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(12) **United States Plant Patent**
de Teresa Cortes

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(54) **MANDARIN TREE NAMED 'MANDARIN QUEEN'**

(50) Latin Name: ***Citrus reticulata***
Varietal Denomination: **Mandarin Queen**

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(21) Appl. No.: **12/584,258**

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(65) **Prior Publication Data**

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(51) **Int. Cl.**
A01H 5/00 (2006.01)

(52) **U.S. Cl.** **Plt./202**

(58) **Field of Classification Search** Plt./202, Plt./201
See application file for complete search history.

(56) **References Cited**

OTHER PUBLICATIONS

Hutchison. Performance of 'Queen' Orange Trees on 15 Citrus Rootstocks. Proc. Fla. State Hort. Soc. 94:29-30, 1981.*
Upov-rom GTITM Plant Variet Database 2010/03, GTI Jouve Retrieval Software, Citation for Citrus 'Queen', 2 pages.*

* cited by examiner

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(74) *Attorney, Agent, or Firm* — Kilpatrick Townsend & Stockton LLP

(57) **ABSTRACT**

'Mandarin Queen' is a new and distinctive mandarin hybrid cultivar, which distinguishes itself by having mid to late season maturity, a large size, distinguished flat shape, easily peeled, a smooth rind texture, white albedo, red color, rich sweet flavor and pleasant aroma. It further distinguishes itself by being seedless or virtually seedless.

9 Drawing Sheets

Latin name of the genus and species: The mandarin cultivar of this invention is botanically identified as *Citrus reticulata.*

Variety denomination: The variety denomination is 'Mandarin Queen'.

BACKGROUND OF THE INVENTION

This invention relates to a new and distinctive mandarin hybrid cultivar designated 'Queen' which was developed in Spain. It is distinguished from other cultivars by producing fruit that combines mid to late season maturity, large size, distinguished flat shape, easily peeled, smooth rind texture, white albedo, red color, rich sweet flavor and pleasant aroma. It further distinguishes itself by being seedless or virtually seedless.

BRIEF SUMMARY OF THE INVENTION

'Mandarin Queen' mandarin appeared in Pilar de la Horadada, Alicante, Spain in 1987 as a natural hybrid of a 'Satsuma' mandarin seed parent and an unknown pollen parent. First, seeds of the 'Satsuma' fruit were planted and one of the planted seeds produced a tree having different fruit. The tree from this planted seed was then grafted over 'Macrophylla', 'Volkameriana', 'Carrizo' and 'Cleopatra' rootstocks. Fruit production and evaluation began in 1995. Trials with cross pollination have been made with 'Orogrande', 'Oronules', 'Ortanique', 'Clemenpons,' 'Fortune' and 'Valencia-Late'. Only the trials with 'Fortune' have occasionally produced some seed in the fruit of the 'Mandarin Queen' mandarin.

In 2006, budwood was sent to a center in Valencia, Spain, to clean the variety of the tristeza virus. The budwood was

grafted to rootstock in Alicante, Spain, thereby asexually reproducing the new variety. In 2007, four trees certified as tristeza-free were kept in a breeding block of the center for further propagation and four trees were sent to a breeding block in Pilar de la Horadada, Alicante, Spain. Fruit production of those trees commenced in 2009.

BRIEF DESCRIPTION OF THE DRAWINGS

The figures depict various characteristics of 'Mandarin Queen'.

FIG. **1** shows the 'Mandarin Queen' mandarin flower.

FIG. **2** shows the 'Fortune' mandarin flower.

FIG. **3**A shows the fruit of a three year old 'Queen' tree in week three, grafted over a 20 year old Cleopatra rootstock with Valencia Late.

FIG. **3**B shows a close-up view of the fruit of Queen in week three.

FIG. **4**A shows the peeled fruit of 'Queen' mandarin with navel.

FIG. **4**B shows the flower buds and flowers.

FIG. **5** shows a view of a three year old grafted 'Mandarin Queen' mandarin tree over a 20 year old rootstock of 'Cleopatra' (Valencia Late).

FIG. **6** shows a four year old grafted 'Mandarin Queen' mandarin tree over a 20 year old rootstock of 'Cleopatra' (Valencia Late).

FIG. **7** shows a cross section of representative mid-season 'Queen' fruit.

FIG. **8**A shows a top view (stem end) of a typical fruit of 'Queen'.

FIG. **8**B shows a bottom view (blossom end or tip) of a typical fruit of 'Queen'.

DETAILED DESCRIPTION OF THE INVENTION

The following is a detailed description of the new *Citrus reticulata*, 'Mandarin Queen', based upon observation of four year old plants grown in Alicante, Spain. The color designations being according to The R.H.S. Colour Chart published by The Royal Horticultural Society of London, England. Further, additional character descriptions listed herein are in accordance with the *IPGRI Descriptors for Citrus.*

Fruit of 'Queen' mandarins are virtually seedless and do not cross-pollinate with other mandarins as it is auto incompatible. 'Queen' mandarin is a mid to late season variety, harvested between the beginning of January to the end of April in Pilar de la Horadada, Alicante, Spain. The fruit is very easy to peel, with a flat shape and having a diameter between 58-68 mm. The fruit has around 49% juice content, is very homogeneous, and has a red fruit skin color (see FIG. **3**A), with a typical flat shape (see FIG. **3**B). The oil glands have a pleasant aroma. At maturity the 'Queen' mandarin fruit has around 1.05% of acid concentration and 12° Brix. At the beginning of January, the 'Queen' mandarin has around 1.25% of acid concentration and 11.5° Brix over Macrophylla rootstock. By the end of February, the 'Queen' mandarin has around 1.15% of acid concentration and 13.5° Brix over Cleopatra rootstock. By mid-April, the 'Queen' mandarin has around 1.00% of acid concentration and 15° Brix over Cleopatra rootstock.

The flavor is sweet and lightly acidic. The pulp has a smooth texture and the segments have an easy-eating texture. Some 'Queen' fruit have navels that differ from 1 to 5 mm in diameter and develop inside as a typical navel orange does (See FIG. **4**A). Usually, between 14 and 16 segments are found in a 'Queen' mandarin fruit. Growing conditions are easy to manage as they do not need pruning and treatments to produce a good yield.

Comparison With Existing Mandarins

The 'Mandarin Queen' mandarin variety differs from its parents in harvesting period. 'Satsuma' is harvested in October through December and 'Mandarin Queen' is harvested in January through April, in Pilar de la Horadada, Alicante, Spain. 'Satsuma' has a puffy skin, while 'Mandarin Queen' has a skin that is easy to peel, but not puffy. 'Satsuma' has an orange color, while 'Mandarin Queen' has a vivid reddish orange color. 'Satsuma' has low level acidity during harvesting period, between 0.90 and 0.60, while 'Mandarin Queen' has an acid level of 1.25 and 1.00 during harvesting.

'Mandarin Queen' mandarin differs from main mid to late season cultivars because trees of 'Mandarin Queen' do not show alternate bearing and do not need to be pruned as, for example, 'Orri' or 'Nadorcott'. 'Mandarin Queen' is virtually seedless, larger sized and a deeper red color than 'Orri' and 'Nadorcott'. 'Mandarin Queen' mandarin's resistance to heat and cold is similar to 'Clementine'.

Trees, Foliage and Flowers

The 'Mandarin Queen' mandarin tree has a drooping growth habit, obloid shape and is without spines. The bark of the trunk has a green and brown color (RHS color: 199 A) and the branches tend to curve down. The surface texture of the trunk is even. The tree is vigorous with dark green leaves (See FIGS. **5**-**6**). A typical five-year old 'Mandarin Queen' mandarin tree has an average height of 2.60 m and an average width of 2.20 m. A typical truck diameter is 7 cm at 30 cm about the ground.

Flowering occurs at the end of March to April in Pilar de la Horadada, Alicante, Spain (See, FIG. **4**B) The flowers have no pollen and are hermaphrodite. Open flowers are white (RHS color: 155 C) and have five petals. The flowers do not have anthers and cannot produce pollen (See, FIGS. **1**, **2**). The ratio of petal length and width, and stamen length, is medium. The average size of the flower is 8 to 13 mm and the average number of stamens is 16 to 20. The average number of pistil per flower is 1, and the average length of pistils is 15 to 20 mm.

Leaf length on average is 10.2 cm, with a medium leaf width of 4.0 cm on average, and a large leaf ratio (2.55). There is no leaf blade or spine. The leaf has a straight shape in the cross section and an acute shape of apex. The leaf shape is elliptic (see descriptor 1 in section 7.2.9 of the *IPGRI Descriptors for Citrus*) and the margin type is wavy (see descriptor 4 in section 7.2.10 of the *IPGRI Descriptors for Citrus*). The base shape is absent (see descriptor 0 in section 7.2.12 of the *IPGRI Descriptors for Citrus*). The length of the petiole is medium, typically 10 mm, and wings are absent. Upper leaf surface color is typically dark green, RHS 139 A, while lower leave surface color is typically a strong yellowish green, RHS 144 C.

Fruiting, Fruit and Production Characteristics

'Mandarin Queen' mandarin fruit is typically harvested middle of January to end of April in Pilar de la Horadada, Alicante, Spain. Fruit production is similar to its parent, 'Satsuma'. Fruit production of a five year old 'Mandarin Queen' mandarin tree grafted in a plantation over Cleopatra rootstock is on average 75 kg per tree.

The 'Mandarin Queen' mandarin fruit has a short height, on average 45.2 mm, and a medium to large diameter, on average 65.9 mm. The color of the fruit surface is typically a vivid reddish orange, RHS 30A. It has a flattened general shape, absence of neck and presence of depression at stalk end. There are an intermediate number of radial grooves at the stock end, absent presence of collar, presence of depression at distal end, and complete grooved presence of the areola. There is no persistence of style. Occasionally there is the presence of a navel and, when present, the size of the navel is medium, while the bulging of the navel is intermediate to strong. The fruit rind has medium thickness, medium strength and medium oiliness, with a medium adherence to flesh, white color and loose density of albedo. The color of the albedo is typically white, RHS 155B and the presence of the albedo strand is medium present. The fruit surface texture is even (see descriptor 1 in section 7.4.12 of the *IPGRI Descriptors for Citrus*) and the pulp vesicles size is average. The date of maturity in Alicante, Spain is from the middle of January until the end of April.

The areola is grooved and the average diameter is from 5 mm to 15 mm. The average diameter of the stylar scar is from 5 mm to 15 mm and the protruding stylar point is large. The fruit has a strong glossy surface and the fruit's average weight is between 100 gr. to 150 gr. The size of the oil glands is typically 1 mm.

The fruit flesh has a medium orange color, large core diameter, and an average of 16 well developed segments. Specifically, the typical color of the mature internal fruit flesh is RHS

30D. The segment walls have a strong strength and there is an intermediate presence of a navel internally. There is no presence of rudimentary segments. The fruit, while virtually seedless, will occasionally have some seeds and the variety does not require pollination. Specifically, the number of seeds is absent or very few, the surface texture of the seeds is smooth and the average size of the seeds is 7 mm by 3 mm. The fruit flavor is sweet and lightly acidic, having a mandarin aroma, with soft pulp texture and thicker segment texture than a 'Clementine'. The fruit is also high in juiciness.

Results of storage trials have indicated that the first significant signs of fruit deterioration has been found at day 37, with no post harvesting treatments (as imazalil) at +5 Celsius. Fruit of the trial had a Brix of 13 and acid of 1.05%.

No susceptibilities to plant or fruit diseases or to pests beyond those normally associated with *citrus* species have been observed. Specifically, 'Mandarin Queen' mandarin is tolerant to *Citrus Tristeza Virus* (CTV) and *Alternaria* species. Further, aphids, mites and scales affect this variety similar to 'Clementines'. Like all varieties, only summer treatments for pests are needed.

DNA Analysis

DNA of Queen mandarin leaves was extracted using the Qiagen DNeasy Plant kit. Based on their level of polymorphism the following 32 simple sequence repeat (SSR) suitable markers were selected (see table). Extracted DNA was amplified by PCR and separated by capillary electrophoresis using a CEQ 8000 Beckman DNA analyser (Beckman). The table indicates the size of each of the two Mandarin Queen alleles of each marker. Therefore, the following primers can be used separately, or in combination, to identify 'Mandarin Queen' and to distinguish 'Mandarin Queen' from other varieties.

Sequence forward (SEQ ID NO:)	Sequence reverse (SEQ ID NO:)	Allele 1	Allele 2
ATCACAATTACTAGC AGCGCC (1)	TTGCATTGTAGCATGT TGG (2)	248	248
GGACCACAACAAAGA CAG (3)	TGGAGACACAAAGAAG AA (4)	132	146
GCAAAACAAGCAGAC TACAAAT (5)	AGGACAGATGACCCAG ATGACA (6)	203	205
AAGCATTTAGGGAGG GTCACT (7)	TGCTGCTGCTGTTGTT GTTCT (8)	216	226
CAGCTCAACATGAAA GG (9)	TTGGAGAACAGGATGG (10)	162	164
AATGATGAGGGTAAA GATG (11)	ACCCATCACAAAACAG A (12)	230	230
CAATAAGAAAACGCA GG (13)	TGGTAGAGAAACAGAG GTG (14)	122	124

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Sequence forward (SEQ ID NO:)	Sequence reverse (SEQ ID NO:)	Allele 1	Allele 2
CACCTTTCCCTTCCA (15)	TGAGGGACTAAACAGC A (16)	261	265
CAGAGACAGCCAAGA GA (17)	GCTTCTTACATTCCTC AAA (18)	207	220
CCACACAGGCAGACA (19)	CCTTGGAGGAGCTTTA C (20)	198	227
CCCAACAAACTCAAA CTTC (21)	TTTTTATTTCGGTCTC CTT (22)	96	96
CGGAACAACTAAAAC AAT (23)	TGGGCTTGTAGACAGT TA (24)	104	107
GACCCTGCCTCCAAA GTATC (25)	GTGGCTGTTGAGGGGT TG (26)	241	249
CCTTTTCACAGTTTG CTAT (27)	TCAATTCCTCTAGTGT GTGT (28)	188	188
TGTAGTCAAAAGCAT CAC (29)	TCTATGATTCCTGACT TTA (30)	118	118
TCCACAGATTGCCCA TTA (31)	CCCTAAAAACCAAGTG ACA (32)	151	157
GTTGCTGATGCTACA GATG (33)	CCTCTCTCTCTTCTTT ACCG(34)	240	242
CCTTATCTTCATCAC CTCCGTC (35)	TAAAAAGATGGGGCCT TGTG (36)	237	239
GCTGAGATGGGGATG AAAGA (37)	CCCCATCCTTTCAACT TGTG (38)	176	176
TCCCTATCATCGGCA ACTTC (39)	CAATAATGTTAGGCTG GATGGA (40)	181	184
TACCTCCACGTGTCA AACCA (41)	GCTGTCACGTTGGGTG TATG (42)	141	147
CGCGGATCATCTAGCA TACA (43)	CTTGGCACCATCAACA CATC (44)	215	217
CATTAAAATATCCGTG CCGC (45)	GAGCAAGTGCGTTGTT GTGT (46)	226	226
GAGCTCAAAACAATAG CCGC (47)	CATACCTCCCCGTCCA TCTA (48)	332	343
GAACCAGAATCAGAAC CCGA (49)	GGTGAGCATCTGGACG ACTT (50)	215	215
CACGCTCTTGACTTTC TCCC (51)	CTTTGCGTGTTTGTGC TGTT (52)	156	165
AGTCCGCCTTTGCTTT TTCT (53)	GGTGCAAAAGAGAGCG AGAG (54)	135	145
GAAAGGGTTACTTGAC CAGGC (55)	CTTCCCAGCTGCACAA GC (56)	185	204

SEQUENCE LISTING

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cttggcacca tcaacacatc 20

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<210> SEQ ID NO 49

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<400> SEQUENCE: 52

ctttgcgtgt ttgtgctgtt 20

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agtccgcctt tgctttttct 20

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<400> SEQUENCE: 54

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gaaagggtta cttgaccagg c 21

<210> SEQ ID NO 56
<211> LENGTH: 18
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<400> SEQUENCE: 56

cttcccagct gcacaagc 18

What is claimed is:

1. A new and distinct cultivar of mandarin tree having the characteristics substantially as described and illustrated herein.

* * * * *

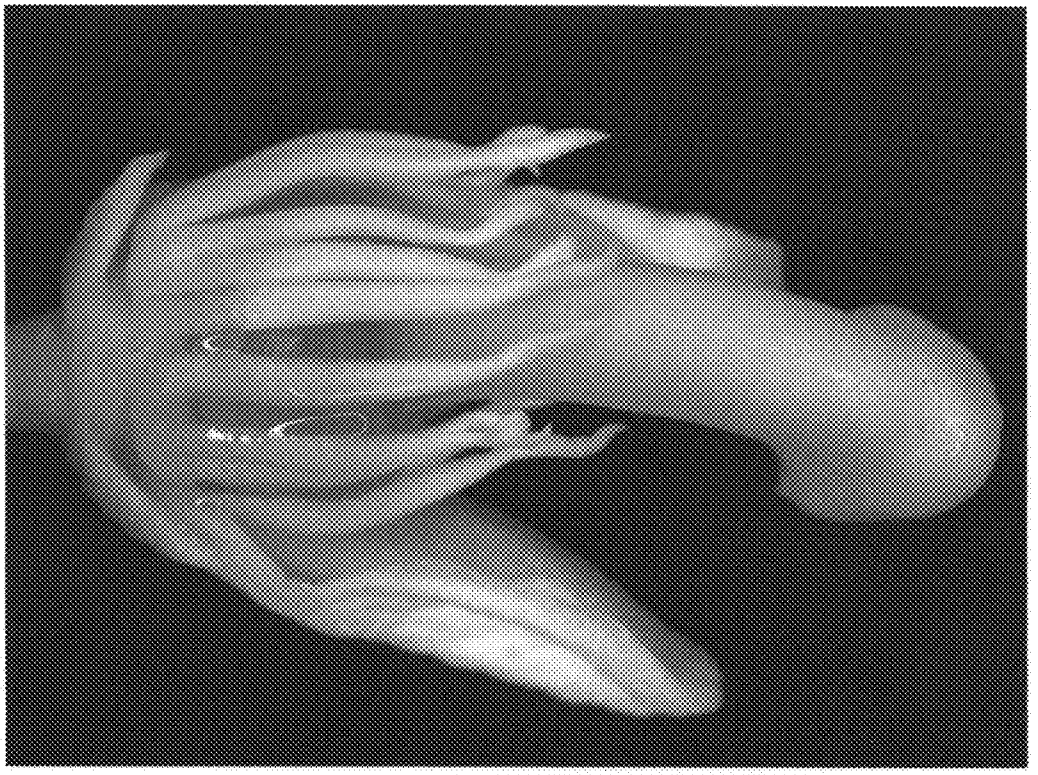

FIG. 1

FIG. 2

FIG. 3A

FIG. 3B

FIG. 4A

FIG. 4B

FIG. 5

FIG. 6

FIG. 7

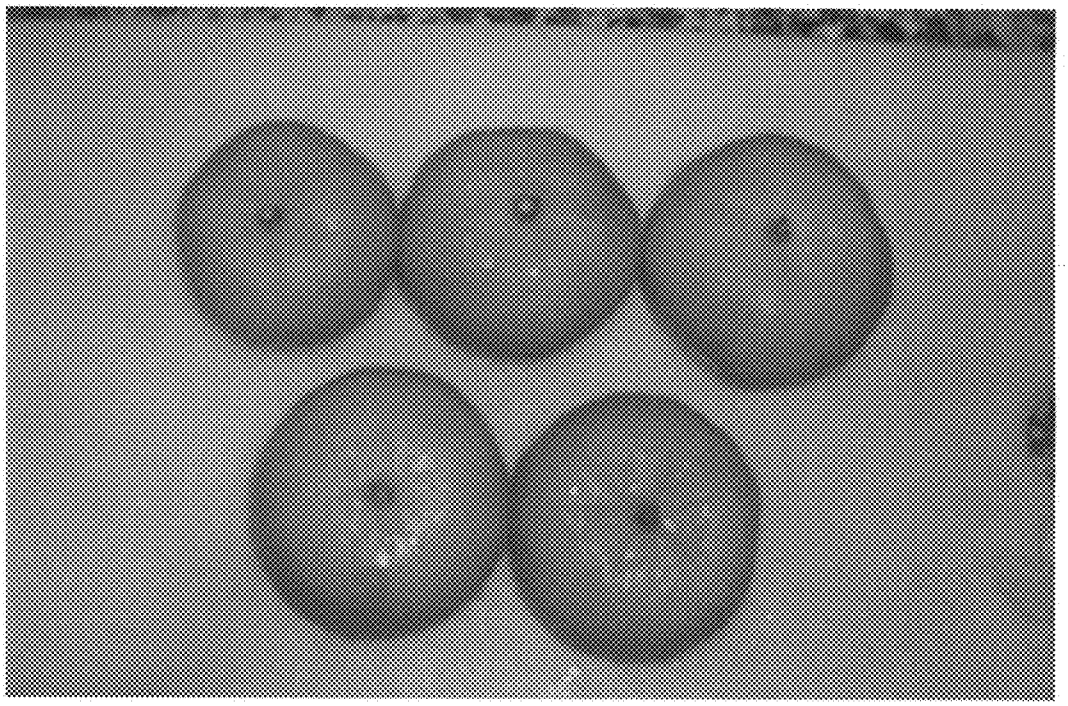

FIG. 8A

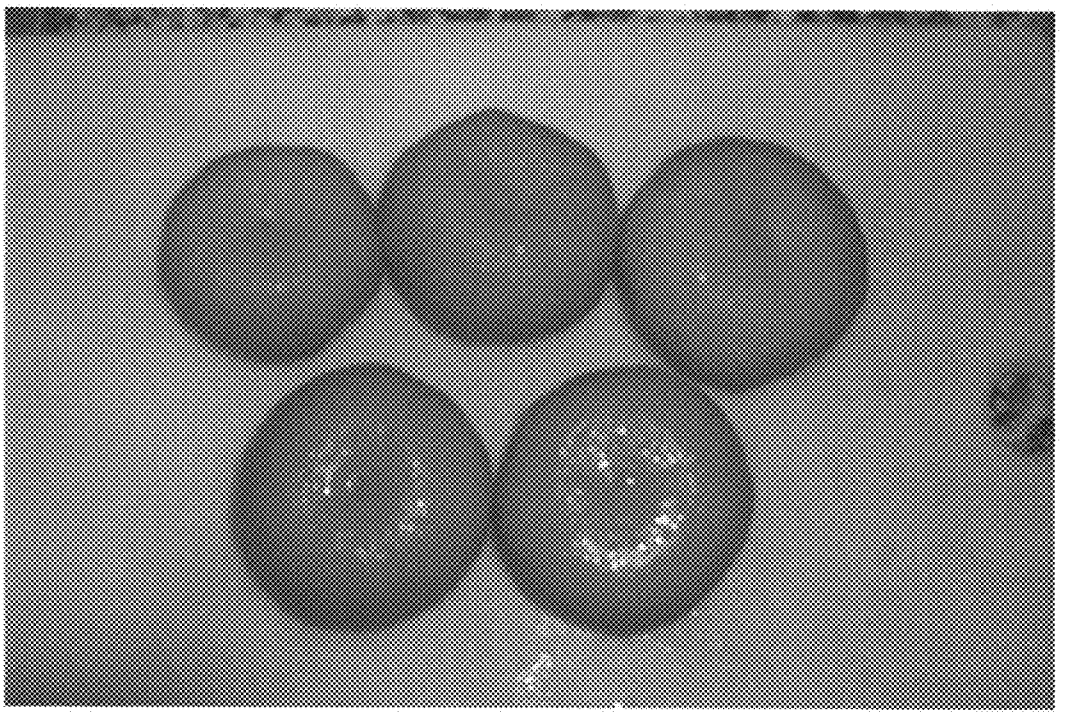

FIG. 8B