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Mehlenbacher et al.

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(54) **CORYLUS PLANT NAMED ‘WEPSTER’**

(50) Latin Name: *Corylus avellana*
Varietal Denomination: **Wepster**

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A01H 5/08 (2006.01)

(52) **U.S. Cl.**
USPC **Plt./152**

(58) **Field of Classification Search**
USPC Plt./152, 216
See application file for complete search history.

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(57) **ABSTRACT**

A new and distinct cultivar of *Corylus* plant named 'Wepster' characterized by high vigor and an upright-spreading plant habit, yellowish-green developing and fully expanded leaves during the spring and summer, resistance to eastern filbert blight caused by the fungus *Anisogramma anomala* (Peck) E. Müller, presence of random amplified polymorphic DNA markers 152-800 and 268-580 amplified by the polymerase chain reaction and which are linked to a dominant allele for resistance to eastern filbert blight from the cultivar Gasaway, expression of incompatibility alleles S₁ and S₂ in the styles, and DNA fingerprints at 8 of 20 microsatellite marker loci differ from both parents OSU 440.005 and 'Tonda Pacifica', and from one parent at an additional 12 marker loci.

7 Drawing Sheets

ACKNOWLEDGMENT OF GOVERNMENT SUPPORT

This invention was made with government support under Specific Cooperative Agreement No. 58-5358-9-447 awarded by the United States Department of Agriculture. The government has certain rights in the invention.

Botanical denomination: *Corylus avellana*.
Variety designation: 'Wepster'.

BACKGROUND

The present Invention relates to a new and distinct cultivar of *Corylus* plant, botanically known as *Corylus avellana*, and hereinafter referred to by the name 'Wepster'. *Corylus avellana* is in the family Betulaceae.

The new *Corylus* resulted from a controlled cross of female parent 'Tonda Pacifica' and male parent OSU 440.005 (unpatented) made in 1997 by Shawn A. Mehlenbacher and David C. Smith. 'Tonda Pacifica' is protected by U.S. Plant Pat. No. 22,715 (issued May 8, 2012). Hybrid seeds from the cross were harvested in August 1997, stratified, and seedlings grown in the greenhouse during the summer of 1998. From this cross, a total of 182 seedling trees were planted in the field in Corvallis, Oreg., USA in October, 1998. 'Wepster' was discovered and selected by the Inventors as a single plant within the progeny of the stated cross-pollination in a controlled environment in Corvallis, Oreg. It was originally assigned the designation OSU 894.030 (unpatented), which indicates the row and tree location of the original seedling. OSU 440.005 (unpatented) is from a cross of OSU 49.073×VR 8-32 (both unpatented). OSU 49.073 is from a cross of OSU 14.084×'Tombul Ghiaghli' (both unpatented). OSU 14.084 is from a cross of 'Barcelona'×'Daviana' (both unpatented). VR 8-32 is from a cross of 'Montebello'×'Gasaway' (both unpatented). 'Tonda Gentile delle Langhe' (unpatented), the female parent of 'Tonda Pacifica', is an important cultivar in Piemonte, northern Italy. 'Barcelona', Oregon's most widely planted hazelnut cultivar, is known as 'Castanera' (unpatented) where it originated in Catalunya, Spain. 'Daviana', originally from England, is the most widely planted pollinizer in 'Barcelona' orchards. 'Tombul Ghiaghli', obtained from Greece, is similar to the Turkish cultivar 'Mincane' (unpatented). 'Montebello' is widely grown under several names in Sicily. 'Gasaway' is the source of a single dominant gene for resistance to eastern filbert blight.

The new cultivar was asexually reproduced by rooted suckers annually for eight years (2004-05 and 2007-12) in Corvallis, Oreg. The new cultivar was also asexually propagated by whip grafting in 2005 in Corvallis, Oreg. The unique features of this new *Corylus* are stable and reproduced true-to-type in successive generations of asexual reproduction.

SUMMARY

The following traits have been repeatedly observed and are determined to be the unique characteristics of 'Wepster'. These characteristics in combination distinguish 'Wepster' as a new and distinct cultivar:

1. High vigor and upright-spreading plant habit.
2. Yellowish-green developing and fully expanded leaves during the spring and summer.
3. Resistance to eastern filbert blight caused by the fungus *Anisogramma anomala* (Peck) E. Müller.
4. Presence of random amplified polymorphic DNA markers 152-800 and 268-580 in DNA of 'Wepster' amplified by the polymerase chain reaction. These two markers are linked to a dominant allele for resistance to eastern filbert blight from the cultivar Gasaway (unpatented).
5. Expression of incompatibility alleles S₁ and S₂ in the styles.
6. DNA fingerprints at 8 of 20 microsatellite marker loci differ from both parents, 'Tonda Pacifica' and OSU 440.005, and from one parent at an additional 12 marker loci. Additional DNA fingerprints of grandparent 'Tonda Gentile delle Langhe', standard cultivar 'Barcelona', eastern filbert blight resistance source 'Gasaway' and five cultivars released by Oregon State University hazelnut breeding program are shown in attached Table 2.

In comparisons in two replicated trials conducted in Corvallis, Oreg., plants of the new *Corylus* differed from plants of the *Corylus avellana* cultivar 'Barcelona' (unpatented), and other cultivars and selections of *Corylus avellana* known to the Inventors primarily in nut size, nut shape, kernel percentage (ratio of kernel weight to nut weight), frequency of blank nuts (nuts lacking kernels), time of pollen shed, time of nut maturity, length of the husk or involucre, and plant size. For example:

- Blank nut frequency: 'Wepster' in two trials 7.25%, 'Barcelona' in one trial 7.7%;
- Pollen shed: 'Wepster' sheds pollen about 6 days later than 'Barcelona' (average of 3 years, 2011-13);
- Nut maturity: 'Wepster' nuts mature 8 days earlier than Barcelona; and
- Husk Length: 'Wepster' 2 times nut length, 'Barcelona' 1.5 times nut length.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying colored photographs illustrate the overall appearance of the new cultivar, showing the colors as true as it is reasonably possible to obtain in colored reproductions of this type. Colors in the photographs may differ slightly from the color values cited in the detailed botanical description which accurately describe the colors of the new *Corylus*.

FIG. 1 shows typical nuts, raw kernels, and blanched kernels of 'Wepster' hazelnut (OSU 894.030) compared to those of 'Yamhill' hazelnut.

FIG. 2 shows the typical nuts, raw kernels, and blanched kernels of 'Wepster' hazelnut (OSU 894.030) compared to those of 'Barcelona', 'Felix,' and 'York' hazelnut cultivars.

FIG. 3 shows the blanched kernels of 'Wepster' hazelnut (OSU 894.030).

FIG. 4 shows the tree of the new cultivar 'Wepster' growing in a field in January, in Corvallis, Oreg.

FIG. 5 shows a pruned tree of the new cultivar 'Wepster' in January, in Corvallis, Oreg.

FIG. 6 shows the husks and nuts of 'Wepster' hazelnut.

FIG. 7 shows a tree of the new cultivar 'Wepster,' 8th leaf, growing in a field in the summer, in Corvallis, Oreg.

DETAILED DESCRIPTION

The cultivar 'Wepster' has not been observed under all possible environmental conditions. The phenotype may vary somewhat with variations in environment such as temperature and light intensity, without, however, any variance in genotype. The aforementioned images and following observations and measurements describe plants grown in Corvallis, Oreg. under commercial practice outdoors in the field during the fall, winter and spring. Plants used for the photographs and description were propagated by tie-off layerage and growing on their own roots, and about seven years old. In the following description, color references are made to *The Royal Horticultural Society Colour Chart*, 1966 Edition, except where general terms of ordinary dictionary significance are used. The list of UPOV descriptors are from the Mar. 28, 1979 Hazelnut guidelines from UPOV.

Botanical classification: *Corylus avellana* cultivar Wepster.
Parentage:

Female, or seed, parent.—*Corylus avellana* cultivar Tonda Pacifica (U.S. Plant Pat. No. 22,715).

Male, or pollen, parent.—*Corylus avellana* selection OSU 440.005 (unpatented).

Propagation (type rooted suckers):

Time to initiate roots.—About 30 days at 20° C.

Time to produce a rooted young plant.—About six months at 22° C.

Root description.—Fine to thick; freely branching; creamy white in color. 5

Propagation (type whip grafting):

Time to budbreak on the scions.—About 14 days at 25° C.

Time to produce a grafted plant.—About six months at 25° C. 10

Plant description:

Type.—Natural habit is a perennial shrub, but in commercial orchards is a single-trunk tree. Upright-spreading plant habit. 15

Growth and branching habit.—Freely branching; about 15 lateral branches develop per plant. Pinching, i.e., removal of the terminal apices, enhances branching with lateral branches potentially forming at every node. 20

Size.—Plant height. — About 6 meters; plant diameter or spread is about 6 meters.

Vigor.—High vigor growth habit.

Lateral branch description:

Length.—About 32 cm. 25

Diameter.—About 6 mm.

Internode length.—About 3.0 cm.

Texture.—Smooth, glabrous.

Strength.—Strong. 30

Color.—Immature — 152B; mature — 152B.

Foliage description:

Arrangement.—Alternate, simple.

Length.—About 10.2 cm.

Width.—About 9.1 cm. 35

Shape.—Oblong to ovate.

Apex.—Obtuse to acute.

Base.—Cordate.

Margin.—Serrate.

Texture, upper and lower surfaces.—Slightly pubescent. 40

Venation pattern.—Pinnate.

Leaf bud shape.—Globular.

Time of leaf budbreak.—Descriptor=6 (medium to late).

Coloration of leaf bud.—178C.

Time of leaf fall.—Descriptor=4 (between ‘Tonda Gentile delle Langhe’ and ‘Barcelona’).

Color.—Developing foliage, upper surface 144A, lower surfaces: 187A. Fully expanded foliage, upper surface: Spring and summer, 143A; late summer and fall, 143A. Fully expanded foliage, lower surface: Spring and summer, 139C; late summer and fall, 139C. Venation, upper surface: Spring and summer, 139C; late summer and fall, 139C. Venation, lower surface: Spring and summer, 139D; late summer and fall, 139D. 55

Petiole description:

Length.—About 2.7 cm.

Diameter.—About 1.8 mm.

Texture, upper and lower surfaces.—Pubescent. 60

Color.—Upper surface: Spring and summer, 139D; late summer and fall, 139D. Lower surface: Spring and summer, 139D; late summer and fall, 139D.

Flower description:

Male inflorescences.—Catkins, color prior to elongation 176C. 65

Female inflorescence.—Style color 048B to 047B.

Time of pollen shed.—Descriptor=6 (same as ‘Daviana’, ‘Cosford’, and ‘Tonda Romana’).

Catkin length.—29.5 mm, descriptor=5 (medium).

Time of female flowering.—Descriptor=5 (medium).

Time of female flowering compared to male flowering.—Protogyny, descriptor=1 (earlier).

Involucre constriction.—Absent.

Involucre length.—Twice length of nut, descriptor=7.

Size of indentation.—Descriptor=7 (strong).

Strength of serration of indentation.—Descriptor=7 (strong).

Pubescence on husk.—Descriptor=9 (present).

Thickness of callus at base.—Descriptor=5 (medium).

Jointing of bracts.—Descriptor=2 (on one side).

Nut description:

Length.—About 18.3 mm.

Width.—About 19.0 mm.

Depth.—About 16.6 mm.

Nut shape.—Round.

*Nut shape index [(width+depth)/2*length]*—0.97.

Nut compression index (width/depth).—1.15.

Nut shell color.—164A.

Nut weight.—About 2.39 grams.

Kernel weight.—About 1.11 grams. 25

Kernel percentage (kernel weight/nut weight).—About 43.9%.

Number of fruits per cluster.—Two to three.

Number of stripes on shell.—Descriptor=5 (medium).

Prominence of fruit apex.—Slight, descriptor=3.

Size of fruit pistil.—Very small, descriptor=3.

Hairiness of top of fruit.—Weak, descriptor=3.

Curvature of nut basal scar.—Flat.

Double kernels.—Absent.

Kernel shape.—Globular. 35

Shape of kernel in cross-section.—Circular.

Lateral groove in kernel.—Absent.

Corkiness of pellicle of kernel.—Descriptor=5 (medium corky).

Nut yield (pounds per tree or per acre).—Total 25.91 kg per tree, years 3 to 7 (1st trial) (very high) total 19.67 kg per tree, years 3 to 7 (2nd trial).

Storability of fruits.—Excellent, similar to OSU releases and check cultivars.

45 Disease/pest resistance: Plants of the new *Corylus* are highly resistant to eastern filbert blight caused by the fungus *Anisogramma anomala* (Peck) E. Müller. Plants of the new *Corylus* are highly resistant to bud mites (*Phytoptus avelanae* Nal.), while plants of ‘Tonda Gentile delle Langhe’ are highly susceptible, and plants of ‘Barcelona’ are highly resistant.

Temperature tolerance: Plants of the new *Corylus* have been observed to tolerate temperatures from -10 to 38 degrees C. in the field in Corvallis, Oreg.

TABLE 1

Primers and annealing temperatures for the 20 microsatellite marker loci used to fingerprint ‘Wepster’ and other hazelnut cultivars.						
Locus	Repeat motif	Size	T _a	n	He	Ho
A614	(TC) ₁₇ (CA) ₁₀ NNN(CA) ₆	125-156	60	14	0.85	0.85
A616	(AC) ₁₁	136-162	60	13	0.85	0.85
A640	(CT) ₁₅ (CA) ₁₃	354-378	67	11	0.80	0.73

TABLE 1-continued

Primers and annealing temperatures for the 20 microsatellite marker loci used to fingerprint 'Wepster' and other hazelnut cultivars.						
Locus	PIC	r	LG	Primers 5'-3' (forward)		
B617				(GA) ₁₅	280-298	60 9 0.80 0.78
B619				(TC) ₂₁	146-180	60 14 0.88 0.88
B634				(AG) ₁₅	218-238	60 9 0.76 0.76
B671				(AG) ₆ NN(GA) ₁₇	221-249	60 13 0.86 0.88
B709				(GA) ₂₁	219-233	60 16 0.87 0.80
B733				(TC) ₁₅	161-183	60 8 0.68 0.68
B749				(TC) ₁₂	200-210	60 6 0.60 0.64
B767				(TC) ₁₅ (AT) ₇	198-238	60 16 0.87 0.80
B774				(AG) ₁₅	195-213	60 8 0.80 0.80
B795				(TC) ₈ Ns(CT) ₇ Ns (CT) ₁₀ Ns(CT) ₅	296-332	60 12 0.76 0.74
C115				(TAA) ₅ (GAA) ₁₂	167-226	60 14 0.80 0.80
KG807				(TAAA)AA(TAAA) ₂ A(TAAA) ₂	226-248	54 4 0.67 0.78
KG809				(AGG) ₆	333-345	55 5 0.66 0.64
KG811				(GA) ₁₇	240-278	58 12 0.83 0.82
KG827				(CT) ₁₃ AA(CA) ₇	264-282	67 9 0.78 0.84
KG830				(CT) ₁₄ GTATT(CA) ₈	279-311	67 9 0.79 0.78
Soman-G (=856- MS1-13)				(AAT) ₅	193-200	54 3 0.60 0.98

TABLE 1-continued

Primers and annealing temperatures for the 20 microsatellite marker loci used to fingerprint 'Wepster' and other hazelnut cultivars.		
Locus	Primers 5'-3' (reverse)	Reference
A614	R-GCAGTGGAGGATTGCTGACT (SEQ ID NO: 2)	Gurcan et al. 2010
A616	R-ATGGCTTTTGCTTCGTTTTG (SEQ ID NO: 4)	Gurcan et al. 2010
A640	Fam-CGCCATAATAATTGGATGC TTGTTG (SEQ ID NO: 6)	Gurcan et al. 2010
B617	R-TGTTTTTGGTGGAGCGATG (SEQ ID NO: 8)	Gurcan et al. 2010
B619	R-GCGATCTGACCTCATTTTT (SEQ ID NO: 10)	Gurcan et al. 2010
B634	R-GTGCAGAGGTTGCACTCAAA (SEQ ID NO: 12)	Gurcan et al. 2010
B671	R-ACCAGCTCTGGGCTTAACAC (SEQ ID NO: 14)	Gurcan et al. 2010
B709	R-GCGAAATGGAGCTCTTGAAC (SEQ ID NO: 16)	Gurcan et al. 2010
B733	R-CATCCCCTGTTGGAGTTTT (SEQ ID NO: 18)	Gurcan et al. 2010
B749	R-TCGGCTAGGGTTAGGGTTTT (SEQ ID NO: 20)	Gurcan et al. 2010
B767	R-GCGAAATGGAGCTCTTGAAC (SEQ ID NO: 22)	Gurcan et al. 2010
B774	R-TGTGTGTGGTCTGTAGGCAC T (SEQ ID NO: 24)	Gurcan et al. 2010
B795	R-TGGGCATCATCCAGGTCTA (SEQ ID NO: 26)	Gurcan et al. 2010
C115	GTTTCCAGATCTGCCTCCATAT AAT (SEQ ID NO: 28)	Bassil et al. 2005b, Gokirmak et al. 2009
KG807	FAM-CTTACAGATAAATGGCTC AAA (SEQ ID NO: 30)	Gurcan and Mehlenbacher 2010
KG809	F-GGAAGGTGAGAGAAATCAAG T (SEQ ID NO: 32)	Gurcan and Mehlenbacher 2010
KG811	F-GAACAACTGAAGACAGCAAA G (SEQ ID NO: 34)	Gurcan and Mehlenbacher 2010
KG827	GAGGGAGCAAGTCAAAGTTGAG AAGAAA (SEQ ID NO: 36)	Gurcan and Mehlenbacher 2010
KG830	AAAGCAACTCATAGC TGAAGTCCAATCA (SEQ ID NO: 38)	Gurcan and Mehlenbacher 2010
Soman-G (=856- MS1-13)	R-GCCATCTTTAG AAAGTTCGATACAG (SEQ ID NO: 40)	unpublished

Primer fluorescent tags are FAM, HEX, and NED.

45 Ta: annealing temperature (° C.)

N: number of alleles

He: expected heterozygosity

Ho: observed heterozygosity

PIC: polymorphism information content

r: estimated null allele frequency

50 LG: linkage group

Reference: for development and characterization

TABLE 2

Allele sizes in Wepstee and other hazelnut cultivars at 20 microsatellite loci.					
Locus	Wepster	Tonda Pacifica	OSU 440.005	Tonda Gentile Bar-delle Langhe	Bar-celona
A614	135/158	135/150	125/158	125/135	125/132
A616	152/160	150/160	152/160	150/152	144/152
A640	368/374	368/374	355/368	355/368	355/374
B617	293/295	293/293	293/295	285/295	285/289
B619	166/172	166/172	166/166	150/166	158/172
B634	228/228	228/228	228/234	228/228	228/228
B671	239/249	229/239	249/249	239/243	225/229
B709	229/235	229/235	223/229	229/229	227/235

TABLE 2-continued

Allele sizes in Wepstee and other hazelnut cultivars at 20 microsatellite loci.						
Locus	Vanillin	Dorris	York	Felix	Santiam	Gasaway
B733	173/175	173/175	173/175	173/175	173/175	173/175
B749	207/209	207/209	209/209	207/209	209/209	209/209
B767	200/242	200/218	212/242	214/218	214/240	214/240
B774	203/207	203/207	203/211	203/211	203/207	203/207
B795	333/333	315/333	333/333	315/333	333/333	333/333
C115	183/194	174/183	194/216	174/174	174/194	174/194
KG807	252/252	228/252	252/252	238/252	238/252	238/252
KG809	342/342	339/342	342/348	339/342	339/339	339/339
KG811	257/257	245/257	257/267	257/267	261/267	261/267
KG827	270/282	270/284	272/282	268/278	282/284	282/284
KG830	295/305	291/295	295/305	291/295	291/295	291/295
Soman-G	196/200	196/200	196/196	196/200	196/200	196/200

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SEQUENCE LISTING

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 cctgcatcca ggactcatta 20

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 gtgcagaggt tgcactcaaa 20

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 ttgccagtgc atactctgat g 21

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 accagctctg ggcttaacac 20

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gcgaaatgga gctcttgaac 20

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caccctcttc accacctcat 20

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catcccctgt tggagttttc 20

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 tgggcatcat ccaggtcta 19

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 attttccgca gataatacag g 21

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aagcaagaaa gggatggt 18

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ggaaggtgag agaaatcaag t 21

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aaggcggcac tcgctcac 18

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gaacaactga agacagcaa g 21

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agaactccga ctaataatcc taacccttgc 30

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 tggaggaagt tttgaatggt agtagagga 29

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 <400> SEQUENCE: 38

 aaagcaactc atagctgaag tccaatca 28

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 <223> OTHER INFORMATION: Synthetic polynucleotide

 <400> SEQUENCE: 39

 tggcgttgca acatattctc 20

<210> SEQ ID NO 40
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 <220> FEATURE:
 <223> OTHER INFORMATION: Synthetic polynucleotide

 <400> SEQUENCE: 40

 gccatcttta gaaagttcga tacag 25

We claim:

1. A new and distinct cultivar of *Corylus* plant named 'Wepster', as illustrated and described.

* * * * *

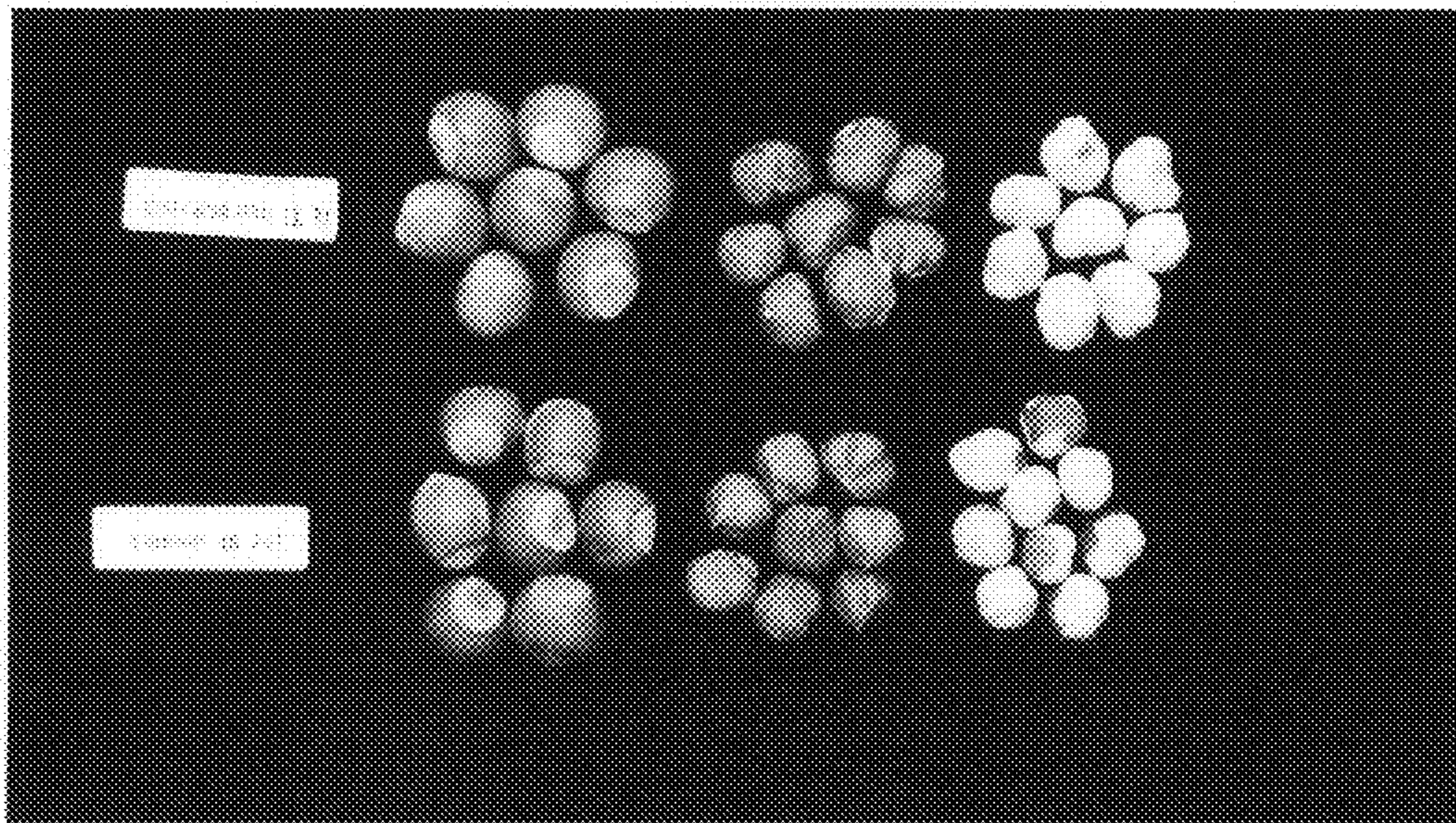


FIG. 1

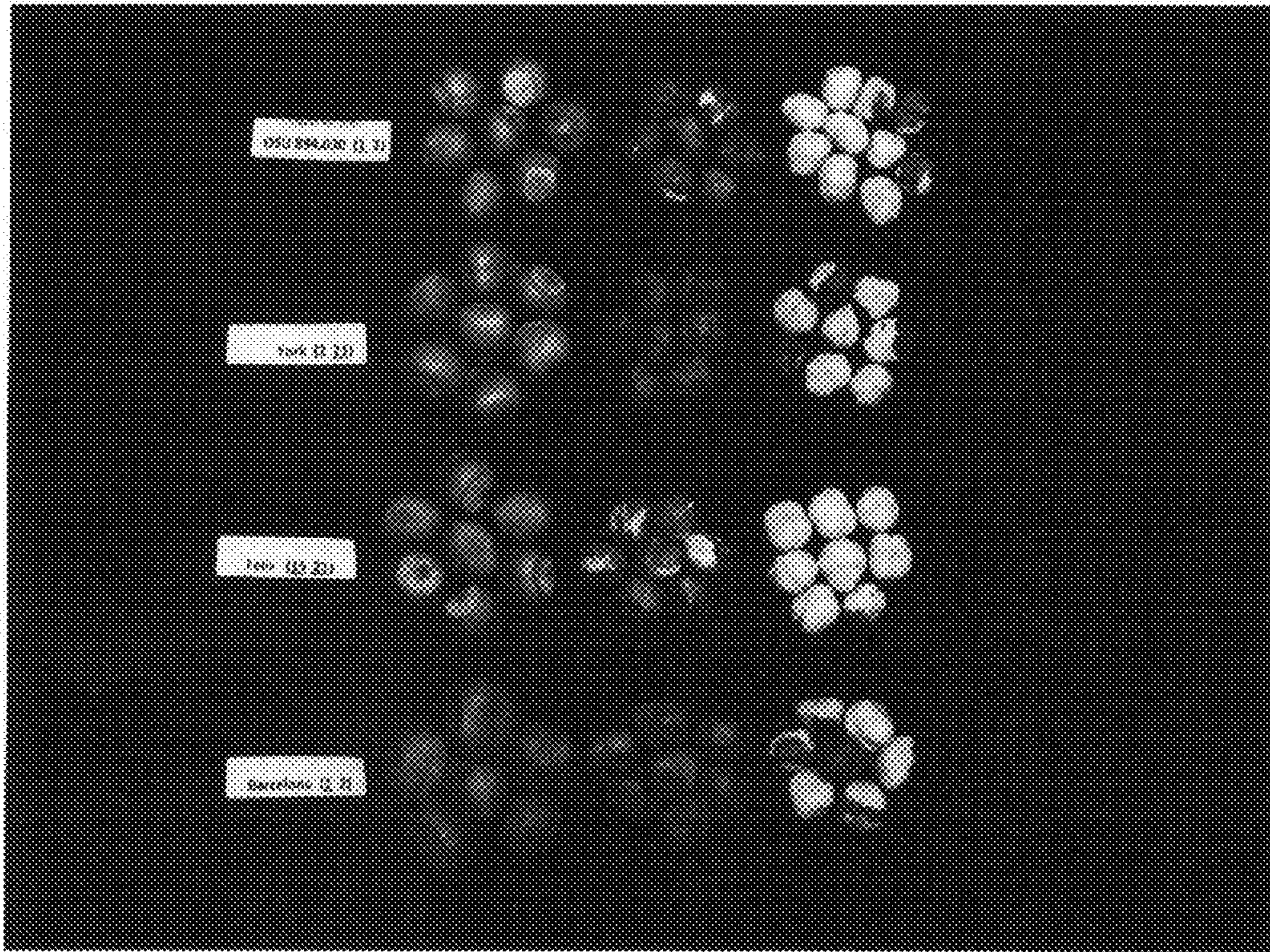


FIG. 2



FIG. 3



FIG. 4



FIG. 5



FIG. 6



FIG. 7