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Cummins et al.

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(54) **APPLE TREE ROOTSTOCK NAMED ‘G.890’**
(50) Latin Name: ***Malus domestica* × *Malus robusta***
hybrid
Varietal Denomination: **G.890**
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A01H 5/00 (2006.01)

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(58) **Field of Classification Search** **Plt./174**
See application file for complete search history.

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(57) **ABSTRACT**

The present invention relates to a new and distinct variety of
apple tree rootstock named ‘G.890.’ The ‘G.890’ apple tree
rootstock is a dwarfing rootstock that is resistant to fire blight
(*Erwinia amylovora*) and crown rot (*Phytophthora cactorum*). The ‘G.890’ rootstock is useful in that it can be
propagated clonally and used as a rootstock or root system for
apple trees as well as for interstems of apple trees.

5 Drawing Sheets

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**STATEMENT REGARDING FEDERAL
FUNDING**

Research related to this invention was funded under USDA
ARS CRADA, Sponsor’s Contract #: 58-3K95-9-1358-M;
the U.S. government may have rights herein.
Genus and species: *Malus domestica* × *Malus robusta*
hybrid.
Variety denomination: ‘G.890’.

BACKGROUND OF THE INVENTION

I. Field & Utility Summary

The present invention relates to a new and distinct variety
of apple tree rootstock. The rootstock is useful in that it can be
propagated clonally and used as a rootstock or root system for
apple trees as well as for interstems of apple trees.

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II. Cultivation Summary

‘G.890’ originated from a planned cross in 1976 in Geneva,
N.Y.

III. Characteristics Summary

The ‘G.890’ apple tree rootstock is a dwarfing rootstock
that is resistant to fire blight (*Erwinia amylovora*) and crown
rot (*Phytophthora cactorum*). While ‘G.890’ rootstock is a
hybrid from a cross between ‘Ottawa 3’ and ‘Robusta 5’, it is
distinct from its parent cultivars in terms of dwarfing. The
apple tree rootstock ‘G.890’ is less dwarfing than ‘Ottawa 3’
and more dwarfing than the non-dwarfing parent ‘Robusta 5’.
Unlike ‘Ottawa 3’, ‘G.890’ is resistant to fire blight. Although
‘G.890’ is in the same dwarfing market class as ‘M.7’, and
‘MM.106’ it is distinguishable from ‘M.7’ and ‘MM-106’
because ‘G.890’ is resistant to fire blight whereas ‘M.7’ and
‘MM-106’ are susceptible. It is also distinguishable from

'M.7' and 'MM.106' because it is tolerant to the biotic replant disease complex whereas 'M.7' and 'MM-106' are not.

Apple tree rootstock 'G.890' is more vigorous than two other apple tree rootstock having the same 'Ottawa 3' and 'Robusta 5' parents, namely, apple tree rootstock 'G.969' and apple tree rootstock 'G.935'. 'G.890' is in a different dwarfing category than either 'G.969' or 'G.935'. 'G.890' is better suited for weaker scion varieties of low density apple plantings. 'G.890' is less yield efficient than 'G.935'. 'G.890' is resistant to woolly apple aphid and 'G.935' is susceptible'. 'G.890' has rounder and straighter leaves than the epinastic recurved leaves of 'G.935'.

IV. Breeding History

In the spring of 1976, pollen from a *Malus robusta* 'Robusta 5' apple tree was applied to emasculated flowers of a *Malus domestica* 'Ottawa 3' apple tree in Geneva, N.Y. In the fall of 1976, approximately 500 seeds resulting from this pollination were extracted from mature fruit derived from this cross. In the winter of 1976-77, the seeds were stratified and planted in large flats under conditions effective to germinate seeds and obtain seedlings. When germinated seedlings were about 2.5 cm tall they were inoculated with a mixture of isolates of the fungus *Phytophthora cactorum* (the causal agent of crown and root rots). The flats were flooded to mid-hypocotyl level and kept at 23° C. for one week. Surviving seedlings were transplanted into individual pots.

In the summer of 1977, each of the transplanted seedlings was inoculated with approximately 10⁶ colony forming units of the Ea 273 strain of the fire blight bacterium *Erwinia amylovora* by inserting a 26-gauge hypodermic syringe needle into the shoot tip. The seedling designated as #890 was one of the survivors of this battery of inoculations from the same cross. All the surviving plants were transplanted in Geneva, N.Y., in the fall of 1977 and allowed to grow side shoots for propagation/evaluation. In 1980, 'G.890' was evaluated for rooting ability, lack of spine production, and low root brittleness in a layering bed (stool bed). In 1983, 4 finished trees with 'G.890' rootstock were planted in a first test orchard in Geneva, N.Y. with *Malus domestica* cv. 'Golden Delicious' grafted onto this rootstock as the scion cultivar. This rootstock performed well (top 20% of many rootstocks tested) in these first test trials. In the Spring of 2002 'G.890' and other experimental rootstocks were planted as finished trees with two scion varieties in Geneva, N.Y. and in 2003 and 2004 the orchard was spray inoculated while in bloom with fire blight and all trees of 'G.890' survived indicating good resistance of the rootstock in an orchard environment. In August 2002, several rootstock liners of 'G.890' were budded with 15 different scion cultivars to test graft union compatibility the test results showed that 'G.890' was compatible with all the cultivars tested. In summer 2007, 20 rootstock liners were inoculated with two different strains of fire blight (ten liners per strain) in Geneva, N.Y. As a result, the apple rootstock 'G.890' was classified as immune to one of the strains tested and less resistant to the other strain of fire blight. In the fall of 2005 and 2006 the inventors measured tree architecture of nursery trees on 'G.890' and found that it promotes a spreading habit (flatter branches) on three diverse grafted scion varieties.

V. Asexual Reproduction

Asexual reproduction of the 'G.890' apple rootstock has been achieved using the traditional method of clonally propa-

gating apple rootstocks. In particular, the original seedling of the 'G.890' apple rootstock was planted in Geneva, N.Y. and allowed to develop into a "mother plant." The 'G.890' mother plant was then used to obtain rooted liners using conventional layering procedures. The resulting liners were then planted in a row to generate a layering stool bed (also referred to as the "mother stool bed"). The living tissues (i.e. leaves, stems, roots, buds, and spines) of the mother stool bed were observed to be identical to secondary and tertiary stool bed plants. In addition to conventional layering, the 'G.890' apple rootstock variety has been asexually reproduced by root cuttings, by budding and grafting onto seedling and clonal rootstocks, and by tissue culture.

VI. Stability

Observations of trees from these propagations indicate that all trees have proven true to type and identical in all appearances to the original tree.

VII. Detailed Comparisons

The seed parent *Malus domestica* 'Ottawa 3' is a dwarfing rootstock, i.e., trees grown on this rootstock are 30 to 35 percent the size of a standard self-rooted seedling tree. 'Ottawa 3' is known to induce good precocity to the scion (i.e., the ability to induce early reproductive development in the scion) and has high yield efficiency. 'Ottawa 3' plants produce no spines, are fairly well anchored, are a very cold hardy rootstock and have resistance to crown and root rot caused by *Phytophthora cactorum*. However, 'Ottawa 3' is susceptible to the woolly apple aphid (*Eriosoma lanigerum*) and to fire blight (*Erwinia amylovora*).

The pollen parent *Malus robusta* 'Robusta 5' is a non-dwarfing rootstock, i.e. trees on this rootstock are the same size as a standard self-rooted tree. 'Robusta 5' does not induce precocity to the scion and is not highly yield efficient. Juvenile plants of 'Robusta 5' produce many spines. 'Robusta 5' breaks buds very early in the spring and is winter hardy. It is resistant to powdery mildew (*Podosphaera leucotricha*) and fire blight, and is immune to the woolly apple aphid. Further, 'Robusta 5' has shown tolerance to the specific replant disease complex.

The 'G.890' apple rootstock of the present invention has a combination of qualities that distinguishes it from its parental plants (i.e., 'Ottawa 3' and 'Robusta 5'). For example, although 'G.890' has dwarfing properties derived from 'Ottawa 3', it is different from its dwarfing parent (i.e., 'Ottawa 3') because it produces a tree that is 60 to 70 percent of the size of a standard self-rooted seedling tree. Thus 'G.890' belongs to a different dwarfing vigor class than its 'Ottawa 3' parent. In particular, 'G.890' has dwarfing characteristics that are intermediate between the industry standards of *Malus domestica* 'Malling 7' and *Malus domestica* 'Malling-Merton 106'. 'G.890' shares similarities with 'Ottawa 3' in that they both induce precocity to the scion, are yield efficient, winter hardy, and resistant to crown and root rot caused by *Phytophthora cactorum*.

With regard to its 'Robusta 5' parent, 'G.890' is distinguishable in that it is a dwarfing rootstock and is highly yield efficient, while 'Robusta 5' is not. However, like 'Robusta 5', 'G.890' is resistant to fire blight and possesses the genetic markers linked to the main resistance to powdery mildew and has shown field resistance to powdery mildew. In addition, 'G.890' has been shown to have some tolerance to the replant disease complex.

As discussed above, 'G.890' is intermediate between 'M.7' and 'MM.106' in terms of dwarfing class. However, 'G.890' is more precocious and yield efficient than 'M.7' and 'MM.106'. 'G.890' is resistant to fire blight whereas 'M.7', 'MM.106' and other rootstocks in its market class are not.

With regard to apple tree rootstock 'G.969', a variety from the same parents as 'G.890', 'G.890' produced trees that were at least 20% more vigorous than 'G.969', when grown in the northeast United States, placing 'G.890' in a different dwarfing category from 'G.969'. For this reason, 'G.890' rootstocks are better suited for weaker scion varieties of low density apple plantings such as those for processing apple varieties.

With regard to apple tree rootstock 'G.935', a variety from the same parents as 'G.890', 'G.890' produced trees that were at least 30-35% more vigorous than 'G.935', when grown in the northeast United States, placing 'G.890' in a different dwarfing category. For this reason, 'G.890' rootstocks are better suited for weaker scion varieties of low density apple plantings such as those for processing apple varieties, while 'G.935' is recommended for high density plantings. 'G.935' is approximately 30% more yield efficient (Kg of fruit/trunk cross sectional area) than 'G.890'. 'G.890' is resistant to woolly apple aphid (*Eriosoma lanigerum*) and 'G.935' is susceptible. 'G.890' has rounder and straighter leaves than the epinastic recurved leaves of 'G.935'.

VIII. Brief Description of the Figures

FIG. 1 shows budded liners in the nursery. The plants shown are two seasons old.

FIG. 2 shows live plants in a propagation bed. The shoots and leaves shown are one season old.

FIG. 3 shows a close up of an actively growing shoot. The shoot shown is one season old, cut from a stoolbed that is more than 12 years old.

FIG. 4 shows the adaxial (upper) lamina surface of a mature leaf. The leaf shown is from one season growth, cut from a stoolbed that is more than 12 years old.

FIG. 5 shows bark and leaves on an actively growing shoot. The shoot shown is in its first season of growth.

IX. Detailed Botanical Description

The following description of apple tree rootstock 'G.890' contains references to color names taken from The Royal Horticultural Society Colour Chart (R.H.S.), 2001 edition. Botanical descriptions follow the Manual of Cultivated Plants (Bailey, 1949).

Tree:

Habit.—A self-rooted tree of 'G.890' is a small shrub typically standing about 1.5-2 meters tall by about 2 meters wide when 7 years old. There is no single dominant trunk. Instead there are few shoots arising from the crown. Very few suckers (i.e., new shoots emerging from below ground) are produced. Liners planted in the nursery stop apical growth mid season. The apical bud in these plants is pubescent Greyed-Green (RHS 191D).

Productivity.—In an intermediate trial performed at the NYSAES (Cornell University, Geneva, N.Y.), the

'G.890' rootstock received the cultivar 'Empire' (*Malus domestica*) as the scion and was compared to the *Malus domestica* check rootstocks M.9 EMLA, M.26 and M.7. 'G.890' was shown to have statistically higher ($p \leq 0.05$) yield efficiency (kg yield/cm² trunk cross sectional area) than all the check rootstocks.

Precocity.—Scion cultivars budded on 'G.890' exhibit the same precocity as those budded on M.9.

Fertility (Fecundity).—The 'G.890' plant produces flowers and fruits regularly.

Dormant shoots (buds and bark):

Dormant mature shoots.—Color: Greyed-Red (RHS 178A) where exposed to full sunlight grading to Greyed-Orange (RHS 173B) with diminished light exposure. Texture: Very light pubescence which gradually disappears in older tissues. Size: 30-60 cm long; may have some spines.

Axillary buds.—Size: 2-3 mm long and 3 mm wide with little pubescence. Shape: Obtuse, sessile, somewhat appressed and flattened. Texture: Some pubescence.

Bark on three-year-old shoots.—Color: Greyed-Green (RHS 197A). Lenticels: Color: Greyed-Orange (RHS 163B). Size: 0.3-0.4 mm in diameter. Quantity: 1-2 lenticels per cm².

Leaves:

Mature leaves.—Leaf arrangement: Alternate. Shape: Simple, recurved, oblong-ovate. Size: Length: 85 mm. Width: 50 mm at the widest point. Laminae: Somewhat wavy. Apex: Acuminate. Base: Nearly symmetrical rounded. Margin: Acutely serrated, with about 5 serrations per cm. Upper surface: Color: Green (RHS 126B). Texture: Glabrous and translucent. Lower surface: Color: Green (RHS 146C). Texture: Somewhat pubescent. Venation: Netted. Leaf poise: 15°-25° from the shoot, depending on shoot orientation. Stipules: Length: 8 mm. Width: 2 mm. Petioles: Diameter: 2 mm. Color: Gradation of Green (RHS 140A) to Greyed-Red (RHS 179A) depending on low or high exposure to light.

Flowers: Because their primary use is for rootstocks, the plants of G.890 have not been allowed to flower yet and therefore no flowers have been observed yet.

Fruit: Because their primary use is for rootstocks, the plants of 'G.890' have not been allowed to set fruit yet and therefore no fruit has been observed yet.

Disease resistance: As described above, the 'G.890' rootstock of the present invention exhibits resistance to fire blight. The percent lesion measured after inoculation of potted liners in the greenhouse using four different strains of *E. amylovora* was negligible for two of the strains and moderate for the other two, indicating a specific resistance to the bacterium. The 'G.890' rootstock, having survived the inoculation with crown and root rot, is also considered resistant to crown and root rots caused by *Phytophthora cactorum*.

We claim:

1. A new and distinct variety of apple rootstock named 'G.890' herein described and illustrated.

* * * * *

Figure 1

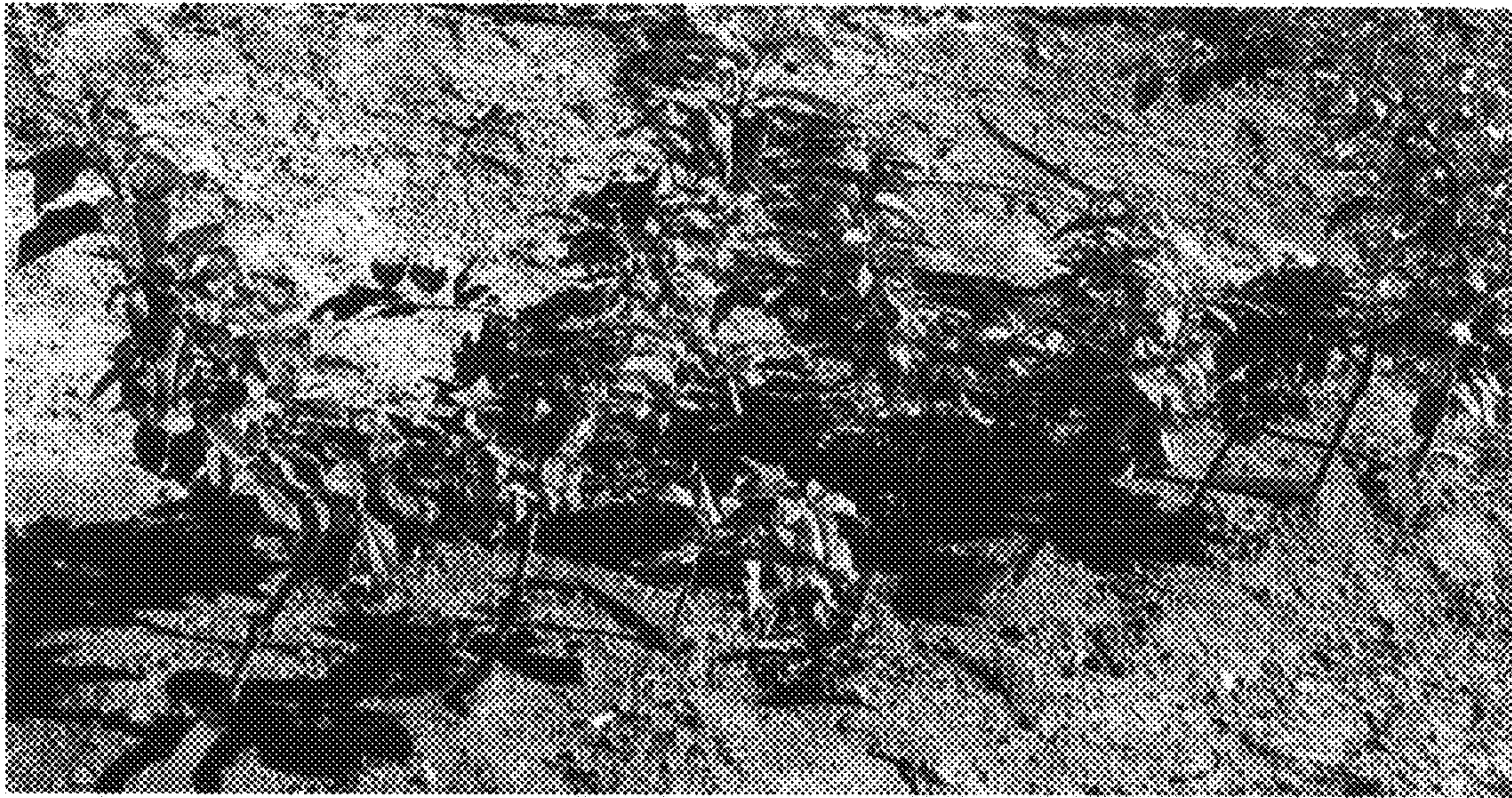


Figure 2



Figure 3



Figure 4

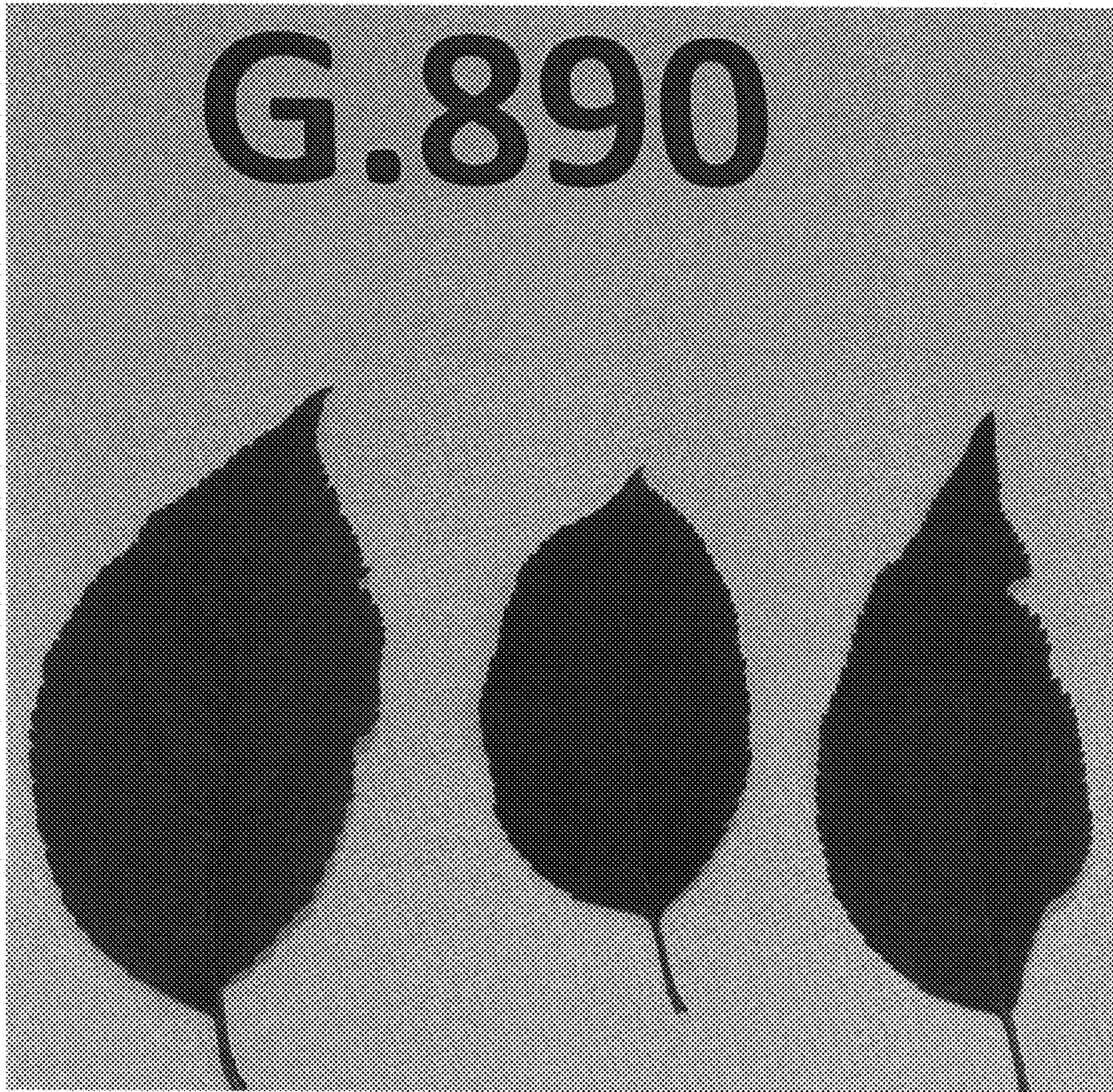


Figure 5

