THE OCCURENCE OF PERONOSPORA TABACINA ON TOBACCO IN IRAN IN 1962

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Tobacco is a crop of great economic importance in Iran, where it covers a surface of more than 32000 ha. of cultivated lands. From this cigarette tobacco with an area of 26000 ha. is the most important. It is chiefly grown along the coast of the Caspian Sea and in the north-west of the country. The main tobacco growing area and also with the best quality of tobacco are the western parts of Rasht (Guilan). Local varieties for iranian pipe ("tootoon tchpoghe" 3500 ha.) and waterpipe ("tanbakhu" 2100 ha.) are grown in small areas in Azarbayejan, Kordestan. Esfahan, and Fars (Fig. 1). The occurence of ***Peronospora tabacina*** Adam (blue mold of tobacco) in Iran in 1962 threatens greatly this crop, especially when the climatic conditions in some parts of the country where tobacco is grown are very favourable for the disease.

In the following report it is tried to point out the observations made in 1962 about the dependence of blue mold upon climatic conditions and cultural methods.

EXPASION OF THE DISEASE

On 22.5.1962 the first specimens of ***Peronospora*** - infected tobacco leaves were brought to Plant Pest and Disease Research Institute Tehran for identification. On visiting the infected area near Rasht (Guilan) shortly after that date the following observations were resulted:

Late May: Two early planted fields near Ahmad - Goorab about 4 Km. in the west of Rasht were the first foci of infection. The visit of these fields was made on 27.5.1962 when the tobacco plants were about 20 cm high. At this time all plants were severely infected and fructifications of the fungus were frequent. Young plants which still remained in plant beds were also severely infected. It seemed that the infection had been started in plant beds some weeks before, i.e about the end of April.

Away from those two foci towards the west the intensity of infections became gradually less and less. In fields 30-50 km. in the west of Rasht only a few infected tobacco plants were seen on this visit of the end of May. It was thought that the wind from east to west had brought the spores to these areas from the two first infected fields. The infection in old seedbeds at first was

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slight and seemed to be started after the time of transplanting, and not from the soil by oospores. Later, because of the dense stands of seedlings, blue mold soon increased in these secondary sources of infection from which spread to all adjoining fields.

To eliminate these foci of infection it was ordered for the whole province of Guilan to destroy at once all seedbeds. To destroy infected fields at this time was already too late, and it only would have meant a useless hardship to tobacco farmers.

June : The expansion of the disease in the west of Rasht was so rapid that there in late June no fields were left without a rather severe infection. Of the two first infected fields one with heavier soil was already completely destroyed, while the other with lighter soil showed at least a little hope for a small crop.

In such situation the disease was threatening the tobacco areas near Astara (180 Km. in the north-west of Rasht), and in Mazandaran (the first tobacco fields are here located in Kelardasht, 160 Km in the south east of Rasht, and then near Amol, another 110 Km. in the east).

On the visit of the Astara area on 1.6. 1962 near Hashtpar (half the way between Rasht and Astara) in one plant bed was found some infection. In fields planted from this seed bed no infection was seen . In Astara only in one field was found one leaf with fructifications of the fungus. Two weeks later all Astara showed moderate or heavy infection.

Mazandaran, that means the eastern part of the Caspian Sea region and the areas towards the Turkmenian steppe, remained safe from infection during this period.

July: Because of the warm weather and picking of lower leaves the development of the disease in Rasht and Astara stopped in July. Most of the upper leaves and the seed capsules remained healthy.

Only a few new infections producing necrotic blotches without much fructifications (conidia) were seen.

In early July the disease spread to Kelardasht, Amol, Shahi, and Sari, but it was restricted to fields in high regions, banks of rivers and the inside valleys . The northern plain towards the sea side was safe (Fig.2). In several places beside the infected fields we found old neglected seedbeds with heavy infection and fructifications of blue mold . It was obvious that from here the spores had been transmitted by wind to the adjoining fields . On tobacco plants under the field much fructifications was only produced in moist locations or under the shades of trees . In a large number of fields because of warm weather fructifications were scarce,so that sometimes an exact identification of Peronospora only could be made by microscopic investigation. At once after receiving reports that blue mold had been found in Mazandaran, the local tobacco officer had ordered the farmers to start picking of the lower leaves . By doing this the lower parts of the plants get more sun and air circulation and so the damage due to Peronospora in moist fields can be reduced .

Only in some fields situated in unfavourable conditions the loss

amounted to 50 % or more . On the whole in Mazandaran about 15 % of the fields in 1962 showed more or less severe infection .

In the east of Mazandaran (Gorgan, Gonbadkavoos), Azarbayejan (Tabriz, Khoy. Rezaeyeh) and other toccaco growing areas of the country the disease was not seen in 1962 .

September / October : A few lesions were reported on young leaves of old tobacco stems after harvest time from east of Behshahr . Before this time , during the summer, no infection had been seen in this area .

LOSS

The average reduction of tobacco crop due to blue mold in 1962 in Iran was : In Rasht 50 % , Astara 40 % , Mazandaran (Kelardasht, Amol, Sari, Shahi) 2 - 3 % .

These figures are valid for the tobacco areas as a whole . As is mentioned above in some fields the damage was less or higher, depending on climatical conditions and location . For instance in Mazandaran many fields were free of infection, while others which were situated inside the valleys or in high regions, and so because of cooler weather were planted later, showed a reduction of 50 % or more .

In areas where seedlings in the plant beds had been already infected, as in the Rasht district, after transplanting many plants died in a young stage, or growth was reduced . In such fields damage was worse than in fields where infection had started late after transplanting . Here at first leaves of normal size and grade were formed, but later their quality was depressed by some necrosis due to blue mold .

Beside the reduction of crop, as it is mentioned above, especially in Guilan , most tobacco leaves were of a lower grade or quality because of necrotic spots or early picking . So the whole loss of tobacco crop in 1962 due to blue mold was much higher than those figures show .

ORIGIN OF THE DISEASE

Sometimes it was said that the spores of blue mold might be brought to Iran unconsciously by travellers who came to this country through Turkey. Nobody has uudertaken to prove this assertion . It seems more probable that the conidia were blown by wind from Turkey or Russia to Iran . The transmission from the south russian tobacco areas in the north of the Caspian Sea and Caucasus is the most probable version because of non - existence of high mountains in the way of the spores . If so, the conidia might be transmitted 700 Km from their places of origin .

DEPENDENCE ON CLIMATICAL CONDITION AND LOCATION

The climatical conditions of the tobacco growing areas in Iran, as well as the time of sowing, transplanting and harvesting are different from a region to another (Fig . 3 and the following Table).

Area	*Sowing Plant beds*	*Transplanting*	*Harvesting*
Guilan (Rasht , Astara)	4 . 2 . - 24 . 2	14 . 4 . - 21 . 5.	22 . 6 . _ 31 . 8 .
Mazandaran (Amol , Sari, Shahi, Behshahr , Gorgan, Gonbadkavoos)	4 . 2. - 24 2 .	21 . 4 . _ 26 . 5.	27 . 7 . - 22 . 10.
Azarbayejan (Tabriz, Khoy, Rezaeyeh) and Kordestan (Saghez)	from 21.3.onwards	31 . 5 . - 1 . 7.	23 . 7 . - 12. 10.

Guilan (Rasht and Astara) : Here the weather is warm and humid, with much rain, even during the summer,and with luxuriant virgin forests . Many fields are of small size . They are often surrounded by trees or even placed in the middle of forests (Fig . 4) . Mostly they are hedged in by thick wooden fences to keep away the grazing animals . For irrigation of rice fields there exist many canals in this district . All these factors favour a moist and damp condition and prevent extreme high or low temperatures .

Gorgan and Gonbadkavoos : Here the climate is less humid and most rains occur between October and May . In the north _ east of this area vegetation shows the typical character of a steppe .

Fields are larger than in Guilan and mostly situated in the open plains . Culture of rice is rarely to find . Only the fields in the south, near to the mountains, are located in the valleys or inclosed in thick forests . Because of the wind ascending in the day time on the slopes of mountains, this area is more cloudy and rainy. So the fields here get more shade and are cooler and moist.

Sari, Shahi, Behshahr, Amol, Kelardasht : The climatical conditions are intermediate between the two above regions (Fig. 3). Here as fields are nearer to the sea the climate is more humid than in the Gorgan_steppe. But fields are larger and more open than in Guilan. Cultures of rice with canals for irrigation sometimes are frequent. Fields inside of valleys or on the banks of rivers are moist. Kelardasht is mountaineous and so is cooler than the other parts of Mazandaran .

Azarbayejan and Kordestan : An example for the continental climate of these areas is shown in figure 3 by the climatical datas of Rezaeyeh. Winters are cold and wet. Summers are dry, but as these provinces have a high altitude (Rezaeyeh 1332 m; above sea level) they are cooler than the Caspian regions. Vegetation is m ostly restricted to some small trees and shrubs, and the fields are usually more open than in Guilan. Rarely fields are surrounded by small woods and then they are more moist .

Beside these climatical conditions there are in some regions, other favourable factors for infection of tobacco by blue mold .

In the Caspian provinces (Guilan and Mazandaran) many tobacco fields are situated in closed places in the middle of forests. The ways which lead

to these hidden places are mostly mountaineous and difficult to pass, especially in rainy weather. These small fields which remain out of the watch of officials of Tobacco Monopoly Department and Agricultural Extension people, and which have the most favourable conditions for blue mold make the best sources of infection. The winds which blow during the night from the mountains toward the sea may bring the conidia of the fungus to tobacco fields underneath in the plains. Therefore, a control of blue mold in the caspian area would be impossible if these potential sources of infection could not be kept under especial observation by the tobacco officials.

The main crops in Guilan are rice, tobacco and tea. As the rice needs irrigation with its own especial lands, and canals, and tea is perennial, none of them can go in rotation with tobacco. So mostly tobacco is grown after tobacco and infection by oospores from the soil makes a grave problem. Contrarily, in Mazandaran Azarbayejan and Kordestan there are other crops, as wheat and cotton, which can go in rotation with tobacco.

It is still unknown to what extent in Iran blue mold may start in the spring by conidia and mycelium, which are produced in mild climates (as the Caspian areas) on some overwintering tobacco plants or other Solanaceae weeds. This problem needs further investigation.

The rate of tobacco seed, sown in plant beds in Iran normally is about 1,2 g per m2. That means a very dense stand of seedlings. Also in the field, as is shown by the following table, tobacoo plants of the most frequently grown varieties have a more dense stand than in Europe.

Variety	*Chiefly grown in the area of*	*Distance of plants in cm*		*Average number of plants per ha*
		between rows	between plants in the row	
Basma	Rezaeyeh, Mahabad	40–45	12–15	185000
Tikulak, Samsun	West Mazandaran, Tabriz, Khoy, Shahindezh, Kordestan (Saghez)	50–55	15–18	115500
Trabusan	East- Mazandaran, Rasht , Astara	55–60	18–25	81000
Sumatra	Rasht (only 7 ha)	60–70	30–35	50000
Virginia- Burley	Rasht, Astara	100	70	14300

Dense stands provide more shade in the scope of the lower leaves ; so the temperature is lowered and air moisture increased. Infection and fructification of ***Peronospora*** by this is favoured. In such stands it is also more difficult to protect plants completely and from all sides by a fungicidal spray against new infections.

In 1962 weather in the tobacco growing areas of Iran was not much different from the normal weather, as it is shown by the climatical datas for long years (Fig. 3 and 5). Only March 1962 in all areas was somewhat drier and warmer than normal.

CONCLUSION

From all what is mentioned above it is believed that in Guilan (Rasht-Astara) conditions for blue mold not only in 1962, but also in the future will be most favourable and optimal. Each year there will be much danger from this disease in the seed beds as well as in the fields. Merely in July intensity of infection and fructifications somewhat could diminish because of hot and dry weather in this month.

In the open plains near Gorgan, in Azarbayejan (Tabriz, Rezaeyeh) and Kordestan (Saghez, Sanandaj) blue mold from March till May would find favourable conditions in the plant beds. Later in the season dry weather should prevent further infection and fructification. Only shady and moist places, for example near rivers, should be also endangered by Peronospora in the summer.

In West - Mazandaran (Sari, Shahi, Amol, Behshahr, Kelardasht) during the time when plants are in the seed beds conditions are optimal for infection. In June and July weather is variable, especially precipitations. So in years with much rain in early summer there will be much danger for tobacco from Peronospora, in dry years not so much.

In such situation in future each year in all tobacco areas in the north and the north-west of Iran a preventive control of blue mold must be given at the time when plants are in seedbed. If farmers would be able to transplant healthy plants in the fields in Azarbayejan, Kordestan and Gorgan they also should be able to control blue mold in the field later in the season and to grow up a healthy crop.

It is not so in Guilan and the west of Mazandaran. Here preventive control by fungicidal sprays must be started early in the season in seed beds and then continued intensely in the fields umtil July. Beside this in Guilan some changes concerning the cultural practices must be established. If anyhow possible, it is better to grow tobacco only in yearly rotation with other crops. Especially this is advisable for plant beds. Dense stands of plants must also be avoided in plant beds as well as in the fields. The best practice would be to prepare all plant beds under the supervision of the governmental tobacco sections on a central location of each area. Then the officials of the Tobacco Department could take care for proper sprays and inspection of plant beds. No tobacco should be grown in fields with uncommon heavy soils and in too damp or shady places.

We know very well, that there will be much difficult to carry out all these control practices in Guilan. But there is no other alternative, if culture of tobacco in this province should not be left, sooner or later, because of too much damage due to Peronospora.

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EXPLANATION OF FIGURES

Fig. 1. Tobacco growing areas in Iran and infection by blue mold in 1962, According to the informations given by the Tobacco Monopoly Depart - ment. Tehran.

Fig. 2. Culture of tobacco and infection by Peronospora in the area of Shahi, Sari, and Behshahr in 1962. The map clearly demonstrates, that infected fields mostly are located in the valleys, coming down from the mountains. According to ioformations, given by Mr. Moshrefi. Tobacco Monopoly Department, Sari.

Fig. 3. Comparison of the climate of different places, characteristic for the main tobacco growing areas. Average monthly data, according to the long year reports, given by the Iranian Meteorological Department (1)

Altitude of the stations: Rezaeyeh 1332 m; Gonbadkavoos 150 m; Rasht 3 m above sea level.

a = relative air humidity at 6. 30 a. m. Iranian time

b = relative air humidity at 12. 30 Iranian time

c = daily maximum of temperature, °C

d = average daily temperature, °C ($= \frac{\text{max.} + \text{min.}}{2}$)

e = daily mininum temperature °C

f = tolal precipitations per month in mm.

Fig. 4. Tobacco field in the middle of a luxuriant forest in the Caspian plains between Rasht and Astara. Such closed and damp places are typical for some parts of this province.

Fig. 5. Difference of weather in 1962 from the long year meteorological data. Aversges of monthly differences, according to reports given by the Meteorological Department, Tehran. See also Fig. 3.