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# The Superior Tree Breeding of *Rubus coreanus* Miq. Cultivar "Jungkeum" for High Productivity in Korea

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**Abstract** - This study was conducted to selected Korean black raspberry (*Rubus coreanus* Miq.) for high productivity. The eight major agronomic traits were investigated from 198 clones of the clone bank established in Korea Forest Research Institute, Suwon, Korea. The selection levels based on number of fruit per fructify lateral (NFFL) over 20, and fruit weight (FW) over 1.3g, and yield of individual per fructify lateral (YIFL) over 25g, were applied on 198 clones, resulted in 17 clones selected. The selected superior trees, 17 clones, appeared regional differences for amount of fruiting among 4 different test sites. When number of fruit per fruit petiole (NRFP), fruit weight (FW), yield of individual (YI) and sugar content were satisfied over 20, 1.4g, 6kg and 9.5 brix, respectively, as a select condition, 5 clones were reselected as the superior trees among 17 clones, for 3 years.

**Key words** - *Rubus coreanus* Miq., Superior tree breeding, High productivity

## Introduction

The Korean black raspberry (*Rubus coreanus*Miq.), a shrubby perennial species is an endemic species in Korea, China, and Japan, where it favours sunny habitats. On account of their high demand for sunlight, they do not flower under shady conditions and will die if conditions are too shady. They are more demanding of sunny conditions than other *Rubus* sp. and therefore have a more restricted distribution in Korea. They frequently inhabit open woodlands and well preserved temple forests in Korea (Kim *et al.*, 2002).

Among the Korean endemic *Rubus* spp., *R. coreanus*fruit have an excellent reputiation for their medicinal effects and have been utilized for a variety of medicinal purposes through the ages. In traditional folk remedies, dried immature fruits have been used as a tonic to stimulate the body and the heart, and for diabetes treatment (de Ancos *et al.*, 2000; Cho *et al.*, 2000; Kim *et al.*, 2005).

In 1800, the first Rubus breeding started in Americaand it was focused on selecting superior selections from a wild populations. After 1900, hybridizationwithin species and between species was studied and many countries have developed programs to breed adapted cultivarsfor their environments (Hall and Brewer, 1993; Knight, 1993). Their main objective was to select genotypes that produced large fruit, had high yields and that were disease tolerance, had an upright habit and were thornless.

This study was conducted to select and cultivate superior, *R. coreanus* genotypes with high productivity and to describe their flowering and fruiting characteristics.

## Materials and Methods

A clone bankthat contained highly productive, superior genotypes of *R. coreanus* was assembledin 1998. The orchard was composed of a collection of 227 clones from 15 regions in Korea. From the clone bank, 198 clones that regularly completed flowering and fruiting were used as official materials.

To evaluate of flowering and fruiting, the length of the fruiting lateral (LF), the number of flowers per fruiting lateral (NFL) and the number of fruit per fruiting lateral (NFFL) were evaluated. Fruit were harvested when fully ripe and the fruit length (FL), width (FW), and weight of fruit (WF) were measured as well as the soluble solids. The soluble solids was measured by 20 ripe fruits from each clone.

In 2001, 17 of the original 227 clones were identified as being the most superior and, in 2002, these selected genotypes were tested for regional adaptability in four different regions. Finally, these advanced selections were evaluated for flowering, fruiting and fruit production characteristics from 2003 to 2005.

## Results and Discussion

The selection level based on major fruiting characteristics, which

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Table 1. Mean for number or flowers and fruits and per lateral, yield per lateral, total yield and soluble solids content for 17 *Rubus coreanu-sclones* selected for high productivity in Suwon Korea in 2001

| Selected clone* | No. of flower/ fruiting lateral | No. of fruit/ fruiting lateral | Fruit weight (g) | Soluble soilds content (%) | Yield/fruiting lateral (g) | Yield/ bush(Kg) |
|---|---|---|---|---|---|---|
| Gochang 3 | 33.3 | 33.2 | 1.50 | 8.16 | 49.9 | 11.6 |
| Uiryeong 19 | 27.1 | 26.5 | 1.44 | 8.76 | 38.0 | 3.8 |
| Uiryeong 7 | 26.9 | 25.9 | 1.46 | 11.67 | 37.8 | 5.6 |
| Hannam 1 | 26.7 | 26.3 | 1.36 | 8.63 | 35.8 | 6.7 |
| Chungju 13 | 21.8 | 21.5 | 1.65 | 8.70 | 35.5 | 6.7 |
| Soyang 1 | 23.7 | 23.2 | 1.46 | 12.24 | 33.9 | 4.7 |
| Macheon 8 | 25.8 | 24.8 | 1.35 | 9.48 | 33.6 | 3.6 |
| Seungju 8 | 24.4 | 24.0 | 1.37 | 10.21 | 32.9 | 7.2 |
| Wonju 19 | 22.5 | 22.2 | 1.46 | 8.92 | 32.5 | 4.8 |
| Uiryeong 20 | 22.8 | 22.6 | 1.42 | 9.01 | 32.2 | 4.9 |
| Uiryeong 5 | 22.5 | 22.1 | 1.46 | 9.20 | 32.2 | 7.5 |
| Wonju 4 | 21.4 | 21.0 | 1.51 | 9.47 | 31.7 | 3.3 |
| Wonju 18 | 24.2 | 23.4 | 1.33 | 10.85 | 31.0 | 4.1 |
| Hadong 7 | 21.7 | 21.5 | 1.43 | 8.29 | 30.6 | 6.3 |
| Gochang 1 | 20.3 | 20.2 | 1.42 | 8.59 | 28.8 | 4.1 |
| Hadong 15 | 21.6 | 21.2 | 1.34 | 8.58 | 28.3 | 2.3 |
| Soyang 10 | 22.6 | 21.5 | 1.31 | 11.72 | 28.1 | 4.6 |
| Mean | 24.1 | 23.6 | 1.43 | 9.56 | 33.7 | 5.4 |

*No. of fruit/fruiting lateral ≥20&, Fruit weight(g)≥1.3g &, Yield/fruiting lateral(g)≥25g.

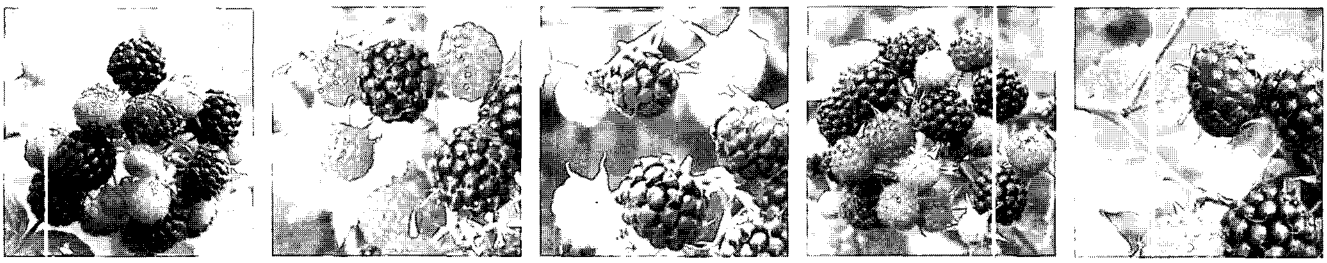
Table 2. Comparison of 4 agronomic traits of clones selected by two different selection level with those of 198 clones

| Selection level | No. of flower/ fruiting lateral | No. of fruit/ fruiting lateral | Fruit weight (g) | Yield/fruiting lateral (g) | No. of clones selected |
|---|---|---|---|---|---|
| No. of fruit/fruiting lateral≥20& Fruit weight≥1.4g& Yield/fruiting lateral≥30g | 24.4 ± 3.74<br>21.4 ~ 33.3 | 24.0 ± 3.73<br>21.0 ~ 33.2 | 1.48 ± 0.07<br>1.42 ~ 1.65 | 35.4 ± 5.69<br>30.6 ~ 49.9 | 10 clones |
| Selection effect(%) | 141.9% | 145.8% | 120.3% | 171.8% | |
| No. of fruit/fruiting lateral≥20& Fruit weight≥1.3g& Yield/fruiting lateral≥25g | 24.1 ± 3.16<br>20.3 ~ 33.3 | 23.6 ± 3.14<br>20.2 ~ 33.2 | 1.43 ± 0.08<br>1.31 ~ 1.65 | 33.7 ± 5.11<br>28.1 ~ 49.9 | 17 clones |
| Selection effect(%) | 140.1% | 142.2% | 116.3% | 163.6% | |
| Mean of 198clones | 17.2 ± 4.42<br>6.5 ~ 33.3 | 16.6 ± 4.40<br>5.5 ~ 33.2 | 1.23 ± 0.22<br>0.72 ~ 1.91 | 20.6 ± 6.77<br>5.5 ~ 49.9 | |

* No. of fruit/fruiting lateral × Fruit weight (g).

Table 3. Characteristics of selected *R. coreanus* superior trees for larger fruit and high productivity

| Cultivars | Type | Cold resistance | Length of fruition branch(cm) | No. of blooming (Ea) | Fruit weight (g) | Brix value (%) | Yield (kg) |
|---|---|---|---|---|---|---|---|
| Jungkeum 1 | Vine | High | 17.10 | 24.3 - 32.5 | 1.46 - 1.50 | 9.92 - 10.26 | 4.81 - 6.77 |
| Jungkeum 2 | Semi-upright | High | 18.45 | 20.5 - 23.8 | 1.53 - 1.65 | 9.7 - 11.20 | 6.12 - 8.74 |
| Jungkeum 3 | Vine | High | 20.50 | 21.2 - 26.9 | 1.46 - 1.54 | 10.26 - 11.67 | 5.95 - 7.62 |
| Jungkeum 4 | Semi-upright | High | 16.50 | 23.4 - 26.8 | 1.43 - 1.65 | 9.58 - 1.30 | 6.19 - 6.28 |
| Jungkeum 5 | Vine | High | 20.00 | 20.1 - 22.5 | 1.46 - 1.58 | 9.98 - 10.88 | 6.03 - 7.45 |



Jungkeum 1 Jungkeum 2 Jungkeum 3 Jungkeum 4 Jungkeum 5

Fig. 1. Photograph of the comparison fruit characteristics between five new R.coreanus cultivars.

were the NPFL over 20, FW over 1.4g and YIFL over 30g, were applied on whole clones, and 10 clones were selected (priority of 10% rank). NFFP, NFFL, FW and YIFL values of the selected clones showed 24.4, 24.0, 1.48g and 35.4g respectively, and those values were evaluated as 141%, 145.8%, 120.3% and 171.8% compared to the mean of whole clones, respectively. 17 clones were selected and their selection effects of NFFP, NFFL, FW and YIFL were 140.1%, 142.2%, 116.3% and 163.6% when the selection level were applied on NPFL, FW and YIFL over 20, 1.3g and 25g, respectively. The selected superior trees, 17 clones, appeared regional differences for amount of fruiting among 4 different test sites. When the NRFP, FW, YI and sugar content which over 20, 1.4g, 6kg and 9.5 brix, respectively, were applied to select among 17 clones, 5 clones were reselected the superior trees for YI and YI values of those (Jungkeuam 2, Jungkeuam 3, Jungkeuam 5, Jungkeuam 4 and Jungkeuam 1) showed 6.12～8.74kg, 5.95～7.62kg, 6.03～7.45kg, 6.19～6.28kg and 4.31～6.77 respectively, for 3 years.

## Literature Cited

Kim, M. J., S. H. Kim and Uk. Lee. 2002a. Selection of Korean black raspberry (*Rubus. coreanus* Miq.) for large fruit and high productivity. Jour. Korean For. Soc. 91(1): 96-101.

Kim, M. J., Uk. Lee, S. H. Kim and H. G. Chung. 2002b. The variation of leaf, fruiting andfruit characteristics in *Rubus coreanus* Miq. Korean J. Breed. 34(1): 50-55.

Kim, S. H. 1998. Ecology and superior tree selection of *Dendropanax morbifera* Lev. Ph. D. Thesis, Gyeongsang Nat. Univ. Chinju, Korea.

Kim, S. H., Y. S. Jang, H. G. Chung, M. S. Choi and S. C. Kim. 2003. Selection of superior trees for larger fruit and high productivity in *Sorbus commixta* Hedl. Korean J. Plant Res. 6(2): 120-128.

Kim, S. H., H. G. Chung and Y. S. Jang. 2004. Characteristics and breeding of a new thornless castor aralia cultivar "Cheongsong Ⅱ". Korean J. Plant Res. 7(2): 12-126.

Lee, Y. A. and M. W. Lee. 1995. Tannins from *Rubus coreanum*.

Korean Journal of Pharmacogn 26(1): 27-30.

Maxwell, S. J. 1995. Prospects for the use of antioxidants therapies. Drugs 49(3): 345-361.

Cho, H.S., M. K. Lee, J. B. Hwang, M. S. Park and K. M. Park. 2000. Physicochemical characteristics of *Rubus coreanus* Miq. J. Korean Soc. Food Sci. Nutr. 30: 1021-1025.

De Ancos, B., E.M. Gonzalez and M.P. Cano. 2000. Ellagic acid, vitamin C, and total phenolic contents and radical scavenging capacity affected by freezing and frozen storage in raspberry fruit. J. of Agri. Food Chem. 48: 4565-4570.

Hall, H.K. and L.R. Brewer. 1993. Breeding Rubus cultivars for quality and diversity. Acta Hort. 352: 329-337.

Kim, M. J., S. H. Kim and Uk. Lee. 2002. Selection of Korean black raspberry (*Rubus. coreanus* Miq.) for large fruit and high productivity. J. Korean For. Soc. 91: 96-101.

Kim, S. H, H. G. Chung, Y. S. Jang, Y. K. Park, H. S. Park and S. H. Kim. 2005. Characteristics and screening of antioxidative activity for the fruit by *Rubus coreanus* Miq. clones. J. Korean For. Soc. 94: 11-15.

Knight, V.H. 1993. Review of *Rubus* species used in raspberry breeding at east Malling. Acta Hort. 352: 363-371.

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