



**Genetic and QTL Analysis of
Pericarp Thickness and
Ear Traits Related to Consumer
Preference of Fresh Waxy Corn**

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OUTLINE

- **Fresh Consumption of Waxy Corn**
- **Introduction**
- **Material and Methods**
- **Results**
- **Summary and Conclusion**



Fresh Consumption Aspect of Waxy Corn

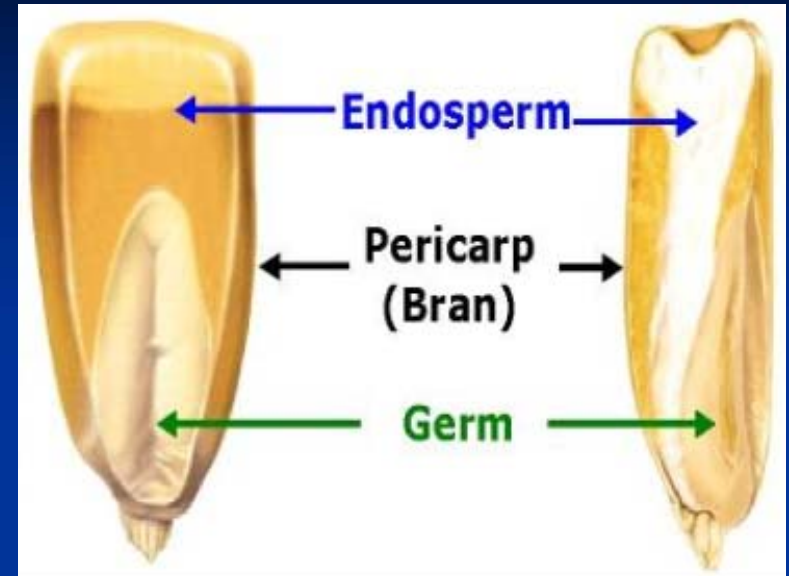
- **South Korean Waxy Hybrids**
 - : Fresh Consumption at 25 DAP
 - : Unadapted and Low Yield
 - : Window Harvest & Longer Storage
- **Major Taste characteristics:**
Tenderness, Stickiness, Sweetness, Aroma etc.
- **Potential for Breeding Fresh Waxy Corn Hybrids in U.S.**



Asian Market in Chicago selling BH20xBH30 Waxy Corn Hybrid

Pericarp Thickness Traits

- **Associated with;**
 - **Tenderness of Sweet corn**
- **Tender sweet corns (35 μm) to thick dent corns (200 μm)**
- **Three QTL detected on chromosome 1, 2, and 6 (Wang & Brewbaker, 2001)**



Ear Traits

- **Associated with Consumer Appeal and Preference**
- **Yield Components**



Objectives

- **Identify Genetic Relationships among Pericarp Thickness and Ear Inflorescence Architecture traits using Multivariate Principal Components Analysis (PCA)**
- **Detect QTL for Pericarp Thickness and Ear Inflorescence Architecture traits using both Univariate and Multivariate approaches**

Materials and Methods

- 264 (BH20xBH30)F2:3 (2004)
- 264 (BH20xBH30)#F3 (2004 winter)
- 2 reps of 264 (BH20xBH30)F3:4 (2005 & 2006)



(BH20xBH30)F1
hybrid

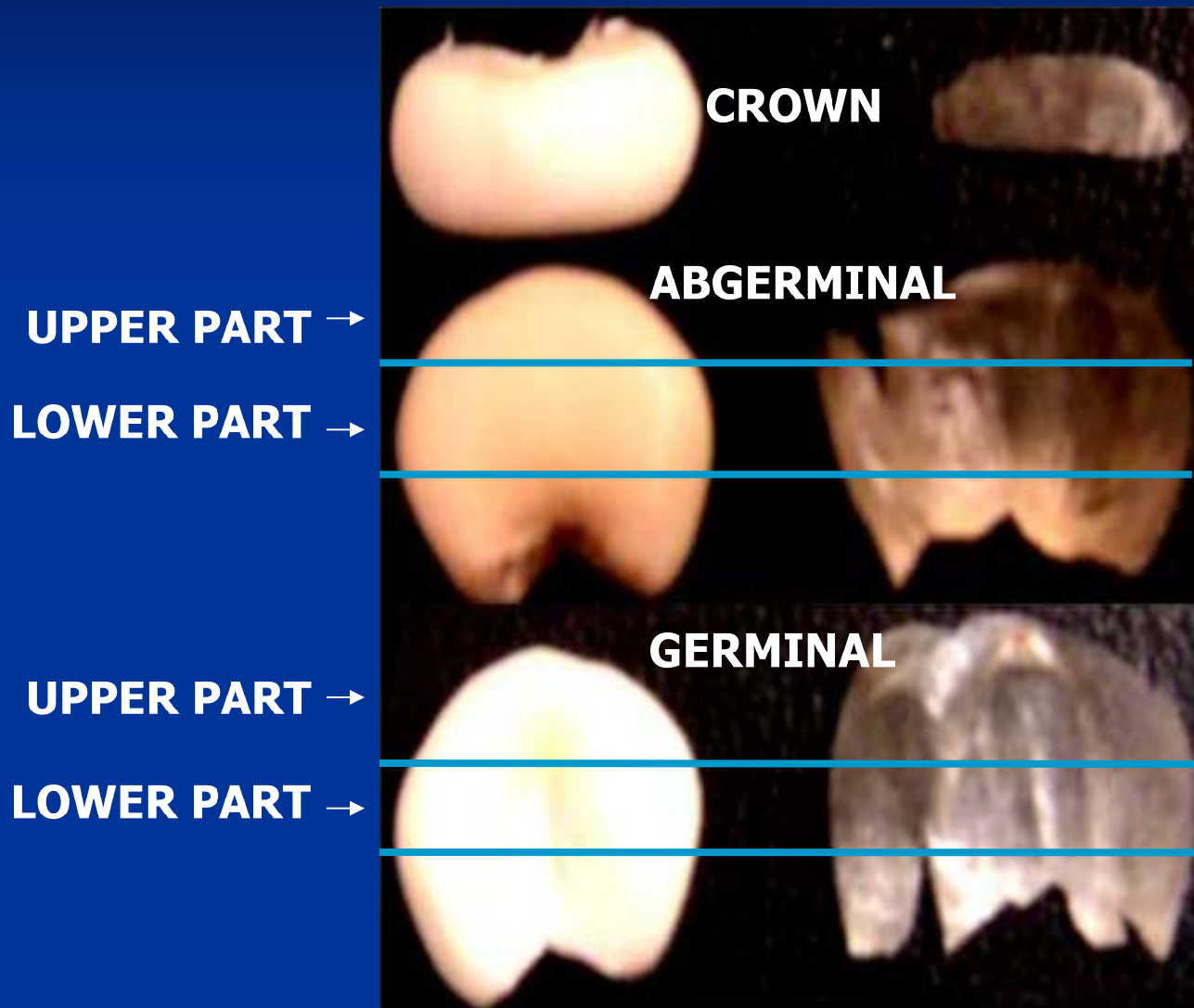
- 100 polymorphic SSR
Markers using JOIN MAP
- Composite Interval
Mapping (CIM) PLAB QTL
- Principal Component
Analysis (PCA) using SAS



264 (BH20xBH30)F2

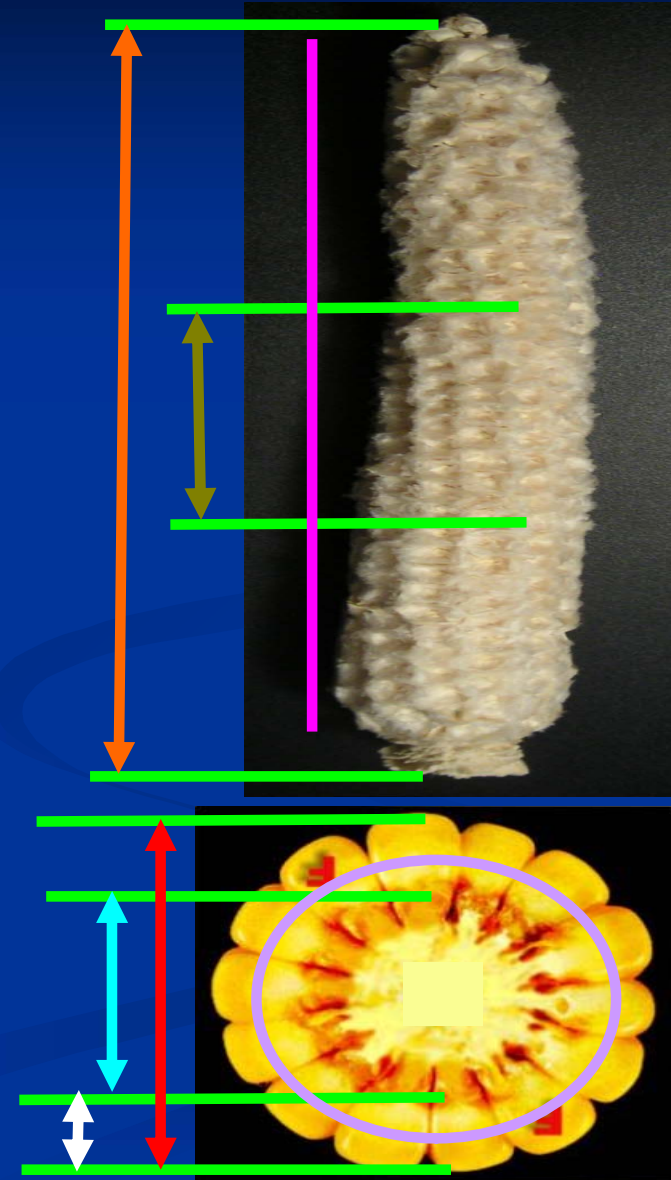
Phenotypic Measurements

- Pericarp thickness – 5 kernels per family (μm)



Phenotypic Measurements

- Ear Traits- 5 ears per family
 - Ear Weight (g) - EW
 - Cob Weight (g) - CW
 - 100K Weight (g) - KW
 - Cob Length (mm) - CL
 - Kernel Thickness (cm) - KT
 - Number of Kernels/row - NK
 - Number of Rows/cob - NR
 - Cob Diameter (mm) - CD
 - Ear Diameter (mm) - ED
 - Kernel Depth (mm) - KD





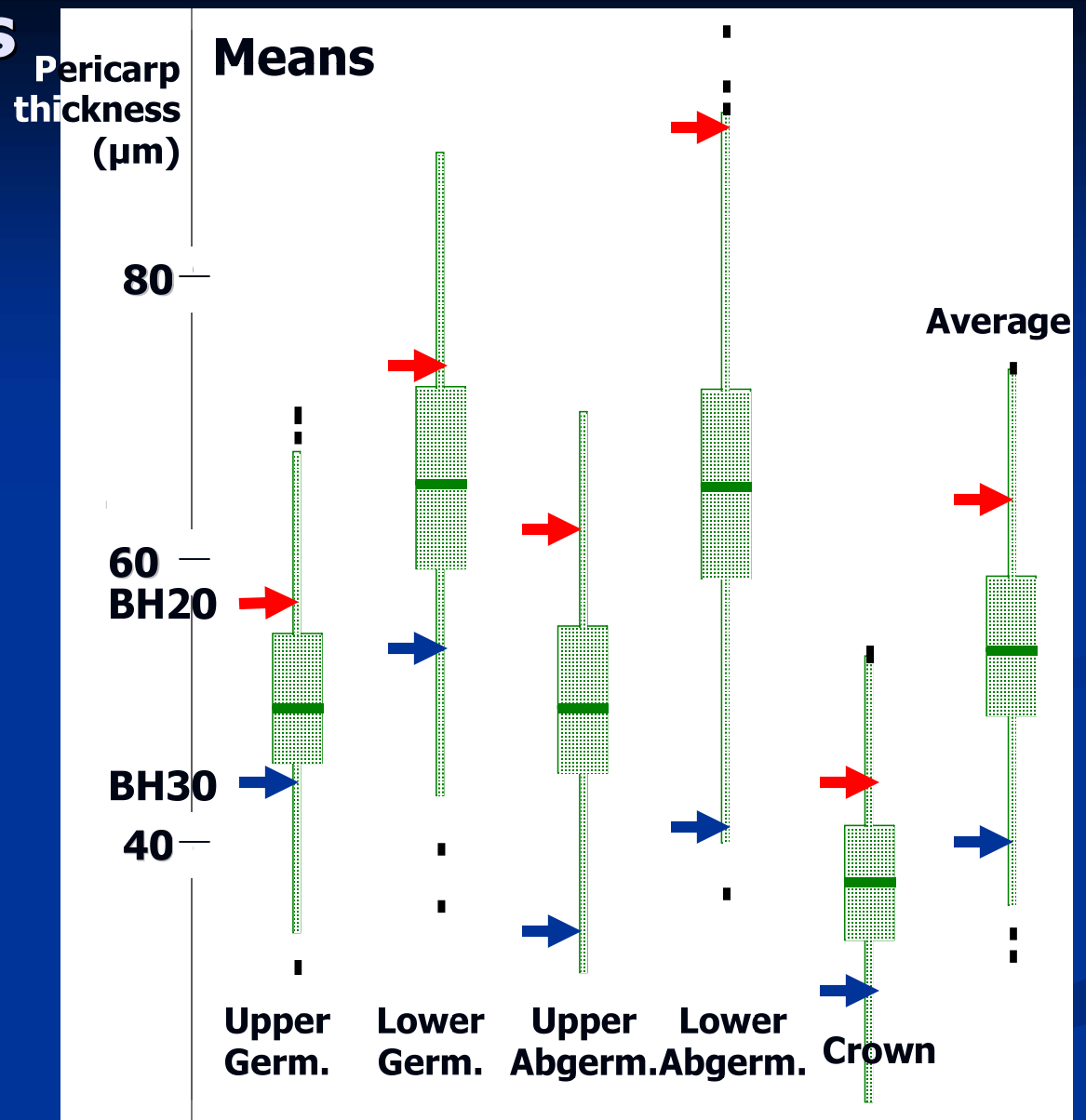
Results

Objectives

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Pericarp Thickness Traits

- **High correlations** among pericarp thickness regions (0.75-0.96)
- **PCA result**
 - **PC1** explained **88.4%** of total variation
 - Loadings ranged **0.44-0.46**



Boxplots of each part of pericarp thickness
On 264(BH20xBH30)F3 families

PCA for Ear Inflorescence Architecture

Parameter	PC1	PC2	PC3
Eigenvalue (λ)	3.52	1.61	1.50
% of total Variation	39.08	17.92	16.44
Cob Length	0.34	-0.41	0.34
Ear Diameter	0.38^{\$}	0.22	-0.39
Cob Diameter	0.39	0.21	-0.30
Number of Kernels/row	0.35	-0.50	0.22
Kernel thickness	0.18	0.46	0.25
Number of Rows/cob	0.22	-0.20	-0.62
Ear Weight	0.38	-0.06	0.06
Cob Weight	0.44	-0.05	0.14
Kernel Weight	0.22	0.49	0.34

^{\$} PC loadings larger than 0.35 and smaller than -0.35 were regarded as substantial

Objectives

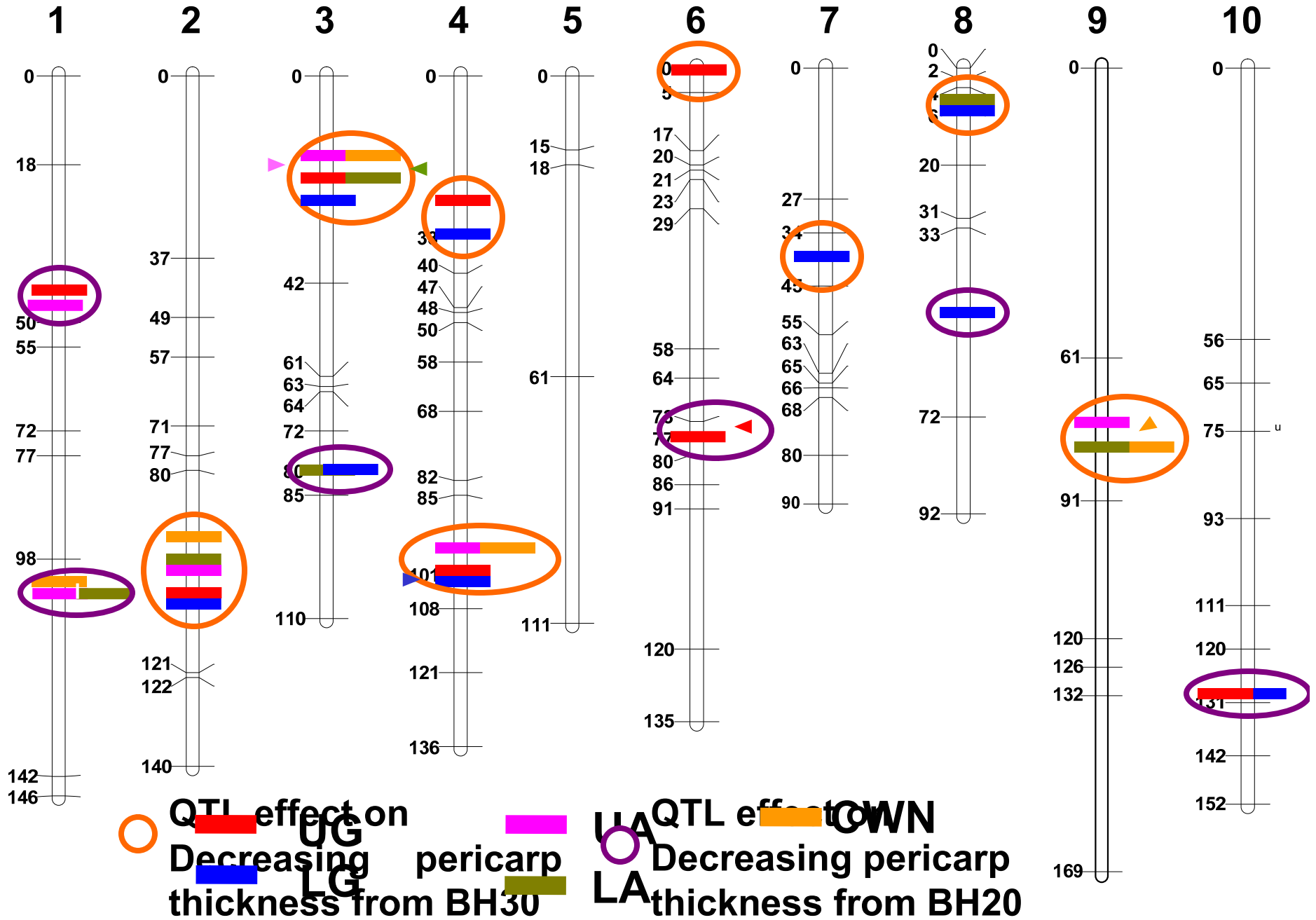
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QTL Pericarp Thickness Traits

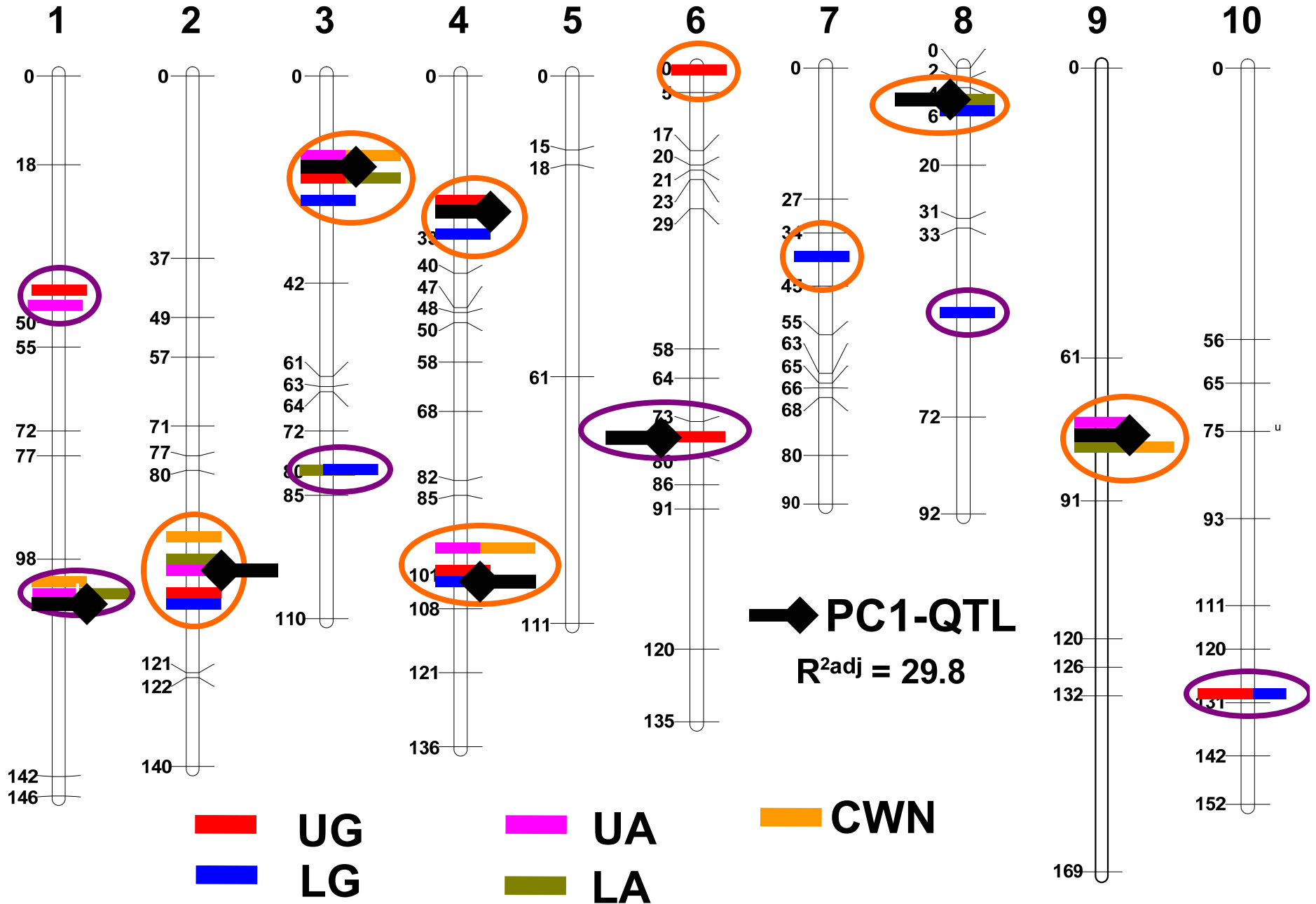
Traits	Number of QTL	$R^2_{adj}\%$
Upper Germinal (UG)	8	33.8
Lower Germinal (LG)	9	31.0
Upper Abgerminal (UA)	5	29.5
Lower Abgerminal (LA)	6	22.9
Crown (CWN)	5	26.6



QTL for Pericarp Thickness Traits

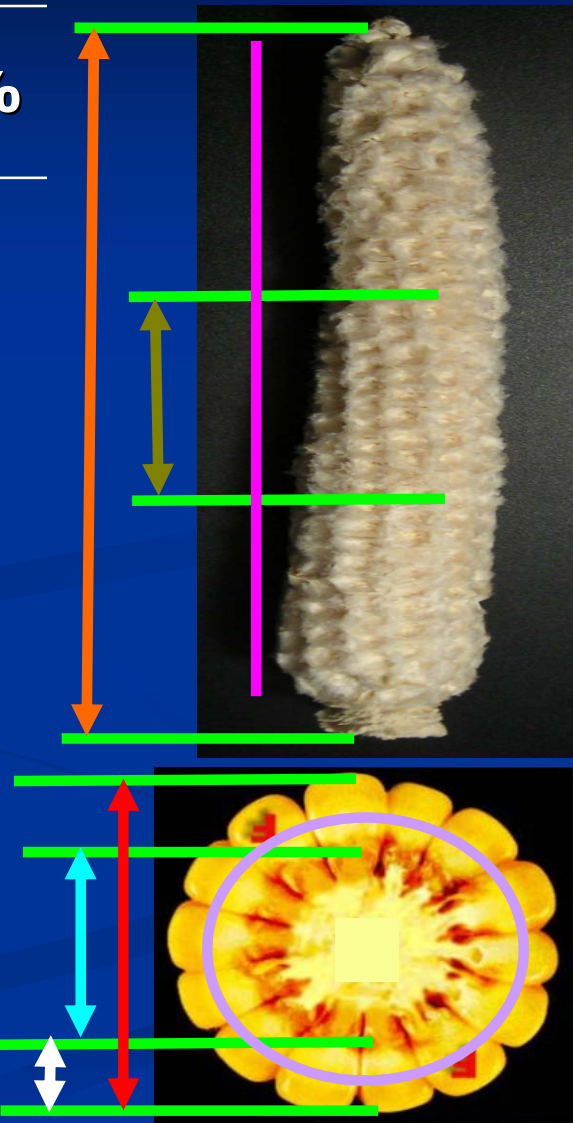


PC-QTL for Pericarp Thickness Traits

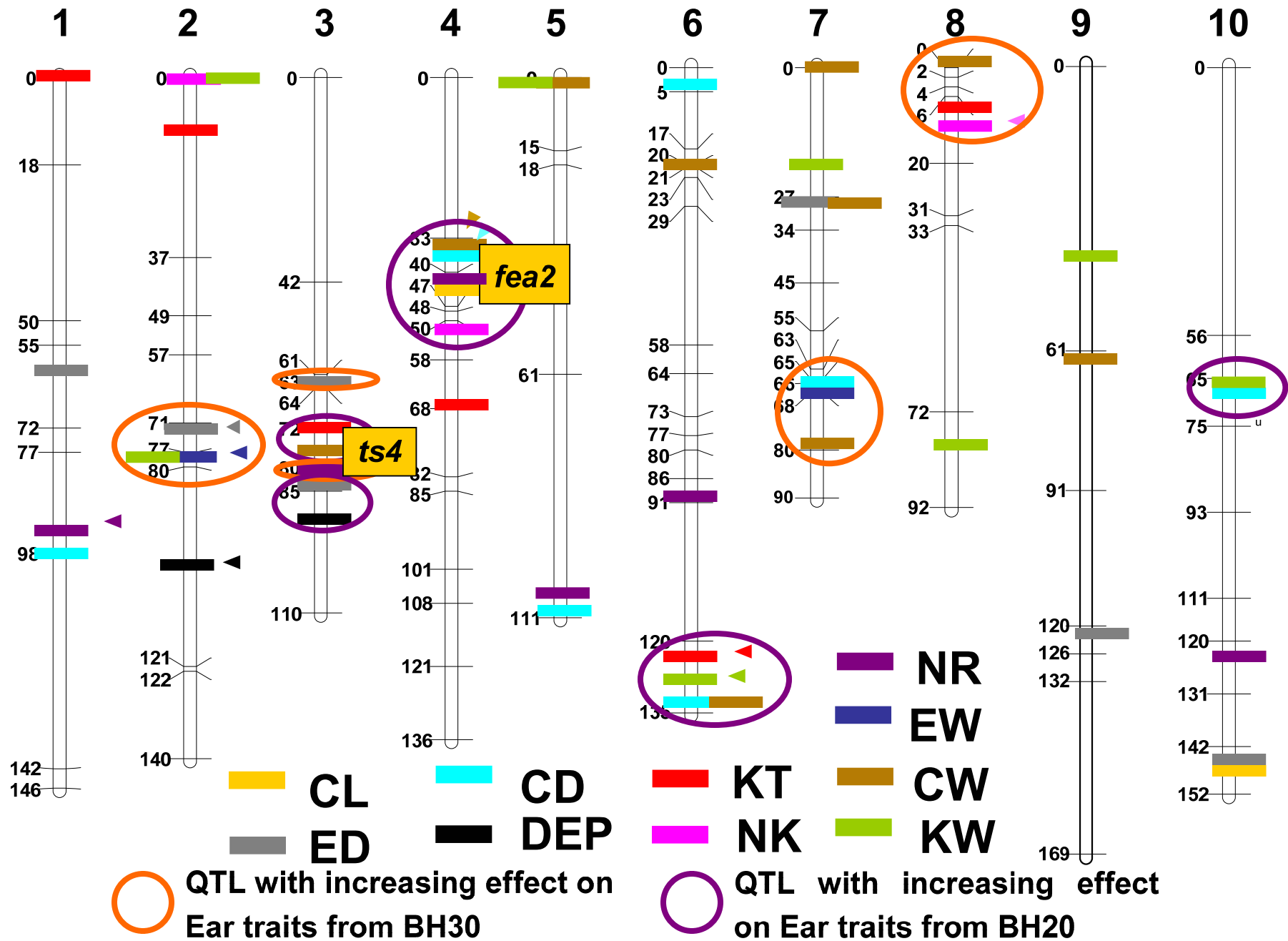


QTL for Ear Inflorescence Architecture Traits

Traits	Number of QTL	R ² _{adj} %
Cob length (CL)	2	8.9
Ear diameter (ED)	7	26.0
Cob diameter (CD)	7	22.8
Kernel depth (DEP)	2	5.8
Number of kernels/row (NK)	3	16.5
Kernel thickness (KT)	6	18.3
Number of rows/ear (NR)	6	27.1
Ear weight (EW)	2	12.9
Cob weight (CW)	10	28.0
Kernel weight (KW)	8	34.1



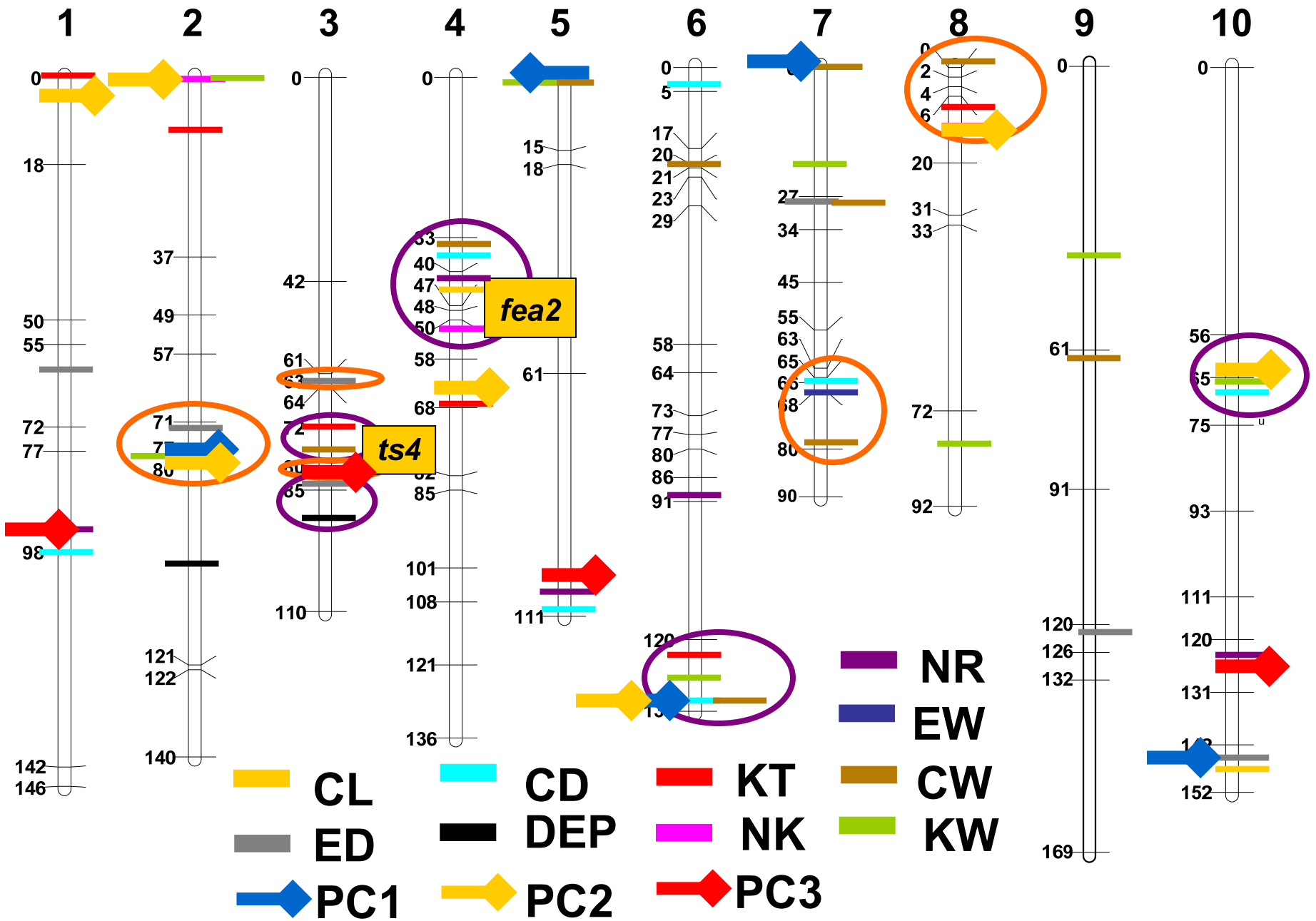
QTL for Ear Inflorescence Architecture Traits



PC-QTL Ear Inflorescence Architecture

Traits	Substantial traits	Number of QTL	R^2_{adj}
PC1	Ear diameter, cob diameter, ear weight & cob weight	5	19.5
PC2	Kernel thickness and kernel weight in contrast to number of kernels/row and cob length	7	38.4
PC3	Ear diameter and number of rows/cob	4	27.5

PC-QTL for Ear Inflorescence Architecture Traits



Summary and Conclusion

- **Useful for conventional phenotypic selection & MAS**
 - **Introgression of QTL regions**
 - **Relationships among the traits**
- **QTL + PC-QTL results can be used collectively**
 - **Pericarp Thickness Traits : bin 1.10, 2.06, 3.00, 4.01, 4.07, 6.05, 8.04, & 9.03**
 - **Ear Traits : bin 2.06, 3.03-3.04, 4.05, 6.06, & 7.02**
 - **Both Traits : bin 1.10, 2.06, 3.03, 8.04, & 10.07**
- **Possible candidate genes (*fea2*, *ts4*) for ear traits**
- **Breeding for more Adapted Waxy varieties by Introgressing favorable pericarp and ear traits into more adapted U.S. background using MAS in PhD**

Acknowledgement

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http://blog.daum.net/ladder2sky/6511783?nil_profile=blog

Thank you
and Questions?