Development of potato planting material production and multiplication systems outside the closed zones in Romania

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Abstract
The success in big and continuous potato production resides in producing healthy planting material with high biological value in quantities covering the needs. Reaching this goal is difficult because of the continuous and progressive infection rates of potato plants with virus diseases causing degeneration and regression of production. In this respect, alongside the organization of closed areas for seed potato production in Romania, there is a need for zones outside the closed areas in order to provide the entire quantity of seed potatoes in our country and also in order to provide a system to renew seed potatoes.

Key words: potato, production, virus infections, clones.

Introduction
In the potato crop technology the most important link providing a big and healthy production is the use of healthy seeding material when planting.

The production of the seed potato is a highly professional scientific activity based on the method of conservative amelioration of repeated, positive, clone selection. Together with the diagnosis of virus infections it is a technique modernized in relatively recent times through rapid micro-propagation techniques. Practically, it doesn’t cover the seed potato need of an area or the country because of a large volume of special works, raising seed potato tuber production costs up to non-profitable values (Pompilica, 2005).

Consequently, maintaining the high sanitary standard at an acceptable level can only be realized by several years of re-multiplication and virus infection prevention through complex and special organization and technical measures adapted to the area’s climate conditions. Obtaining seed potato mass-multiplication can be also done in specialized farms or areas, in counties outside the traditional closed areas and is based on maintaining a low level of virus infections, especially severe potato infections caused by the Y virus (Pompilica, 2005).

According to Benea, 2003 – in Romania potato production are at low rates because of the use of unsuitable seed material – thus, the present paper proposes the study of seed potato production and multiplication for productive crops (Bozesan, 2000).

Material and methods
Starting from the results obtained in Romania by many researchers as evidence of the fact that the conditions in Romania recommend the use of virus resistant species and that indigenous species are used in small percentage – the present paper attempts to study production and multiplication of seed potatoes using adequate biological material and considering that adequate material must be used for a profitable crop. Plant materials
involved in experiment were:
- 9 recently homologated Romanian potato species: Robusta, Rozana, Runica, Timpuriu de Brașov, Amelia, Nicoleta, Productiv, Tentant, Dacia,
- 3 older, imported potato species used for crops because of their proved qualities: Ostara, Sante, Desirée;
- bases for comparing results are the average value for the experiment.

Experiments concerning the evolution of aphid populations in seed potato crops have the goal to determine the suitability of the area for potato planting material multiplication. At the same time the goal was to determine the best moment to stop vegetation at aphid attacked potatoes in order to limit the spread of the attack upon the tuber. In this respect growth coordinates for the development and multiplication of different aphid species were calculated. The virus triggering aphids help determine the cycle of flight for emigration and their multiplication on the potato with great precision. Aphids are the insects most suitable for mathematical models permitting the prognosis and warning system to fight aphids. The experiments concerning the possibilities for seed potatoes multiplication outside closed areas have as a goal to obtain biological class B in areas or specialized farms from biological material produced at Brașov and multiplied over a period of a year in Păltiniș.

Pedoclimatic Conditions for the Experiments
The behavior of the varieties to the seed potato virotic degeneration as well as the evolution of the populations of potato virus vector aphids require a short presentation of soil and climatic conditions for each of the places where the research has been conducted.

The climate of Păltiniș – resort (1420 m) is of mountain type, being part of warm area slopes due to frequent and long termal inversions. The low temperatures < -2°C determine in the spring destroy fundatrix forms on primary hosts and thus minimal collecting in potato crops. At Păltiniș, in the period of the experiments 2003-2007, the period of low temperature > -2°C, was 51 days shorter than the multiannual average.

The average abundance of precipitations (mm / day with precipitations) in Păltiniș show a high rate of precipitations that contribute to a high rate of air moisture that determines the growth of some parasite fungi (Entomophthorales), which favor the decrease of aphid populations.

The specific climate of the Sibiu region is characterized by frequent termic inversions besides cold currents descending the slopes of the neighbor mountains (nights and winter). The low temperatures < -2°C that determine in spring destroy fundatrix forms or primary hosts have as an effect the drastic reduction of aphids in the area. In the potato vegetation period (IV-IX) in the years of the experiment (2003-2007) there were 12,4 days with precipitations higher than 10,0 mm.

Collecting Aphid Populations in the Seed Potato Crops
Entomological material (aphid) collection has been done simultaneously in all three experimental fields (Păltiniș, Sibiu and Avrig). In these areas yellow pots (Möericke) were placed in the seed potato crops. The activity of the aphid species has been analyzed with the help of the main analytic index linked to the number of the aphids and relative dominance (D).
Results and discussion

Evolution of aphid populations in Avrig and Sibiu in 2006-2007

The specific eco climate conditions in Avrig are less favorable than those of Sibiu due to cold currents on the Olt valley and the mountain breezes bringing at night, in the low regions of Avrig, very cold air from the snows covering the Făgăraș Mountain peaks and especially from the mountain river course. This fact makes it possible that winter eggs mature 7-10 days later than in Sibiu and also late spring freezing occurs 2-4 days later.

The aphid fauna structure specific for Avrig resembles to the one of Sibiu with less abundance due to specific eco climate factors and with registered changes in dominance classes. We notice that for Avrig aphid abundance is 33-36% smaller than for Sibiu. As for distribution in time there are no noticeable differences except the values are lower than for Sibiu.

In 2006 and 2007 in Sibiu 22-26 aphid species have been captured but in Avrig only 19 species in 2006 and 17 species in 2007. Out of the total number of captured aphid species the dominant ones represent 31.58% in 2006 and 41.18% in 2007.

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The dominance of potato virus vector species is different for the two years of the study. In 2006 the virus vector species (7) represented 64.18% from the total of captured aphids. In 2007, due to early freezing of 2006 autumn, the male subjects, because of sterility, were not able to fecundate females for several aphid species. An example is the beet black louse (Aphis fabae Scopoli) missing from the captures in 2007. Myzus persicae Sulzer, which has not been affected by the freezing of 20.10.2006, grew in dominance in 2007 to 11.78% from the total of captured aphids, compared to 10.53% in 2006. The potato virus vector aphid species remain the same as at Sibiu (neighborhood areas) but with smaller proportions and a 10 days later development. As a consequence of lower aphid abundance and dominance in Avrig the rates of seed potato virus infection attacks are noticed less than for Sibiu, even in the case of the Desirée variety.

Figure 1 represents the decade, monthly and yearly evolution of aphid populations in the seed potato crop in Păltiniș in 2003-2007.
The specific eco climate data of Păltiniș, the lack of primary hosts, refer to the arrival of aphids in the area by long distance flight from the lower regions and even through passive flight by wind transportation. In the experiment field of Păltiniș, at an altitude of 1420 m, the delay is of about 45 days compared to the low region of Sibiu Depression (Figure 1).

From this figure we notice that in Păltiniș the first aphids appear in the first decade of July and a larger number are noticed in the first and second decade of August. Consequently, virus infections have not enough time to move from stalk to the tuber and thus favor the production of virus free seed potato. This fact contributes to raise the level of potato production in the county and avoids costly transportation of seed potato quantities from the closed potato planting material production units.

The monthly dynamics analysis of virus vector aphids in Păltiniș (Figure 2) shows that in most of the years the seed potato virus vector aphids frequency exceeds 60% from the total of aphids in 2003, 2004 and 2006. Lower frequencies are registered in 2005 and 2007 when they drop to 37, 95% (Figure 2).

In Păltiniș aphids have week temperature conditions to develop and precipitations wash aphids from plants and destroy them. Altitude contributes to 45 days delay compared to maximum flight in the lower regions. Relatively high moisture and frequent fog create high danger of microbiological attack against aphids.

**Conclusions**

In the Sibiu Depression region the seed potato virus vector aphids appear right from the first days of the potato’s life and keep a high level of abundance in the months of June and July dropping in August.

In the Făgăraș Depression region, where Avrig lies, virus vector aphids’ abundance drops to half compared to Sibiu Depression area due to the colder climate and cold air flow descending the Făgăraș Mountains slopes.

In the area of potato crop fields in Păltiniș aphids appear with a 40-45 days delay compared to the areas of Sibiu Depression, due to long distance and passive flight (wind transportation of aphids).

The maximum flight of virus vector aphids in the area of Păltiniș takes place in the first and second decade of August that is 10-20 days before potato stalks are destroyed and thus virus migration to the tubers is stopped.
Obtaining class B biological category outside the closed zones in Sibiu County are the solution for providing seed potato needs in the entire area of the county and creates the premises to raise production by generalizing the use of B class biological category in planting potato crops for consumers.

In the virus free area of Păltiniș – 1420m there can be organized production of Base biological category seed potato on an annual area of 3 ha.

B Class biological category in the low areas of Sibiu county (Avrig – 375m), in favorable climate conditions on a 55 ha surface on grounds of high suitability for potatoes.

By providing locally potato planting material needed for the entire surface for potato planting in Sibiu County expenses are kept low and important sums can be saved yearly.

References:

