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Research Note

Low chilling trait of *Vitis ficifolia* var. Ganebu and its introduction into *Vitis vinifera* by cross breeding

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K e y w o r d s : Chilling requirement, berry composition, Ryuukyuuganebu, Kadainou R-1.

Introduction: Under subtropical conditions, grapevine suffering from inadequate winter chilling exhibits delayed and erratic bud burst, decreased shoots and clusters per vine, and poor uniformity of fruit development. Consequently, yield and quality are reduced (Dokoozlian *et al*. 1995). To solve this problem, chemicals such as hydrogen cyanamide (Kubota *et al*. 2000) and calcium cyanamide (Iwasaki and Weaver 1977) have been applied to enhance bud burst.

On the other hand, genetic improvement of the chilling requirement of genotypes from subtropical origins is an alternative to replace chemical treatments.

V. ficifolia var. Ganebu (commonly named Ryuukyuuganebu) is a native species, distributed in the subtropical region of Japan particularly on the Ryuukyuu Islands. The purpose of this study was to evaluate the chilling trait including berry characteristics of an interspecific hybrid between *V. ficifolia* var. Ganebu and *V. vinifera* 'Muscat of Alexandria'.

Material and Methods: Single node cuttings (about 15 cm long) were collected every 200 h during natural chilling (<7 °C) from mature vines of Ryuukyuuganebu, 'Muscat of Alexandria' and their hybrid 'Kadainou R-1' at the University Farm of Kagawa University, Kagawa, Japan. Starting on October 1, 2005, the temperature was monitored by a digital thermo-recorder (TR-71S; T and D, Japan) in a ventilated case placed at the vineyards until 1000 h of chilling were attained. The chilling temperature (<7 °C) in vineyards was first recorded on November 27, 2005; it accumulated to 1000 h until January 13, 2006. The collected cuttings were planted in a tray (35 cm x 25 cm x 8 cm) containing Kanuma soil (Kumeya, Japan), and kept in a growth chamber at 25 ± 1 °C and a 16 h photoperiod. The cuttings were watered every three days. Light was provided by cool white fluorescent tubes at 30 µmol m^{-2} s^{-1}.

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Bud burst was recorded after 4 weeks of forcing the cuttings in a growth chamber. It was reached when green tissue came visible beneath the bud scales. Chilling requirement was considered to be complete when the bud burst exceeded 70 % and no further increase was observed. Each treatment had 10 cuttings and three replications**.**

Berry characteristics were evaluated at harvest in 2005. Total soluble solids (TSS) were measured using a digital refractometer (Atago, Japan). Titratable acidity (TA) was determined as tartaric acid by titrating with 0.1N NaOH to pH 8.1. The anthocyanin from 25 g pericarps was extracted in 100 ml of HCl:methanol (1:99) by incubating the homogenate for 5 h in the dark. A 0.5 ml aliquot was diluted 10 times and absorbance was measured at 537 nm using UV/VIS spectrophotometer (Shimadzu, Japan). Results were expressed as malvidin equivalent.

Data were subjected to the arc Sin square root transformation before analysis. Differences between means were calculated by the LSD test at 5 % level. Computations were done by SPSS for windows version 13.0 (SPSS Japan Inc., Japan).

Results and Discussion: Bud burst of 'Kadainou R-1' and its parents after exposure to different chilling times (<7 °C) is presented in the Figure. Ryuukyuuganebu showed quite low chilling requirement to complete endodormancy. More than 90 % bud burst was observed in Ryuukyuuganebu cuttings even though they were exposed to only 200 h of chilling. In contrast, bud burst of 'Muscat of Alexandria' was negligible below 600 h of chilling but reached 70 % after 800 h of chilling. Bud burst of 'Muscat of Alexandria' was always significantly lower ($p = 0.05$) than that of Ryuukyuuganebu even after 1000 h of chilling. On the other hand, bud burst of 'Kadainou R-1' was above 80 % under all chilling conditions. However, the rate of bud burst was always slightly lower than that of Ryuukyuuganebu.

Ryuukyuuganebu is found on the Amami, Ryuukyuu and Yaeyama islands (Nakagawa *et al*. 1991) in the subtropical region of Japan. In the natural habitat this species has no dormancy period. The geographic distribution of the species may have influenced the chilling requirement. The low chilling trait of 'Kadainou R-1' could be inherited

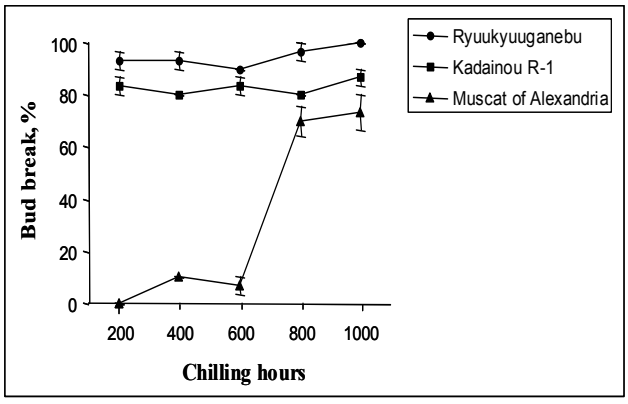

Figure: Bud break of Kadainou R-1 and its parents at different chilling hours. Vertical bars represent ± SE (n = 3).

T a b l e

Berry characteristics of 'Kadainou R-1' and its parents

Genotypes	Cluster weight (g)	Berry weight (g)	TSS (°Brix)	TA (%·100 ml^{-1} of juice)	Anthocyanin content (μg·ml^{-1})
Ryuukyuuganebu	21.7 b	0.4 c	10.7 c	1.2 a	1592.4 a
Muscat of Alexandria	264.7 a	8.7 a	17.5 a	0.2 b	0 c
Kadainou R-1	121.8 ab	1.1 b	15.6 b	1.0 a	892.4 b

Means within a column followed by the same letter(s) are not significant (LSD test at p=0.05).
TSS: Total soluble solids; TA: Titratable acidity.

from Ryuukyuuganebu which is a low chilling genotype. Under field condition, bud burst of Ryuukyuuganebu and 'Kadainou R-1' occurred in late March, two weeks before 'Muscat of Alexandria'.

Berries of 'Kadainou R-1' showed intermediate characteristics and composition compared to its parents (Table). It is likely that the two genotypes are genetically very different in fruit composition and give intermediate characteristics to the F_1 hybrid.

Berries of the new hybrid 'Kadainou R-1' were relatively small and had lower TSS; hence, this cultivar can be utilized for processing purposes like wine or juice production. At high night temperature anthocyanin biosynthesis in grape berries decrease in some genotypes (Mori *et al*. 2005). Since Ryuukyuuganebu originates from a subtropical region in which high amounts of anthocyanin are synthesizes even at high night temperatures, the F_1 hybrid may also develop considerable amounts of anthocyanin under these conditions. Additionally, considering the lower chilling requirement of this cultivar, it might be adapted to the subtropical climate with mild winters and hot summers.

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