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Sensory profiles and preference analysis in ornamental horticulture: The case of the rosebush

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ABSTRACT

The context of ornamental horticulture is considered in order to extend the techniques of sensory and preference evaluation by taking the rosebush as a plant model. In a preliminary study (Boumaza, Demotes-Mainard, Huché-Thélier, & Guérin, 2009), a sensory evaluation was conducted in order to set up a list of attributes. Subsequently, this list was adapted to assess 10 rosebushes. After the control of the panel performance using a multivariate strategy of analysis, the average scores were used in product mapping. The evaluation of the preferences with regard to these rosebushes was undertaken: 253 subjects were asked to rank the products by decreasing order of liking. Thereafter, the preference data were subjected to an internal preference mapping and a cluster analysis. Six homogeneous segments of consumers were eventually retained. By way of performing an external preference mapping, the average ranks were regressed upon the sensory attributes using principal component regression: the preferences of 67% of the consumers were satisfactorily explained by the attributes.

1. Introduction

In ornamental horticulture, visual aspect and fragrance are important elements of overall plant quality (Dijkshoorn-Dekker, 2002; Habib, Triboï, Génard, & Le Bail, 1997; Heuvelink, Tijskens, & Kang, 2004) that can be analysed by sensory analysis methods (Boumaza et al., 2009). These qualities are as important as the gustative quality of food products and must be considered in addition to other quality criteria, such as disease resistance, not dealt with herein. In this study, we evaluated only the visual characteristics of plants, focusing on rosebushes. We have not considered herein the study of the flower fragrance since it requires a complete study of its own. Roses were chosen as a model as they are leading products in ornamental horticulture, with about 80 million pot plants and 220 million garden rosebushes sold each year (Roberts, Debener, & Gudin, 2003).

In its endeavour to generate the novelty and diversity required to support the market, the horticultural sector is continually trying to improve the visual characteristics of plants. This process involves the creation of new varieties or changes in cultivation practices. Both approaches are slow and costly. For example, breeding process requires the selection over several generations of the best lineage from sexual crosses, prior to the large scale propagation of the new variety. This may last on average 10 years before a new variety of rosebush could be released on the market. Therefore, it is essential that efforts made by breeders to improve the visual characteristics of the plants should be aimed towards meeting consumer expectations from the very beginning of the breeding process.

However, assessments of consumer preferences concerning the visual qualities of pot-grown roses and rosebushes have so far mostly been based on expert opinion or sales data. Up to our knowledge, no analysis of preferences associated with sensory attributes has ever been published for roses. In this paper, we present a first attempt to set up experimental conditions to evaluate consumer preferences in ornamental plants. Such an approach would provide rose breeders and producers with a tool for evaluating the acceptability of the products they plan to release onto the market.

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A preliminary evaluation of rosebushes based on sensory analysis methods (Boumaza et al., 2009) was carried out to generate a list of visual attributes of bush roses. Subsequently, this innovative ornamental horticulture study was extended in several directions, three of which form the object of this work: the evaluation of products on the basis of appropriate attributes by a panel of assessors, the description of products in terms of the selected attributes and the analysis of consumer preferences by means of internal and external mapping. This approach is a routine in sensory analysis (Lawless & Heymann, 1999; MacFie & Thomson, 1994; Meilgaard, Civille, & Carr, 2007; Stone & Sidel, 2004). The main aim of this study was to assess the relevance of this approach to products of ornamental horticulture, according to the three main lines of research outlined hereafter and detailed in the materials and methods section.

We decided to use photographs of plants as stimuli, rather than real plants. The panel of assessors developed a list of 16 attributes, based on analyses of photographs of rosebushes and adapted from the list developed by Boumaza et al. (2009) for living plants. The attributes selected by the panel related to the entire plant. They concerned both the form of the plant and its aerial organs easily distinguishable on photographs. The aim was to provide as an exhaustive description as possible with a limited number of attributes.

Thereafter, the panel evaluated the stimuli which were considered for the present study. One of our concerns was to check the repeatability and reproducibility of the assessors and the panel, and their ability to discriminate between the products. Several relevant control techniques have been developed (Meullenet, Xiong, & Findlay, 2007 for review). In this study, we present the results obtained with two established techniques (Dijksterhuis, 1995; Rossi, 2001) and assess the discriminating power of the attributes using a classical method and an original global method based on cluster analysis.

A panel of subjects ranked the same rosebush photographs by order of preference. These subjects were recruited among the exhibitors and visitors of an annual international flower show (*Salon du Végétal* Angers, France, 2008), one of the most important European shows frequented by more than 16,000 visitors. These subjects, named hereinafter consumers, were also asked to provide some socio-demographic information about themselves. The aim was to investigate the relationship between their preferences and the visual characteristics of the rosebushes.

We start by describing the methods used for data collection and processing. Thereafter, we present results for the evaluation of 10 rosebushes and finally discuss further possible investigations.

2. Materials and methods

2.1. Samples

This work was based on the observation of photographs rather than of real plants. This is motivated by the fact that plants are living products and their growth modifies their shape. Rose development is rapid, particularly as concerns the transformation of flower buds into open flowers, the withering of the flowers and fruit production. Therefore, the choice of photographs as stimuli ensures that repeated evaluations of plants were performed in equivalent conditions at each scoring session and for each product. This mode of operation allowed the analysis to be carried out over several days and, more importantly, provided the jury with stimuli that were similar to that presented to the consumers.

In the evaluation considered in this work, 10 photographs of rosebushes (Fig. 1) of different cultivars or forms were selected on the basis of their visual diversity, without reference to their variety.

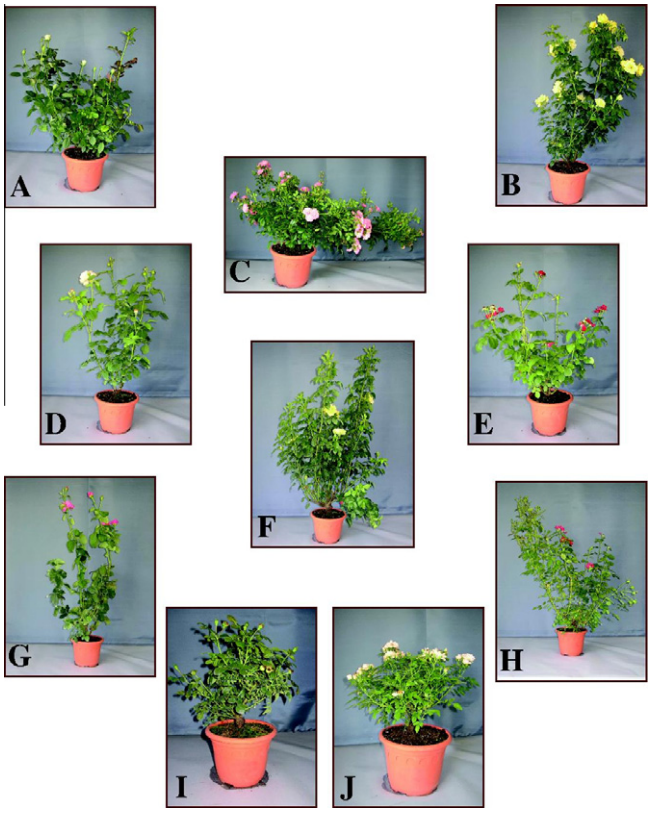

Fig. 1. The panel of 10 rosebushes displayed at the *Salon du Végétal* 2008 at Angers for the collection of preference data. These photographs of rosebushes were also used for the collection of sensory data.

2.2. Sensory data

The products were evaluated by a jury of 14 experts, 2 men and 12 women. Most of them were from the scientific and administrative staff of the *QUASAV* (quality and health of the plant) Federative Research Institute of Angers (France). They all have a good knowledge about plants but no one was acquainted with neither the varieties of the 10 rosebushes nor their origins. They were mainly selected on their availability and motivation. These assessors had previously been trained in seven sessions, each lasting 90 min to 2 h, and had already participated in a jury of this type. That allowed us to assess their ability to carry out such an evaluation.

During training, the assessors selected and specified the following 16 attributes from an initial list of 44 attributes (Boumaza et al., 2009) using a consensus method (Lawless & Heymann, 1999): top sided shape (Top_Sided_Shape), foliage thickness (Foliage_Thickness), plant symmetry (Plant_Symmetry), stem vigour (Stem_Vigour), number of stems (N_Stem), branching level (Branching_Level), number of flowers (N_Flower), staggering of flowering (Flower_Staggering), flower enhancement (Flower_Enhancement), flower size (Flower_Size), number of faded flowers/fruits (N_Faded_Fruit), number of floral buds (N_Bud), density of flower petals (Petal_Density), intensity of flower colour (Flower_Colour_Intensity), leaf size (Leaf_Size), and darkness of leaf colour (Leaf_Colour_Darkness).

Indeed, Boumaza et al. (2009) studied a primary list of 44 attributes and reduced it to a list of 18 attributes by discarding 26 attributes. This reduction was based on three criteria: unambiguity,