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[54] **GERANIUM PLANT "BEN FRANKLIN"**

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[52] **U.S. Cl.** **Plt./68**

[58] **Field of Search** Plt./68

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[57] **ABSTRACT**

This invention relates to a new distinct cultivar of geranium, substantially as illustrated and described, characterized as being particularly well adapted to both commercial greenhouse production and garden performance, and possessing unique flavonol and anthocyanin profiles and a unique flower color when compared to geranium cultivars "Wilhelm Langguth" and "Snowmass".

3 Drawing Sheets

The present invention relates to a new and distinct cultivar of geranium *Pelargonium*×*hortorum* called "Ben Franklin". The cultivar is particularly well adapted to both commercial greenhouse production and garden performance. The cultivar is characterized as to novelty as having foliage characteristics similar to geranium cultivar "Wilhelm Langguth", having flowering ability similar to geranium cultivar "Snowmass" but possessing flower color different from either of those cultivars. The cultivar is further characterized by unique biochemical fingerprint profiles.

The cultivar was developed from an organized, scientifically designed breeding program carried out at the Department of Horticulture, The Pennsylvania State University, University Park, Pa. 16802 and specifically resulted from selection in the progeny of the cross between geranium selection "Wilhelm Langguth" and "Snowmass". The selection was asexually propagated by cuttings and the reproductions ran true.

DESCRIPTION OF THE FIGURES

FIG. **1** illustrates in color the cultivar including foliage and flowers.

FIG. **2** illustrates the anthocyanin profile obtained from HPLC. Quantitative values are found in the tables. Analyses included a single peak that represented both pelargonidin and petunidin 3,5-diglucosides. Corrections were made in accompanying tables.

Peak No.

1. Delphinidin 3,5-diglucoside
2. Cyanidin 3,5-diglucoside
3. Pelargonidin 3,5-diglucoside
4. Peonidin 3,5-diglucoside
5. Malvidin 3,5-diglucoside

FIG. **3** illustrates the flavonol profile obtained from HPLC. Quantitative values are found in the tables.

Peak No.

1. Quercetin 3-rhamnosylgalactoside
2. Quercetin 3-rutinoside
3. Quercetin 3-galactoside
4. Quercetin 3-glucoside
5. Kaempferol 3-rhamnosylgalactoside
6. Kaempferol 3-galactoside
7. Kaempferol 3-rutinoside

8. Kaempferol 3-glucoside; Kaempferol 7-glucoside; Quercetin 3-rhamnoside
9. Kaempferol 3-xyloside
10. Kaempferol 3-arabinoside
11. Kaempferol 3-rhamnoside

With reference to the detailed description of the cultivar which follows, the test plant was grown in full sun under glass, 60° F. night. Soilless medium was fertilized constantly 300 ppm N-K. Color readings were taken under cool white fluorescent lamps at 220 footcandles and color identification was by reference to the Royal Horticulture Society Colour Charts except where common terms of color definition are employed.

THE PLANT

Classification:

Botanical.—*Pelargonium*×*hortorum.*

Tradename.—#734 (78-62-5)="Ben Franklin".

Form: Semi-dwarf; basal branching; comparatively compact growth habit; more compact than Wilhelm Langguth.

Height: 20.0–22.0 cm.

Growth: Short internodes.

Strength: Stands upright, without artificial support.

Foliage: Variegated — green with white.

Leaves:

Size.—4.0–9.0 cm.

Shape.—Reniform, variously lobed.

Margin.—Crenate.

Texture.—Pubescent, dull; veins recessed and obvious.

Color.—Outer margin: Irregular, Fan 4, white group 155-A (RHSCC). Inner margin: Irregular, Fan 4, gray-green group 194-C (RHSCC). Center: Irregular, Fan 3, yellow-green group 147-B (RHSCC).

Ribs and veins.—Palmate.

Petioles: Fan 3, yellow-green group 146-B (RHSCC).

Stem:

Color.—Fan 3, yellow-green group 146-A (RHSCC).

Internodes.—1.0–2.0 cm.

Stipules.—Fan 4, white group 155-A (RHSCC) with center stripe(s) Fan 3, yellow-green group 144-A (RHSCC).

THE BUD

Shape: Upright, irregular cluster.
Size: 2.0–3.0 cm across.

INFLORESCENCE

Blooming habit: Continuous, upright, double, non-shattering, hemispherical.
Size: 7.0–9.9 cm.
Borne: Umbel; florets on pedicel; pedicels on peduncle.
Florets:

Forms.—Petals irregular, slight twisting of inner petal, flat, full double.

Color.—Top of petal: Overall color: Fan 1, red group 52-B (RHSCC). Throat vein color - Fan 1, red group 41-B (RHSCC). Bottom of petal: Overall color: Quite variable, Fan 1, red group, 39-D (RHSCC). Veins: Fan 1, red group 43-D (RHSCC).

Petals.—9–14 in number (including petaloids).

Size.—3.0–4.0 cm.

Texture and appearance.—Double, irregular, flat, dull.

Petaloids:

Quantity.—Cannot distinguish from petals.

Shape.—Cannot distinguish from petals.

Color.—Cannot distinguish from petals.

Pedicel:

Length.—2.0–2.5 cm in length.

Color.—Fan 3, yellow-green group 144-A (RHSCC).

Peduncle: Arises from node; opposed to leaf petiole; 12.0–13.0 cm in length.
Persistence: Persistent, non-shattering.
Disease resistance: Not known.
Lasting quality: Good up to three weeks.

REPRODUCTIVE ORGANS

Stamens: 3–5.

Anthers.—Small, weak, brown in color.

Filaments.—Flat, ribbon-like; 0.3–0.5 cm in length. White, tipped pink.

Pollen.—Rust-colored.

Pistils:

Number.—1 with 5- or 6-parted stigma.

Length.—0.5–0.6 cm.

Stigma.—5- or 6-parted reddish-purple, reflexed.

Style.—1 style: 2.0–3.0 mm long, reddish-purple in color.

Ovaries: Length 0.2–0.3 mm; light green, 5–6 lobes, pubescent.
Fruit: None.

BIOCHEMICAL PROFILES

In recent years, biochemical analysis has played an increasing role in plant systematics and taxonomy. In order to further characterize the cultivar, flavonols and anthocyanins were extracted from the florets and subjected to analysis by high pressure liquid chomatography (HPLC). Background information supporting the validity of the HPLC technique can be found in an article by Asen & Griesbach ("High Pressure Liquid Chromatographic Analysis of Flavonoids in Geranium Florets as an Adjunct for Cultivar Identification", S. Asen and R. Griesbach, *J. Amer. Soc. Hort. Sci.* 108(5):845–850 (1983)), the contents of which are incorporated herein by reference. Briefly, the method for performing the analysis was carried out as follows:

Flavonoid extraction. The sample size for flavonoid identification consisted of the petals from six florets just after anthesis. Three different samples were collected from each cultivar and handled separately for analysis. The petals were weighed, ground in 20 ml of 1% HCl-MeOH with a mortar and pestle, filtered through one layer of Whatman #1 filter paper, and washed with 1% HCl-MeOH. The volume was adjusted to 90 ml and 2–15 ml aliquots were removed for the analysis and handled separately. Each aliquot was taken to dryness at 40° C. in vacuo. All traces of HCl were removed by azeotropic distillation with MeOH. One of the dried extracts was reconstituted in 2 ml of 1% HCl-MeOH and was used for anthocyanin analysis. The other was reconstituted in 2 ml of MeOH and was used for flavonol analysis. Each sample was stored at −34° C. until analyzed.

HPLC. Samples were analyzed on a Waters High Performance Liquid Chromatograph equipped with an automatic injection system (Waters Assoc. Wisp 710A), dual pumps (Waters Assoc. Model 6000A), solvent programmer (Waters Assoc. Model 600), data module (Waters Assoc.), variable wavelength detector (Waters Assoc. Model 480), and a C_{18} column (25 cm×0.46 cm and 5 μm particle size, Supelco).

Most of the flavonol compounds were separated by a linear gradient of 8% to 23% pump B over 55 min (pump A=1% triethylamine buffered to pH 3.0 with H_3PO_4 (TEAP); pump B=CH_3CN) at a flow rate of 1.2 ml/min and a chart speed of 0.5 cm/min. Detection was at 340 nm.

The anthocyanins were resolved by a linear gradient of 30% to 50% pump B over 40 min (pump A=1.5% H_3PO_4; pump B=20% HOAc+25% CN_3CH+55% of 1.5% H_3PO_4) at a flow rate of 1.0 ml/min and a chart speed of 0.5 cm/min. Detection was at 546 nm utilizing a fixed wavelength detector.

The flavonoids were quantified by injecting standards and comparing their peak areas with those from the plant samples. The results are expressed as μg of flavonoid/g fresh weight of plant material.

RESULTS

Chromatographic profiles for anthocyanins and flavonols are present in FIGS. 2 and 3, respectively; quantification of these profiles by comparison to standards is presented in Tables 1 and 2, respectively.

The anthocyanins petunidin and pelargonidin 3,5-diglucoside were not resolved by the solvent system used. Past research has shown only negligible amounts of petunidin 3,5-diglucoside to be present in geranium florets compared to pelargonidin 3,5-diglucoside. In light of this, the peak corresponding to petunidin and pelargonidin 3,5-diglucoside was quantified as pelargonidin 3,5-diglucoside.

Kaempferol 3-rhamnoside could not be quantitated for several cultivars and is designated as ND (not determined). The chromatograms showed a small, wide peak in the region of elution for this compound. If a substantial amount of this compound were present, a distinct peak appeared but minute quantities, if present, were masked.

Other barriers to quantitation of several flavonols existed. Kaempferol 3-glucoside, kaempferol 7-glucoside, and quercetin 3-rhamnoside all had the same retention time under these conditions. If these compounds are needed to distinguish between cultivars, they would have to be separated by other solvents or column types.

Quercetin 3-xyloside appeared in several of the comparisons, but standards were not available to quantify this compound.

TABLE 1

Anthocyanin concentration in petals of geranium florets

	µg anthocyanidin 3,5-diglucoside/g fresh wt.					
Cultivar	Delphinidin	Cyanidin	Pelargonidin	Peonidin	Malvidin	Total
734	—[z]	21	633	505	t[y]	1164

[z]— = not detected.
[y]t = trace < 10 µg.

TABLE 2

Flavonol concentration in petals of geranium florets

	µg/g fresh wt.						
Cultivar	Qu3-[z] rhagal	Qu3-rut	Qu3-gal	Qu3-glu	Km3-rhagal	Km3-gal	Km3-rut
734	t[y]	t	t	15	36	25	100

TABLE 2-continued

Flavonol concentration in petals of geranium florets

	µg/g fresh wt.			
Cultivar	Km3-xyl	Km3-arab	Km3-rha	Total
734	—[w]	—	—	191

[z]Abbreviations: Km = Kaempferol; Qu = Quercetin; arab = arabinoside; gal = galactoside; glu = glucoside; rha = rhamnoside; rhagal = rhamnosylgalactoside; rut = rutinoside; xyl = xyloside.
[y]t = trace < 10 µg.
[w]— = not detected.

What is claimed is:

1. A new distinct cultivar of geranium substantially as illustrated and described, characterized as being particularly well adapted to both commercial greenhouse production and garden performance, and possessing unique flavonol and anthocyanin profiles and a unique flower color when compared to geranium cultivars "Wilhelm Langguth" and "Snowmass".

* * * * *

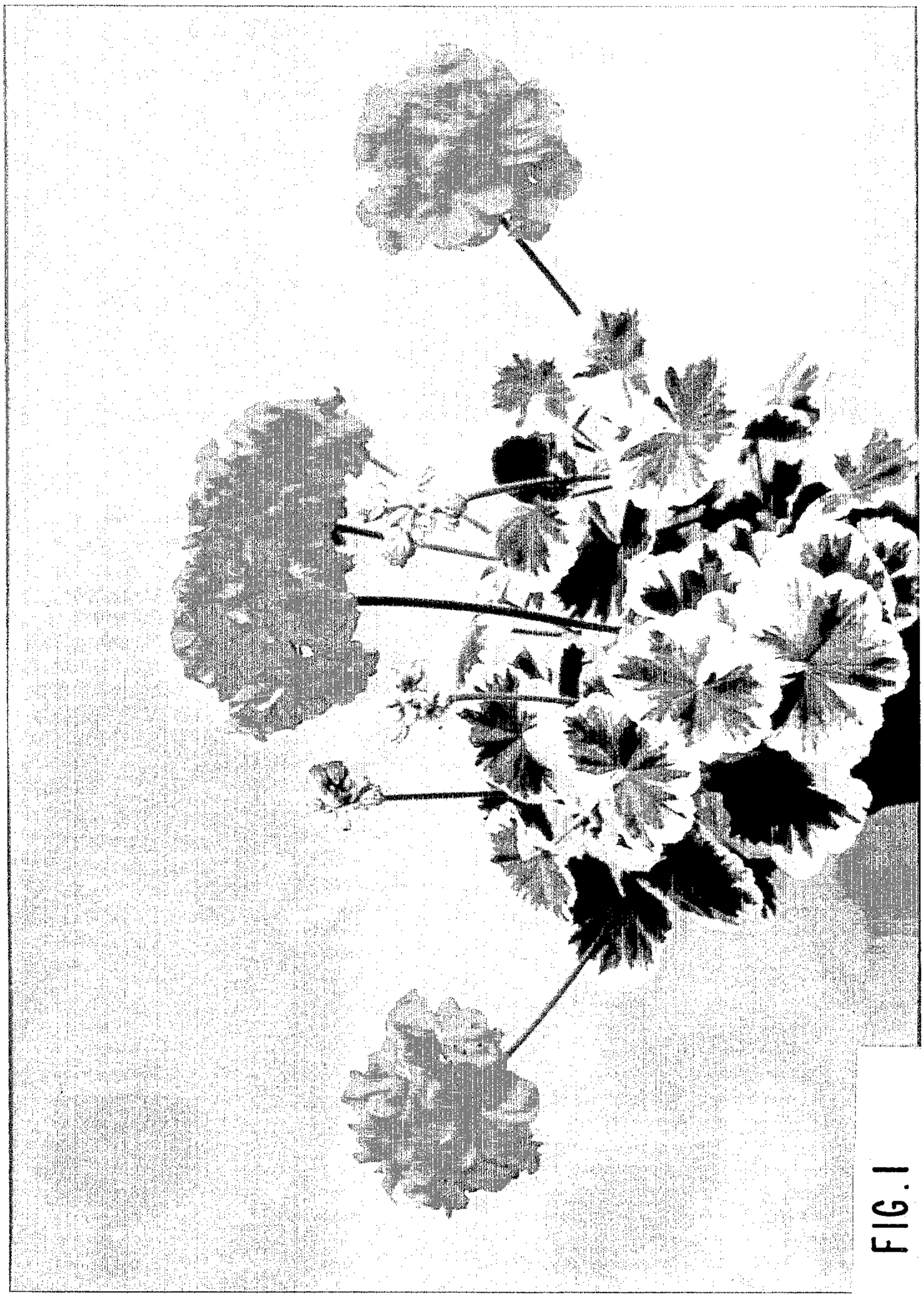

FIG. 1

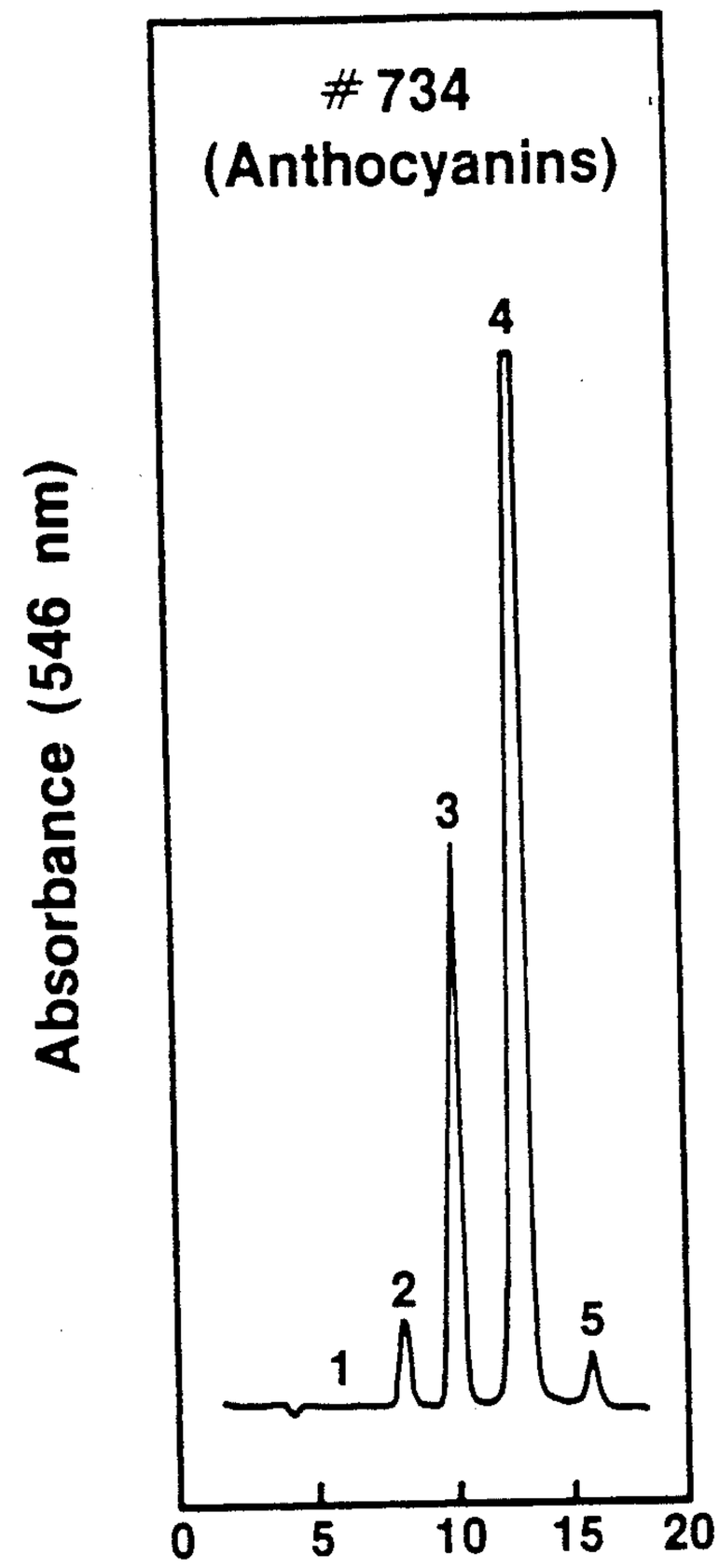
734
(Anthocyanins)
Absorbance (546 nm)
1
2
3
4
5
0
5
10
15
20
Time (min)

FIG. 2

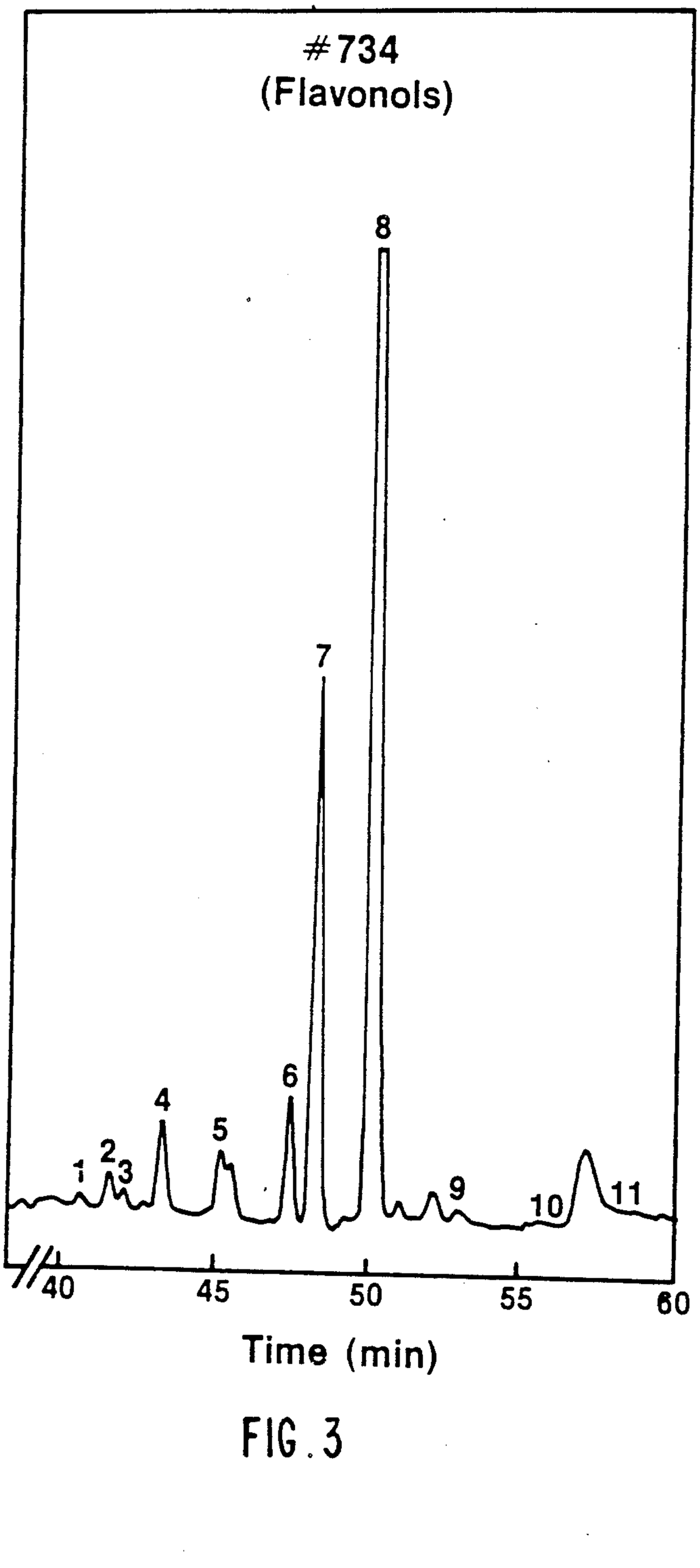
#734
(Flavonols)
Absorbance (340 nm)
8
7
6
4
5
1
2
3
9
10
11
40
45
50
55
60
Time (min)

FIG. 3