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PRESENT STATUS OF CITRUS GENE POOL IN PAKISTAN

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Abstract

Citrus is a rich bounty of edible fruits like mandarins, oranges, grapefruit, lemons and limes with minor categories like tangerines, pummellos and tangelos. Germplasm plays key role in evolving new and high yielding resistant varieties. A study was initiated to document the indigenous and exotic germplasm of existing citrus species/cultivars in Pakistan. Different research centers and institutes of Punjab, NWFP and Federal territories were visited to collect detailed information of existing citrus species/cultivars along with their photographs for preparing an illustrated booklet. We believe this information will contribute towards in understanding of citrus genetic resource in Pakistan by researchers/academicians and better utilization in the national and international research programmes.

INTRODUCTION

The importance of citrus to agriculture and the world's economy is demonstrated by its wide distribution and large scale production. Citrus fruits in all the shapes, sizes and colors are the most attractive, fragrant and appetizing with high nutritional values. These are one of the richest sources of vitamin C and contain 3-4% sugar and minerals such as calcium and magnesium in appreciable amounts, essential for proper health and vigor. These fruits are known to be the natives of Southeast Asia (Indonesia and China) but they are now extensively grown almost throughout the world under tropical and sub-tropical conditions where the soil and climatic regimes are quite favorable for their growth and yield (Shah, 2004). Pakistan stands among top 13 citrus producing countries of world. Citrus fruits comprise about 40% of the total fruits produced in Pakistan and it is cultivated over an area of 185,400 hectares with an annual production of about 1.67 million tonnes (Anonymous, 2005). More than 95% of citrus is being produced in the Punjab province and 70% of citrus grown in Punjab is Kinnow (Niaz et al., 2004). In fact Kinnow has monopolized the citrus industry of Pakistan, which is a leading cultivar and contributes more than 70% of the citrus produce in the country (Butt, 2004). The average yield of citrus in Pakistan is 9-10 tonnes ha⁻¹ while in other citrus growing countries it goes up to 26 tonnes/ha (Anonymous, 2005). Germplasm is vital for breeding new varieties for high yield potential and resistant to biotic and abiotic stress (Forner et al., 1981). The citrus industry of Pakistan is mainly confronted by many problems like lack of genetic diversity, low yield, less productive life span of orchards, alternate bearing, a number of insect pests and huge post harvest losses. Germplasm characterization, evaluation and documentation is important for its utilization in crop improvement (Forner and Jorgensen, 1978). Citrus industry of Pakistan needs commodities with unique

characteristics to compete in the international market, which is impossible without the detailed investigation of crop germplasm available in the country. The study was initiated to know the present citrus species existing in Pakistan, documentation of local and exotic germplasm present at various research station of Pakistan and to document tree and fruit characteristics of citrus species/cultivars along with their pictorial views.

METHODOLOGY

Various Research centers and institutes of Punjab, NWFP and Federal territories involved in citrus research were visited extensively to collect detailed information of existing citrus species/cultivars along with their photographs for preparing an illustrated booklet. The citrus gene pool information was collected from University of Agriculture, Faisalabad, Horticultural Research Center, Sahiwal, Orange Research Insitute Sargodha, Ayyub Agricultural Research Institute, Faisalabad, Barani Agricultural Research Institute, Chakwal, National Agriculture Research Center (NARC), Islamabad, Zarai Taraqati Bank Limited (ZTBL) Farm, Islamabad, Tarnab Agricultural Research Station, Peshawar and Federal Seed Certification, Germplasm unit, Sherkhana, Peshawar

RESULTS AND DISCUSSION

After collection of the related information from different research institutes the results were compiled. A total of 210 citrus cultivars were recorded out of which 154 were scion and 56 were rootstocks. This number is a handsome to be used in our citrus diversification program but still we have failed to properly use this gene pool information. Maximum collections of citrus cultivars (210) were recorded in Punjab province followed by Federal territories (80) and NWFP (46). As 95% of the citrus produced in country comes from Punjab and there are more research centers, more citrus gene pool was observed in Punjab compared to other provinces. If we observe the number of citrus cultivars station wise the results indicated that maximum collection of citrus cultivars was found at Horticultural Research Station, Sahiwal (170) followed by University of Agriculture, Faisalabad (89), Zarai Taraqati Bank Limited Farm, Islamabad (80), Federal Seed Certification, Germplasm unit, Sherkhana, Peshawar (46), Orange Research Institute, Sargodha (43), Ayyub Agricultural Research Institute, Faisalabad (34), Barani Agricultural Research Institute, Chakwal (23), Tarnab Agricultural Research Station, Peshawar (16) and National Agriculture Research Center, Islamabad (12). Among different groups of citrus, 54 cultivars were of Sweet oranges, 28 cultivars of Lemons & Limes, 27 cultivars of mandarins, 15 cultivars of grapefruits, and 27 hybrids were observed along with 56 type of rootstocks and two cultivars of kumquats.

CONCLUSION

We believe this information will contribute towards understanding of citrus genetic resource in Pakistan by researchers/academicians and better utilization in the national and international research programmes. Moreover, new high yielding varieties are expected through utilization of this germplasm and this study will serve the purpose to look into critically by scientists to pick up suitable germplasm to incorporate in their breeding and evaluation programme for insect/pest screening, rootstocks selections, increased shelf life, resistance against salinity, yield and quality of the crop.

Acknowledgements

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Table 1: Citrus gene pool at various research centers

Station	Mandarins & Tangerine	Sweet Oranges	Grapefruits	Lemons & Limes	Rootstocks	Hybrids	Fortunella
HRS, Sahiwal	24	46	16	26	46	10	2
UAF, Faisalabad	9	30	10	9	24	5	2
ZTBL Farm, Islamabad	21	28	8	23	-	-	-
FSC, Peshawar	6	20	5	4	11	-	-
ORI, Sargodha	5	31	2	3	2	-	2
AARI, Faisalabad	5	13	-	7	-	9	-
BARI, Chakwal	7	9	4	3	-	-	-
TARS, Pehawar	4	8	-	3	1	-	-
NARC, Islamabad	2	4	-	3	3	-	-

HRS (Horticultural Research Station), UAF (University of Agriculture, Faisalabad), ZTBL (Zarai Taraqati Bank Limited), FSC (Federal Seed Certification), ORI (Orange Research Institute), AARI (Ayyub Agricultural Research Institute), BARI (Barani Agricultural Research Institute), TARS (Tarnab Agricultural Research Station), NARC (National Agricultural Research Center).

CITRUS GENE POOL OF PAKISTAN

Sweet Oranges

- | | |
|---------------------------|--------------------------|
| 1. Atwood Early Navel | 2. Ruby Blood |
| 3. Olinda Valencia | 4. Mediterranean |
| 5. Boquet-de-Fleura | 6. Pineapple |
| 7. Hamlin | 8. Moro Blood |
| 9. Frost Valencia | 10. Campbell Valencia |
| 11. Torocco | 12. Chinotto |
| 13. Casa Grande | 14. Marrs Early |
| 15. Cutter Valencia | 16. Salustiana |
| 17. Kozan | 18. Trabulus |
| 19. Frost Navel | 20. Hinkley |
| 21. Joppa | 22. Parson Brown |
| 23. Sanguinello | 24. Shamoute |
| 25. Jaffa | 26. Washington Navel |
| 27. Musambi | 28. Succari |
| 29. Washington Navel-3033 | 30. Washington Navel-315 |

- | | |
|---------------------------|------------------------|
| 31. Sanguinello Mos. 4955 | 32. Tarocco Nuc. |
| 33. Moro Nucellar | 34. Navelate Orange |
| 35. New Hall Orange | 36. Navelina Orange |
| 37. Valencia Late | 38. Blood Red |
| 39. Ruby Red Seedling | 40. Midsweet Seedling |
| 41. Amber Sweet Seedling | 42. Valencia Seedling |
| 43. Navel Seedling | 44. Cara Cara Navel |
| 45. Siamese Sweet Orange | 46. Rhode Red Valencia |
| 47. Venille | 48. Sweet Seville |
| 49. Lue-Gim-Roi-King | 50. Mars Early |
| 51. Dweet | 52. Frost Navel |
| 53. 7 UAF | 54. 8 UAF |

Mandarins and Tangerines

- | | |
|---------------------------|-----------------------|
| 1. Kinnow | 2. Willow Leaf |
| 3. Wilking | 4. Pixie |
| 5. Ponkan | 6. Murcott |
| 7. Honey Mandarin | 8. Sunket Sunkey |
| 9. Nova | 10. Oscila |
| 11. Shamel | 12. Clausellino |
| 13. Satsuma | 14. Clemenules |
| 15. Clementine | 16. Clementina |
| 17. Fair Child | 18. Freemont |
| 19. Frost Dancy Tangerine | 20. Algerian |
| 21. Fortune | 22. Sunbrust |
| 23. Natal Nartjee | 24. Mangal Singh |
| 25. USDF Dancy | 26. Kinnow Tetraploid |
| 27. Kinnow Seedless | |

Grapefruit

- | | |
|-------------------------|-----------------------|
| 1. Reed | 2. Shamber |
| 3. Frost Marsh | 4. Marsh Jbc-430 |
| 5. Red Blush | 6. Red Mexican Foster |
| 7. O. P. Davis Seedling | 8. Little River |
| 9. Ruby Red | 10. Foster |
| 11. Marsh Seedless | 12. Star Ruby |
| 13. Rio Red | 14. Flame Seedling |
| 15. Frost Fresh | 16. Duncan |

Hybrids

- | | |
|--------------------------------------|--------------------------------------|
| 1. Seminola | 2. Minneola Tangelo |
| 3. Orlando Tangelo | 4. Pearl |
| 5. Mepo Tangelo | 6. Kinnow (4x) × Kinnow (2x) |
| 7. Kinnow (2x) × Kinnow (4x) | 8. Succari (2x) × Kinnow (4x) |
| 9. Kinnow (4x) × Succari (2x) | 10. Musambi × Kinnow |
| 11. Kinnow × Musambi | 12. Feutrell's Early × Valencia Late |
| 13. Washington Navel × Duncan | 14. Valencia Late × Duncan |
| 15. Valencia Late × Jaffa | 16. Jaffa × Valencia Late |
| 17. Kinnow × Ferutrell's Early | 18. Ferutrell's Early × Kinnow |
| 19. Valencia Late × Feutrell's Early | 20. Musambi × Shamber |
| 21. Shamber × Musambi | 22. AARI Pride (Pineapple × Musambi) |
| 23. Hamlin × Kinnow | 24. Orlando × Kinnow |
| 25. Fair Child × Kinnow | 26. Kinnow × Orlando |
| 27. Orlando × Fair Child | |

Lemon & Limes***i. Sweet Lime***

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|----------------|-------------------|
| 1. Palestine | 2. Peshawari Lime |
| 3. Local Mitha | |

ii. Acid Lime

- | | |
|----------------|----------------|
| 4. Kaghzi Lime | 5. Tahiti Lime |
| 6. Eustis Lime | 7. Lakeland |
| 8. Bearss | |

iii. Lemons

- | | |
|------------------------|----------------------------|
| 9. Allen Eureka | 10. Corona Foothill Eureka |
| 11. Prior Lisbon | 12. Caver's Lisbon |
| 13. Cook Eureka-N | 14. Frost Eureka-N |
| 15. Limoneria | 16. Foothill Lisbon |
| 17. CaseCade Eureka | 18. Frost Lisbon |
| 19. Caver's Lisbon O.L | 20. Verna |
| 21. Corpaci | 22. Feminele |
| 23. Promofiori | 24. Santa Teresa |
| 25. U.C.L.A | 26. Monachello |
| 27. Mesero Lemon | 28. Coock Eureka |

Root Stocks

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|------------------------------------|----------------------------|
| 1. Rouh Lemon/Jatti Khatti | 2. Citron/Mokari |
| 3. Kharna Khatta | 4. Khatta Taru Jabba |
| 5. Sweet Lime | 6. Jullundri Khatti |
| 7. Jambheri Ceylon | 8. Jambheri Lyallpur |
| 9. Shaddock | 10. Galgal |
| 11. Dewana Khatti | 12. Seville Kimb |
| 13. Gada Dehi | 14. Nasnaran |
| 15. Sour Orange | 16. Sylhet Lime |
| 17. Mithi | 18. Citrus Hystrix |
| 19. Cleoptra | 20. Mayer's Lemon |
| 21. Carrizo Citrange | 22. Troyer Citrange |
| 23. Savage Citrange | 24. Citrumello-1452 |
| 25. Citrumello-4475 | 26. Sachtion Citrumello |
| 27. Milam | 28. Red Rough Lemon |
| 29. Keen Sour Orange | 30. Brazillian Sour Orange |
| 31. Bassie | 32. Koethan Sweet Orange |
| 33. Taiwanica | 34. Rubidoux Trifoliolate |
| 35. Volkamariana | 36. Yuzu |
| 37. Macrophylla | 38. Calpi |
| 39. Pomercy | 40. Bearss |
| 41. Rangpur Lime | 42. Etrog 6013 |
| 43. Etrog 861 | 44. Bitter Sweet Orange |
| 45. Yuma Citrange | 46. Sun Chu Shah |
| 47. Smooth Flat Seville | 48. Citrus Obvoid |
| 49. Rangpur lime × Troyer Citrange | 50. Benton Citrange |
| 51. Trifoliolate Orange | 52. Sunki × Benecke |
| 53. Algerian | 54. Hirodo Bunton Pummello |
| 55. Flying Dragon | 56. Bigrade Australian |

Kumquats

- | | |
|----------|---------|
| 1. Nagmi | 2. Mewa |
|----------|---------|

Others

- | | |
|--------------|--------------------|
| 1. Bara Masi | 2. Bunton Pummello |
|--------------|--------------------|