Judgment of aroma types of middle and upper flue-cured tobacco leaves based on proportions of aroma components

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Abstract

To establish mathematical models for judging the aroma types of upper and middle flue-cured tobacco leaves, 128 samples (63 C3F and 65 B2F) from 11 main tobacco production provinces of China were selected as materials. Stepwise discriminant analysis was applied to samples with different aroma types and discriminant function was expressed with the proportions of 67 aroma components in total aroma constituents as the index. The results showed that the proportion of most aroma components in clear and full aroma tobacco leaves was higher than that in middle aroma leaves. The proportions of 51, 43 and 40 aroma components of clear, middle and full aroma tobacco leaves were higher in upper leaves than those in middle leaves. Aroma components dominated certain aroma types differed between middle and upper leaves. The proportions of 18 and 11 aroma components in upper and middle leaves were led in the stepwise discriminant function respectively. Self-validation and cross-validation methods were applied to evaluate the original samples, and the accuracy rates reached 100% and 98.6% on middle leaves, 96.37% and 94.4% on upper leaves. The accuracy rates on some other samples reached 100% on middle leaves and 91.7% on upper leaves predicted by the model. In conclusion, the proportion of aroma components as discriminant index could improve discriminant accuracy significantly in the middle and upper leaves. It could be used to analyze aroma types objectively, accurately and quickly.

Table.1 Prediction of the discrimination functions in different aroma types of tobacco leaves

Position	Aroma types	No. of total samples	No.of Misjudged samples	Accuracy rate //%
Middle leaves	Clear aroma	8	0	100
	Middle aroma	5	0	100
	Full aroma	8	0	100
Upper leaves	Clear aroma	8	2	75.0
	Middle aroma	5	0	100
	Full aroma	6	0	100

Introduction

The different flavor styles of tobacco leaves are more and more important in the cigarette industry. There are many factors that influence and determine the flavor of tobacco, but the chemical composition, aroma components substance, content and proportion of flue-cured tobacco leaf finally determine the aroma style eventually.

Table.2 Validation of the discrimination functions in different aroma types of tobacco leaves

Position	Methods	Aroma types	Clear aroma		Middle aroma		Full aroma		No. of total Samples	Accuracy rate //%
			No.of samples	Proportion //%	No.of samples	Proportion //%	No.of samples	Proportion //%		
Middle leaves	Self validation	Clear aroma	23	100	0	0	0	0	23	100
		Middle aroma	0	0	16	100	0	0	16	100
		Full aroma	0	0	0	0	24	100	24	100
	Cross validation	Clear aroma	23	100	0	0	0	0	23	100
		Middle aroma	0	0	16	100	0	0	16	100
		Full aroma	1	4.2	0	0	23	95.8	24	95.8
Upper leaves	Self validation	Clear aroma	28	100	0	0	0	0	28	100
		Middle aroma	1	5.9	16	94.1	0	0	17	94.1
		Full aroma	1	5.0	0	0	19	95.0	20	95.0
	Cross validation	Clear aroma	28	100	0	0	0	0	28	100
		Middle aroma	2	11.8	15	88.2	0	0	17	88.2
		Full aroma	1	5.0	0	0	19	95.0	20	95.0

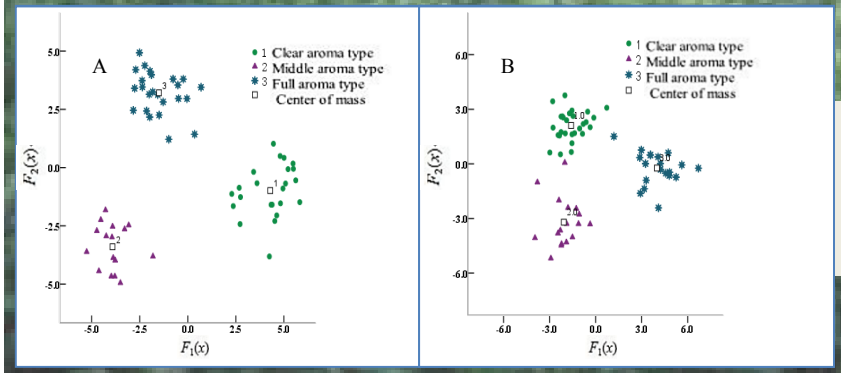

Fig.1 Scores of middle (A) and upper leaves (B) trough the discrimination functions

Conclusions

1. The proportions of most aroma components in clear and full aroma types of tobacco were significantly higher than middle flue-cured tobacco. The ratio of 51, 43 and 40 aroma components separately in the three aroma types was much higher in upper leaves than that in the middle leaves.
2. A total of 18 variables in middle leaves were finally introduced into the discriminant function. A total of 11 variables in upper leaves were finally introduced into the discriminant function.
3. The accuracy rate of the discrimination on three aroma types of flue-cured tobacco in the middle leaves was 100% by self validation. The accuracy rate on both clear and middle aroma from middle leaves was 100% and on full aroma was 95.8% by cross validation. In the upper leaves, the accuracy rate was 100% on clear aroma leaves, 94.1% on middle aroma leaves and 95% on full aroma leaves by self validation; 100% on clear aroma leaves, 88.2% on middle aroma leaves and 95% on full aroma leaves by cross validation. Overall, the discriminant analysis was meaningful.
4. The results of new samples showed that the he accuracy rate of the discrimination on the full, middle and clear aroma middle leaves was 100%, in the upper leaves, the accuracy rate was 75.0 % on clear aroma leaves, and 100% on both middle and full aroma leaves, 91.7% on average. Thus, the discriminant functions were good at predicting the aroma types and had a certain practical value.

References

[1] LI Q H, WANG Y, YU Z H, *et al*. Stepwise discriminatory analysis of chemical components in cut tobacco[J]. *Acta Tabacaria Sinica*, 2009, 15(6): 27–30.
[2] ZHU L J, WANG P, SHI F C, *et al*. Stepwise discriminatory analysis of cigarette-type based on chemical constituents[J]. *Journal of Southwest Agricultural University*, 2012, 34(3): 9–13.