Flower and fragrance characteristics of the 27 oil-bearing rose (Rosa damascena Mill.) genotypes obtained by application of Cobalt-60 gamma ray at 0, 100 and 200 Gray doses were determined in the Department of Field Crops at University of Applied Sciences in Isparta, Turkey. In the oil-bearing rose genotypes with 6 years old, the number of petals ranged from 5 to 85, and the petal color varied between white and dark pink. In general, those with a low number of petals (single flowers with 5-7 petals) tended to flow earlier, those with a higher number of petals (multi-petalled flowers with >25 petals) tended to bloom later. Single-layered flowers were determined to be less weight, less fragrant, shorter petal life and easier petal casting when compared to the multi-layered flowers. The important and negative relationship ($r = -0.85^{**}$) between the number of petals and the number of anthers may be the result of the homeotic functions of MADS-box function genes such as A, B and C. It was a significant observation that the genotypes with hairless (naked) hypanthia, pedicels and sepal leaves were less fragrant, but more resistant to rose aphid (Macrosiphum rosae L.). According to the HS-SPME and GC-MS analysis, while the most important floral scent molecule of the fresh flower was phenylethyl alcohol, the most important molecules of distilled rose oil were monoterpenic alcohols such as citronellol and geraniol, and paraffinic hydrocarbons such as nonadecane and heneicosane. Genotypes with different floral characteristics and scent composition were identified compared to the oil-bearing population cultured in the region. It has been understood that genotypes with a higher number of flowers per plant and higher duration of flowering should be given priority for high flower yield.