physiological studies on the use of tissue culture in potato

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This work was carried out during the period of 1987-1990 in the tissue culture laboratory, Horticulture Department, Faculty of. Agriculture, Ain Shams University.The objective of this work was originally established to find out a suitable substitution of the potato seed importation through using tissue culture technique as a method for virus elimination with a potential for rapid clonal multiplication of virus-free potato plants. Moreover, this study was extended to evaluate the morphological growth, as well as the behaviour of different explants (apical meristems and stem nodes) obtained from different parts (terminal, middle and proximal) of introduced potato tubers cv. Spunta grown on five modified MS media (O,A,B,C and D). Before culturing, endogenous plant hormones contents as auxins, gibberellins, cytokinins and absecic acid in used explants were determined.This study was divided into two main parts: First Part: Included the morphogenetic behaviour of different used explants as affected by various used culture media in the term of their capacity of survival as well as callus, shoots and roots formation. Second Part: Included virus tests on the obtained plantlets in-vitro. Virus tests including potato viruses X,Y,S andM were carried out on the new obtained plantlets in order to evaluate the effect of media used and or explant type on the elimination degree of such viruses.Obtained results could be summarized as follows:First Part: Morphogenetic behaviour of explants grown on different modified MS media.1- Survival %:a-Regardless explant type, the highest survival percentages were recorded in A and C medium compared with the other used ones. After 12 weeks from culturing, values reached 72.9, 64.6, 35.1, 33.7 and 17.4% for A,C,B4O and D medium, respectively.b-Apart from medium used, explants taken from the proximal part of tuber generally showed superiority in their survival percentages' over those taken from either the terminal or the middle tuber parts.c-Explants of apical meristems achieved higher percentages of survival comparing with those of stem nodes regardless to either media type or tuberpart.2- Stunt %a- Both A & C media, which showed the best survival percentages, generally recorded the least stunt explant percentages and vice-versa.b-Explants taken from the middle part of tubers expressed the highest stunt values followed by those of the terminal part, whereas those of the proximal part showed the lowest percentages in this regard.c-No obvious trend could be detected concerning the effect of meristem site on stunt percentages.3- Callus formation %a-Except for explant type, both 0 & C media induced the highest level of callus formation compared with the other studied media. At the end of manipulation, values reached 67.2, 66.0, 44.6, 36.3 and 31.8% for 0,C,B,A and D medium, respectively. Best callus formation was probably correlated with the addition of low adenine sulphate concentration (20 mg/L) combined with (1-2 mg/L) of IAA to MS basal medium.b-Explants from the proximal part of tubers achieved the highest callus percentage followed by those from the terminal part, meanwhile explants taken from the middle part ranked last in this respect.c-Stem nodes generally revealed the highest percentages of callus compared with apical meristems regardless to media type and explant origin.-74-4. Shoots formation %:a. Both A and D media, which induced the least callus formation, showed the best shoots formation and vice-versa. This was probably correlated with the addition of 2 mg/L kinetin to MS basal medium. Recorded values reached 68.3, 51.7, 38.8, 34.0 and 31.9% for D,A,B,Cand 0 medium, respectively.b-Regardless to media type, explants taken from the middlepart of tubers produced the highest shoots percentagesfollowed by those from the terminal part, whereas thosetaken from the

proximal part came last in this regard.c-Apical meristems generally achieved higher percentages of shoots as compared with stem nodes.5. Roots formation %a- The highest percentage of roots were recorded in Amedium followed by D medium. On the other hand thelowest values were recognized in 0 medium regardlessthe type of explant or its origin on the tuber.b.. Explants of the proximal part of tubers achieved maximal rooting capapcity followed by those of the terminal part, whereas the lowest percentages of roots were observed in those of the middle part of tuber.c- Apical meristems generally showed higher rooting percentages than the stem nodes regardless to media type or explant origin.Finally, it can be concluded that the behaviour of each studied morphological growth characteristics seemed to be a multiple function affected criteria that is a result of media and explant factors combinations. Second Part: Relation between medium type, explant type and virus infestation:a- Percentages of virus-free plantlets associated withA or C medium exceeded those obtained in case of other studied media. Overall percentages recorded were 93.1, 85.1, 77.8, .73.9 and 73.3 for A,C,O,DandB medium, respectively.b- As for tuber parts, no obvious trend could be detected, since virus-free plant--- lets percentages were found to vary mainly due to the type of tested viruses.With regard to potato virus X and Y, the terminal part was superior, however such superiority was obvious only in the middle part with respect to PVS, meanwhile all potato tuber parts were equal and produced 100% PVM free plantlets.c- Apical meristems recorded higher percentages of virus-free plantlets compared with stem nodes regardlesseither type of media, tuber part or kind of virus.d- The success of tissue culture technique depends partly on the nature of viruses, since some of them are more readily to be eliminated than others. Irrespective of explant used and media type, obtained plantlets were 100%, 83.1%, 72.3% and 66.1% free from potato viruses M,S,Y and X, respectively.