Utilization of Wild Pears Rootstocks as a Natural Resource for Loquat Production Under Rainfed Condition in Sulaimani Governorate

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ABSTRACT

A study was conducted during the spring season of 2009, at Azmar mountain, Sulaimani city, Kurdistan Region-Iraq. The commercial cultivar of loquat was used as scion and wild pear trees of 25-30 years old, grown naturally in the region were used as rootstock. The treatments consisted of two budding methods (T-budding and pipe-budding) performed during three dates (mid May, early June and mid June). The experiment was laid out in a factorial randomized complete block design with three replications and twenty buds per replication. Least significant difference (LSD, $P \leq 0.05$) was used for mean separation. The percentages of bud-take successes were recorded after two months of the budding operations, whereas the observations on different growth parameters were recorded at the end of the season. Significant influence of the interaction of budding method and budding time on budding success percentage and subsequent growth characteristics of loquat budded on wild pear rootstock were observed. The maximum value of the percentages of budding success (68.20%) was recorded when pipe-budding was done on mid-May, followed by pipe-budding on early-

June (65%) and then pipe-budding on mid-June (55.00%). Budding time-method interaction also resulted in the occurrence of significant differences in the length of budshoots, and the number of leaves per budshoot. Pipe-budding performed on mid-May gave higher values of budshoot length and the number of leaves per budshoot (8.6 cm, and 7.03), respectively. No significant differences were observed in budshoot diameter due to budding time-method interaction.

These results confirm that wild pears can be used as a good rootstock for loquat production either as a drought resistant rootstock under rainfed condition which means entirely depending on rainfall, thus harvesting of about 7000m^3 / ha/ year or as dwarfing rootstock for high density plantation systems in the plains such as Shahrazoor, Kalar, Kifri and Kirkuk, this will be a substantial challenge against ongoing drought years toward the region.

Keywords: Pipe-budding, T-budding, loquat, wild pear, budding success, rainfed cultivation.

INTRODUCTION

Wild pear (*Pyrus pyraster* L. Burgsd.) belongs to the subfamily Maloideae in the Rosaceae (Stephan *et al.* 2003 and Palombi *et al.* 2007), this genus is able to grow on very dry sites due to its tap roots, it can grow on almost all soils except the more acidic, best growth occurs on fresh, calcareous soils (Stephan *et al.* 2003) such as the rocky calcareous soils on mountain peaks and slopes of Kurdistan region. Wild pear is considered to be tolerant to many biotic and abiotic stresses (Shatnawi *et al.*, 2006). Preservation of genetic resources in plants must include both cultivated species and wild relatives of crop plants. Wild relatives can be very useful in breeding programmes as sources of genetic variability, with potentials to exchange genes with the cultivated

varieties. They often have genes that can provide desirable qualities, such as disease resistance or tolerance to unfavourable soil conditions, wild pear is interesting as a potential rootstock for commercial cultivars (Palombi *et al.*, 2007).

The overall average annual precipitation of Sulaimani city during the period extending from 1942-2005 seasons (64 years) (Sulaimani Meteorological Center, 2007) was found to be 687.09 mm. The amount of annual precipitation in the region follows a distinct pattern of duration cycles. These cycles show a drought season each 7-8 years, in which annual rainfall is less than 500 mm and a drought season for 1-3 years each 7-8 years in a cycle (Figure 1) for Sulaimani city (Mohammad Ali, 2008). Thus, production of drought resistant rootstocks is highly a prerequisite.

In Iraq, little information is available on the effect of budding time and technique on budding success of loquat grafted onto wild pear, besides, no literature is available for budding loquats on wild pear rootstocks and this work may be done for the first time at the world level, so we addressed this question in the present study.

In Kurdistan Region-Iraq, wild pear trees are naturally grown and prevailed in oak *Quercus* forests, the deeply grown root system and rigid wood made the trees hardy. Most of the trees bear weak yields and no pleasant small fruits with low sugar contents (Abdullah, 1988). On the other hand, the production of loquats under irrigation systems allover the world requires high costs and much labor, in addition to their vulnerability to diseases and drought. The present investigation was, therefore, conducted with a view to evaluate the performance of pipe-budding in comparison with the traditional methods of vegetative propagation i.e. T-budding, for raising percentage budding success, and to graft loquats on wild pear trees under rain-fed condition. This is considered as an important process due to the low cost of production, less affected by diseases, in addition of making variation in ripening time of loquat fruits according to different

regions of Kurdistan and hence lengthening of the period in which loquat fruits would be available in markets, as well as to exploit the natural resources, in which, these naturally prevailed trees that tolerate drought might be used as a promising rootstock for the different other commercial fruit species within the Rosaceae family.

MATERIALS AND METHODS

The study was conducted during the growing season of 2009, at Azmar mountain, locating on north of Sulaimani city, Kurdistan Region-Iraq. The commercial cultivar of loquat (*Eriobotrya japonica* L.) was used as scion and the rootstock was the wild pear (*Pyrus pyraster* L. Burgsd.) trees grown naturally and densely prevailed in Azmar mountain (Figure 2) mixed with several other *taxa* existed in the natural forests of these mountains. The treatments consisted of two budding techniques (T-budding and pipe-budding) performed during three dates (mid May, early June and mid June). Wild pear trees of 25-30 years old were selected for the study; these old trees were headed back during March, 2009, leaving 50 cm stubs on side branches. When new shoots emerged on the stubs, 3-4 of them were selected from the outer periphery and the remainders were thinned out soon after their emergence and undesired shoots were removed from time to time. The experiment was laid out in a factorial randomized complete block design with three replications and twenty buds per replication. Least significant difference (LSD, $P \leq 0.05$) was used for mean separation and since the interaction means gave the greater values for all studied characteristics, only the interaction means were presented, while the single factors were discarded. The percentages of bud-take successes were recorded after two months of the budding operations, whereas the observations on different growth parameters were recorded at the end of the season.

RESULTS AND DISCUSSION

Data presented in Table (1) highlights the significant influence of the interaction of budding method and budding time on budding success percentage and subsequent growth characteristics of loquat budded on wild pear. The maximum value of the percentages of budding success (68.20%) was recorded when pipe-budding was done on mid-May, which was superior in a highly significant way over the other interactions followed by pipe-budding on early-June (65%) and then pipe-budding on mid-June (55.00%). This indicates that budding method had played a significant role in the enhancement of the percentages of budding success, in which pipe-budding gave the greater values compared to T-budding in the all three times (Figure 3). This may be due to the greater protection of the bud provided by the pipe shaped piece taken to perform the pipe-budding with a greater chance of fixing in place and the less area of the wound subjected to improper environmental conditions, and then a greater chance for union formation as compared to T-buds. These came in confirmation with the reports of (Pathak, 1991) and with the results of (Dwivedi and Singh, 1999).

Budding time-method interaction resulted in the occurrence of high significant differences in the length of budshoots, in which pipe-budding performed on mid-May gave the higher value (8.6 cm) which was significantly superior over the other interactions, indicating that the length of produced budshoots was mostly affected by budding time other than budding method, the earlier the budding performed, the longer the budshoots produced. This may be caused by the greater chance of budshoots having a longer period of time during the growing season (Figure 1). The result is in conformity with the results of many works (Dwivedi and Singh, 1999; Hama Salieh, 2004 and Noori, 2008). Generally, these results preliminarily indicate to a dwarfing effect of the rootstock, wild pear, since there were dwarfing signs shown by loquat scions used

in this study according budshoot length measurements which may have been longer twice as compared to many other studies (Soumelidou *et al.*, 1994; Cohen and Naor, 2002; Basile *et al.*, 2007 and Saeed *et al.*, 2010), this may be a dwarfing rootstock being used in high-density orchards.

Budshoot diameter was not affected significantly by the interaction of budding time and budding method, the higher value of budshoot diameter (7.57 mm), however was obtained from pipe-budding on mid-May, while the lower average (6.60 mm) was shown by pipe-budding on early-June.

Table (1): The interaction effect of budding time and budding method on some growth characteristics of loquat on wild pear rootstock.

Treatments	Budding success (%)	Budshoot length (cm)	Budshoot diameter (mm)	Number of leaves per budshoot
T-budding				
Mid-May	48.20 d†	6.53 b	7.40	6.57 ab
Early-June	47.53 d	5.57 c	6.97	6.07 bc
Mid-June	41.80 e	5.17 d	6.86	5.13 d
Pipe-budding				
Mid-May	68.20 a	8.60 a	7.57	7.03 a
Early-June	65.00 b	6.40 b	6.60	6.20 bc
Mid-June	55.00 c	5.83 c	6.91	5.83 c
Significance	** ††	**	N.S.	*
$LSD_{0.05}$	1.224	0.323	0.418	0.503

† Numbers with the same letters within a column are not different significantly by LSD ($P \leq 0.05$).

†† *, **: Significant ($P \leq 0.05$), Highly significant ($P \leq 0.01$) and N.S. (Not significant), respectively as resulted from analysis of variance (ANOVA).

Significant differences occurred in the number of leaves per budshoot due to the interaction of budding time-method, in which the maximum number of leaves (7.03) was obtained when pipe-budding was done on mid-May, which was higher than all other interactions in a significant way except that of T-budding performed on mid-May. This may be caused by the fact that the same treatment gave the higher significant averages of each budding success and budshoot length, and hence giving the higher number of leaves on the budshoots due to the greater chance of nutrients uptake resulted in a faster and more uniform growth (Howard, 1978; Kennedy *et al.*, 1980 and Erdal *et al.*, 2008) as a result of quick and strong union formation (Skene *et al.*, 1983) in pipe-budding. The case in which no significant difference occurred between pipe-budding and T-budding, both on mid-May, shows that this time is more effective on enhancing budding success and performance than budding method or any other factor, this came in confirmation with those of (Hama Salieh, 2004 and Noori, 2008).

Finally, it was concluded from the results of this study that wild pear which tolerates many environmental stresses such as drought and unfavorable soil conditions, can be used as a promising rootstock for loquat production either as a dwarfing rootstock for high density orchard plantation, or as a drought resistant rootstock for being exploited against ongoing drought condition nowadays allover the world, here, propagation of wild pear in fruit nurseries is highly recommended.

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REFERENCES

- Abdullah, YS. 1988. Fundamentals of Silviculture. Ministry of Higher Education and Scientific Research. University of Mosul. Iraq (In Arabic).
- Basile, B; DR Bryla; M. Salsman; J. Marsal; C. Crillo; R. S. Johnson and T. M. Dejong. 2007. Growth pattern and morphology of fine roots of size-controlling and invigorating peach rootstocks. *Tree Physiology* 27: 231-241.
- Cohen, S and A Naor. 2002. The effect of three rootstocks on water use, canopy conductance and hydraulic parameters of apple trees and predicting canopy from hydraulic conductance. *Plant, Cell and Environment* 25: 17-28.
- Dwivedi, SK and B Singh. 1999. Studies on the topworking of apricot (*Prunus armeniaca* L.) in Ladakh. Prog. *Hort.* 31 (1-2): 29-31.
- Erdal, I; MA Askin; Z. Kucukyumuk; F. Yildirim and A. Yildirim. 2008. Rootstock has an important role on iron nutrition of apple trees. *World Journal of Agricultural Sciences* 4 (2): 173-177.
- Hama Salieh, FM. 2004. Effect of IAA, kinetin and dates on T-budding success of *Pistacia vera* L. on two rootstocks. Ph.D. Dissertation. College of Agriculture. University of Sulaimani. Sulaimani-Iraq.
- Howard, BH. 1978. Chip budding in fruit and ornamental trees. *Proc. Int. Plant Prop. Soc.* 27: 357-364.
- Kennedy, AJ; RW Rowe and TJ Samuelson. 1980. The effects of apple rootstock genotypes on mineral content of scion leaves. *Euphytica* 29: 477-482.
- Mohamed Ali, JJ. 2008. Natural Resources and its Utilization for Development of Agriculture in Sulaimani region. Ph. D. Dissertation. University of Sulaimani.

- Noori, IM. 2008. Studies on seed germination, seedling growth and budding of some stone fruits (*Prunus spp.*). Ph.D. Dissertation. University of Sulaimani. Sulaimani-Iraq.
- Palombi, MA; B Lombardo and E Caboni. 2007. In vitro regeneration of wild pear (*Pyrus pyraster* Burgsd) clones tolerant to Fe-chlorosis and somaclonal variation analysis by RAPD markers. *Plant Cell Rep* 26: 489496.
- Pathak, RK. 1991. Propagation of Fruits Plants. ICAR-New Delhi (in Indian).
- Saeed, M; PB Dodd and L Sohail. 2010. Anatomical studies of stems, roots and leaves of selected Citrus rootstock varieties in relation to their vigour. *Journal of Horticulture and Forestry* 2 (4): 87-94.
- Shatnawi, MA; RA Shibli; H Migdadi; A Obeidat; K Ereifej and A M-Abu-Ein. 2006. Influence of different carbon sources on wild pear (*Pyrus syriaca*) growth and sugar uptake. *World Journal of Agricultural Sciences* 2 (2): 156-161.
- Stephan, BR; I Wagner and J Kleinschmit. 2003. EUFORGEN technical Guidelines for genetic conservation and use for apple and pear (*Malus sylvestris* and *Pyrus pyraster*). International Plant Genetic Resources Institute. Rome, Italy. 6 pages.
- Soumelidou, K; NH Battey; P John and JR Barnett. 1994. The anatomy of developing bud union and its relationship to dwarfing in apple. *Annals of Botany* 74: 605-611.
- Skene, DS; HR Shepherd and BH Howard. 1983. Characteristic anatomy of union formation in budded fruit and ornamental trees. *J. Hort. Sci.* 58 (3): 295-299.

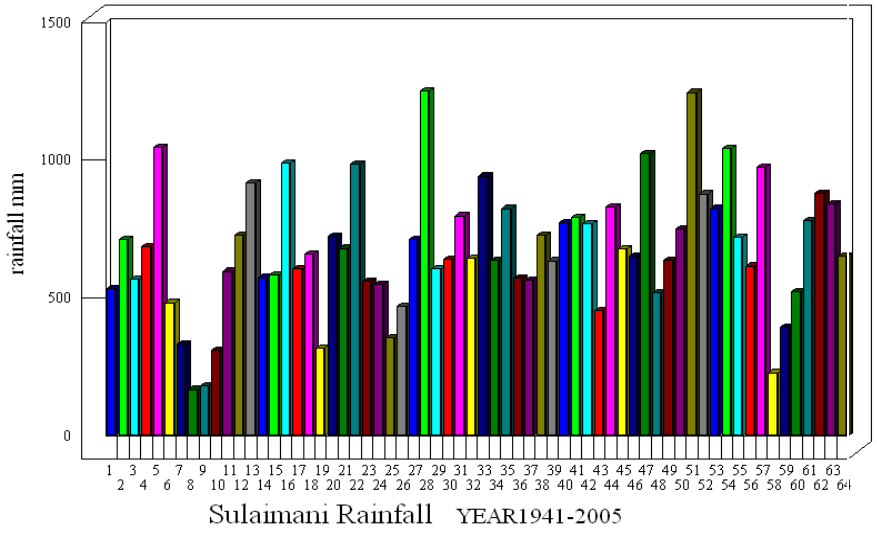

Figure (1): Average annual rainfall of Sulaimani city for 64 years.

Figure (2): Wild pear trees grown naturally on rocky soils of mountains in Sulaimani governorate

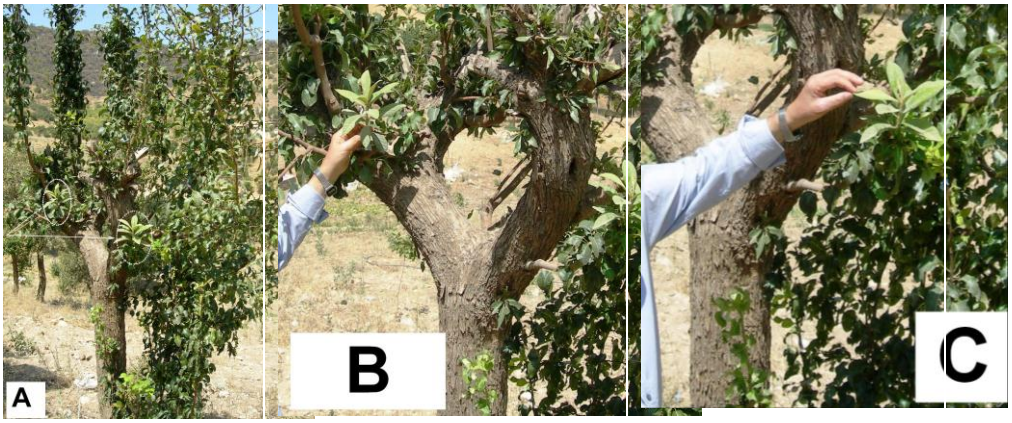

Figure (3): Loquats grafted on wild pear rootstock; two newly grown shoots grafted on mid-May (A), the same two shoots shown individually (B and C).

استخدام العرموط البري كمورد طبيعي كأصل لأنتاج البشملة تحت ظروف الزراعة الديمية في محافظة السليمانية

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الملخص

انجزت هذه الدراسة خلال موسم الربيع لسنة ٢٠٠٩ في جبال ازمر، مدينة السليمانية، اقليم كوردستان العراق، أذ تم استخدام الصنف التجاري للبشملة كالطعم واشجار العرموط البري بعمر ٢٥-٣٠ سنة والتى نمت بصورة طبيعية في المنطقة كاصل للتطعيم عليها. شملت المعاملات طريقتين للتطعيم (التطعيم الدرعي والتطعيم الانبوبي) والتي تمت انجازها خلال ثلاث مواعيد (وسط مايس، بداية حزيران و وسط حزيران). تم تخطيط تجربة عاملية باستخدام تصميم القطاعات العشوائية الكاملة

بواقع ثلاثة مكررات و عشرين طعما في كل مكرر. استخدم اختبار اقل فرق معنوي (مستوى احتمال ≤ ٠.٠٥) لفصل المتوسطات. سجلت بيانات النسبة المئوية لنجاح التطعيم بعد شهرين من اجراء التطعيم بينما اخذت البيانات الاخرى الخاصة بنمو الطعوم في نهاية موسم النمو. تم ملاحظة وجود تأثيرات معنوية لتداخل موعد التطعيم وطريقته في النسبة المئوية لنجاح التطعيم والصفات الاخرى المتعلقة بنموطعوم البشملة المطعمة على اصل العرموط البري. اعلى قيمة معنوية للنسبة المئوية لنجاح التطعيم (٦٨.٢%) كانت نتيجة تأثير تداخل التطعيم الانبوبي في وسط مايس يتبعها تداخل التطعيم الانبوبي في بداية حزيران (٦٥%) والتطعيم الانبوبي في وسط حزيران (٥٥%). كانت هناك ايضا فروقات معنوية في طول نمو الطعوم وعدد الاوراق النامية على الطعوم نتيجة تأثير التداخل بين موعد التطعيم وطريقته. إذ اعطى التطعيم الانبوبي في وسط مايس اعل القيم لكل من طول نمو الطعوم وعدد الاوراق في كل طعم (٨.٦ سم و ٧.٠٣ ورقة) على التوالي. لم يلاحظ وجود فروقات معنوية في قيم اقطار نمو الطعوم نتيجة تأثير التداخل بين موعد التطعيم وطريقته.

تشيرنتائج هذه الدراسة بأنه يمكن استخدام العرموط البري كأصل جيد لأنتاج شتلات البشملة سواء كان كأصل مقاوم لظروف الجفاف في الزراعة الديمية اي معتمداً على الآمطار بذلك يمكن حصاد نحو ٧٠٠٠ م٣ ماء /هكتار / سنة اوكأصل مقصر تستخدم في نظام زراعة البساتين الكثيفة في المناطق السهلية كسهول شهرزور، كلار، كفري و كركوك والتي من الممكن استعمالها كوسيلة جيدة لمقاومة ظروف الجفاف الجاري في المنطقة.