupi" or "Cristal". The plants of this race which I examined came from Minas Gerais, São Paulo and Paraguai. A small knob was found in position 1S in plants from these three regions; however in position 2L, medium and large knobs were found in Minas Gerais, medium knobs in São Paulo but no knob in Paraguai. In position 3L was found a small knob in plants from the three above mentioned areas, however in Minas Gerais were also found in this position medium and large knobs, and in São Paulo large knob. The same situation is true for other positions. In general however, the samples from São Paulo and Minas Gerais have medium and large size knobs which are not found in Paraguai. I think that an intensive analysis of individual races will bring good informations about infiltrations; however a much larger amount of data must be accumulated. I think, this ~~is~~ probably will be the second step in our work. The Cateto race from several region also showed variation in knob constitution. I am trying to do this "dissection" of knob data, using Kato's material and the

results coming out are interesting. I analyzed, for example, the Coastal Flint and the Tuzon. The infiltration of one in the other in certain areas is clear, mainly in Panama.

Right now I am looking in my data the question of homozygosity and heterozygosity of knobs. One difficulty is the low number per region. In some cases I am finding a random distribution of the three classes - homozygous knobbed, heterozygous and homozygous knobless; in other, a predominance of one or another class. However I am in doubt if this is result of a sampling or if it is a real non random distribution resulting from selection effect. In general, however, the observation made by Kato that the larger knobs tend to appear in homozygous condition, more frequently, seems to be true.

This is the general situation around here. I still have a lot of details and I would like to show and discuss them with our group. I think we have to wait until the next meeting in October.

Just before the Symposium was visiting with me the Professor of Genetics and the Dean of the University of Maracaibo, in Venezuela. They were interested in our program of studies on maize and decided to send next January, a just graduate man, to Piracicaba. He will stay working here with me during 18 to 24 months. The University of Maracaibo will pay his fellowship. The plan of work I have proposed to him, is the knob analysis of the races from Venezuela. They consider the collection already made in Venezuela, not complete. Most of the samples were obtained along the roads and bought in markets as they informed me. They will do some re-collection mainly in regions far from the roads, where nothing was done so far. These material will be grown here, next November.

All the samples we collected in northeast Brasil was photographed, measured and now I am sending 600 seeds from each to Dr. Wellhausen, in Mexico.

Two weeks from now I will leave for a collecting trip in the Amazonas region. The University of Brasília will lend me a small airplane used by people studying anthropology for their contacts with the Indians. If possible I will leave Brasília, go north, until Belém in Pará, making stops in regions close to the Indians reserves. Major Goodman is going along with me and also a fellow from our department. The plane has room for only four persons. This trip will be done in more or less 30 days.

I am sending to Dr. Brown a list of samples I would like to obtain in Fort Collins, Colorado. They are mainly from the Guianas and Uruguai.

Sincerely yours,



A. Blumenschein

