

**Sept. 9, 1975**

**E. B. SMALLEY ET AL**

**Plant Pat. 3,780**

**ELM TREE**

**Filed May 31, 1974**

**2 Sheets-Sheet 1**





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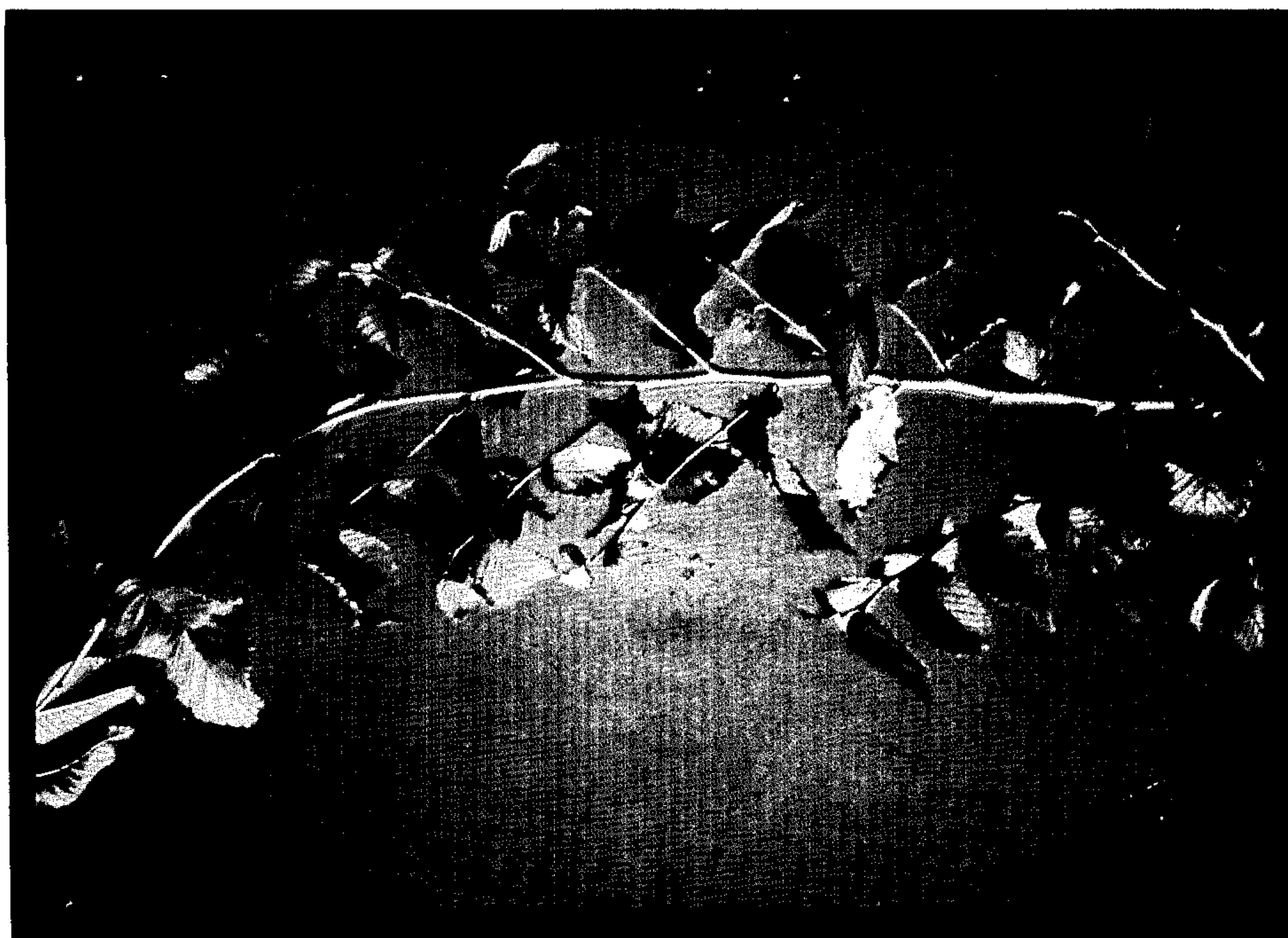
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2 Sheets-Sheet 2





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3,780  
ELM TREE

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U.S. Cl. Plt.—51

1 Claim

The present invention relates to a new and distinct  
variety of elm tree which is primarily distinguished by  
its high resistance to Dutch elm disease caused by  
*Ceratocystis ulmi* (Buism.) C. Moreau. The tree also  
shows a high tolerance to *Verticillium albo-atrum* Reincke  
and Berth., the causal agent of Verticillium wilt and has  
limited susceptibility to the blackleaf spot disease caused  
by *Gnomonia ulmea* (Schw.) Thum.

The tree is characterized by its rapid development in  
its early years to a densely foliated, upright form with  
a vase shaped crown and with a projected height at ma-  
turity of 18 to 20 meters. Budbreak takes place in southern  
Wisconsin in early May, the normal time in that locality  
for budbreak in the native American elm.

New growth on the developing, moderately-pubescent  
shoots is mineral green in color (R#31') tinged on the  
upper surface of morocco red (R5#K) to brick red  
(R#5'K). As leaves mature they change first to a glossy  
Varley's green (R#31'm) and then to a mature forest  
green (R#29'm). The mature leaves exposed to full sun  
are nearly elliptical, obtuse and equal at the base, acu-  
minate at the tip, doubly serrate at the leaf margins.  
8.0–10.0 cm. long and 4.5 to 5.5 cm. wide, with shade  
leaves or leaves on highly vigorous sprouts being slightly  
larger. Leaves become a vivid, semi-transparent, pale  
greenish yellow (R#25d) to light greenish yellow  
(R#25b) in fall with this overall color holding well for  
many days prior to leaf drop. This tree has been named  
Sapporo Autumn Gold because of this fall coloration  
characteristic. (Color standards indicated are from Ridg-  
way's color chart (Ridgway, R. 1912. Color standards  
and color nomenclature. Washington, D.C. 53 plates.))

Apical dominance is moderately strong resulting in  
limited side branch development on shoots of the current  
season, and usually beginning 30 to 60 cm. below the  
apex. Mature bark development progresses at a rate in-  
termediate between the parents resulting in a smooth to  
lightly roughened bark whose weathered color ranges  
from dark to light mouse gray (R#15''''b,k) to black-  
ish brown (R#9''''m) underlaid in exposed cracks and  
new bark with a wood brown (R#17''') to Sanford's

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brown (R#11k) color. The inner bark is also a wood  
brown to Sanford's brown. Floral and seed characters  
are generally intermediate between the two parents. The  
original tree began flowering intensely at 5 years of  
age, somewhat earlier than is normally expected for either  
parent species.

The accompanying drawing shows a specimen tree of  
the new variety, as depicted in black and white to show  
its general form and habit of growth, with additional  
views in color to show new growth and the autumn color-  
ation for which the tree variety has been named.

Origin

The "Sapporo Autumn Gold" elm is derived from open-  
pollinated seed collected from a single Siberian elm, *U.*  
*pumila* L., growing in the Botanical Garden of Hokkaido  
University, Sapporo, Japan. The maternal parent's loca-  
tion in the botanical garden, the physical traits of the  
progeny, and controlled hybridization experiments (see  
references 2 and 3 in E. B. Smalley et al., Hortscience,  
Vol. 8(6), December 1973, p. 514) leave little doubt that  
the tree is an F<sub>1</sub> hybrid between *U. pumila* and *U. japonica*  
(Rehd.) Sarg.

Asexual Reproduction

The "Sapporo Autumn Gold" elm cultivar can be prop-  
agated from root cuttings allowed to sprout in the green-  
house in moist sphagnum peat. Hormone treated sprouts  
can be transplanted as rooted cuttings after approximately  
20 days in a perlite-peat rooting medium under fine inter-  
mittent mist.

Determination of Resistance to Dutch Elm Disease

As a broad approach to identifying hardy elms with low  
disease susceptibility elm seed imported from many parts  
of the world was grown for one year in the seedbed, trans-  
planted into the field the second season, maintained under  
clean cultivation, and artificially inoculated with *Cerato-*  
*cystis ulmi* in the third or fourth year. The inoculum con-  
tained approximately 10<sup>5</sup> spores/ml. and was a mixture  
of spores from 10–15 different Wisconsin isolates of the  
fungus. Trees were inoculated in one-year-old wood in the  
upper crown. The survivors of this procedure were then  
reinoculated at least two or more times in subsequent  
years. As a final test (called the seasonal susceptibility  
test), selected resistant clones having ornamentally de-  
sirable features were clonally propagated in large num-  
bers, grown in randomized field plantings for one or two  
years, and different individuals of each clone inoculated  
at the intervals indicated in the table below. In this test,

SEASONAL SUSCEPTIBILITY OF SELECTED ELM CLONES TO DUTCH ELM DISEASE  
Percent crown damage at final reading (7/5 and 8/72) a b

Elm species °	Clone No.	1971 dates of inoculation										
		4/28	5/12	5/18	5/25	6/1	6/7	6/14	6/21	7/6	7/19	8/2
<i>Ulmus Americana</i> .....	185-1	0	23.4	28.1	29	69.6	62.1	70.1	90.1	100	40	0
	185-2	0	0	2.5	29.8	82.8	79	100	81	37	58.3	0
	185-3	33.3	-----	48.0	7	53.3	80	-----	97.5	100	65	-----
	185-4	-----	-----	-----	-----	-----	-----	31.7	100	-----	-----	-----
	185-5	-----	-----	-----	50	100	100	-----	100	-----	37.5	-----
	411-3	75	62.6	100	60	100	100	100	95.8	99.2	97.2	0.7
<i>Ulmus Pumila</i> ..... X <i>Ulmus Japonica</i> .....	44-11	0	0	0	0	7.5	0	0	6.8	0	0	0
	44-25	-----	-----	0	-----	0	-----	0	-----	-----	-----	-----

a Elm clones all derived from trees previously symptomless following one or more inoculations with Wisconsin strains of *Ceratocystis ulmi*.  
b Mixed inoculum consisted of a conidial suspension prepared from isolates of *C. ulmi* from Wisconsin, Kansas, Massachusetts, Illinois, Nebraska, Minnesota, New York, Connecticut, and Maine.  
c Trees planted as vigorous rooted cuttings in 1970, 3 plants per clone per block, 25 randomized clones per block (with some clones occasionally missing), and 40 blocks.

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inoculum consisted of a mixed conidial suspension from 10 different isolates of the fungus from different North American locations. Observations on disease development were then recorded periodically through the year following inoculation.

The cultivar of this application, named Sapporo Autumn Gold, possessed superior resistance to *C. ulmi* as shown in the table above.

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What is claimed is:

1. A new and distinct variety of elm tree as herein described and illustrated primarily characterized by its high resistance to Dutch elm disease.

No references cited.

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