



INTERNATIONAL SEED TESTING ASSOCIATION (ISTA)

Secretariat, Zürichstrasse 50, 8303 Bassersdorf, CH-Switzerland

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SLIDES SHOWING ABNORMAL SEEDLINGS

The slides show a normal seedling to the left and 1- 3 abnormal seedlings to the right (except those slides showing normal seedling development or seedling with slight defects.)

CATEGORY OF SEEDLING ABNORMALITY:

According to the handbook for Seedling Evaluation 1997

DESCRIPTION OF ABNORMALITY:

Two abnormalities separated by a comma: combined in one seedling
Two abnormalities separated by a semicolon: shown in different seedling on the slide

PLANT SPECIES: **ALLIUM**

Category	Description	Slide Number	Order
I 1	Primary root stunted	183	
I 3	Primary root retarded	184	
I 4	Primary root missing	185	
III 9	Cotyledon short & thick	112 73 134	
III 12	Cotyledon forming a spiral	113 135	
III 13	Cotyledon without a "knee"	64	
VII 1	Seedling deformed	136	
VII 6	Seedling yellow or white	231 51	
VII 8	Seedling glassy	186	



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PLANT SPECIES: **APIUM**

Category	Description	Slide Number	Order
I 1	Primary root stunted	67 66	
I 3	Primary root retarded	76	
I 4	Primary root missing	77 out of stock	
II 9	Hypocotyl forming a loop	68	
II 12	Hypocotyl decayed	69	

PLANT SPECIES: **ARACHIS**

Category	Description	Slide Number	Order
I 1	Primary root stunted, sufficient; insufficient secondary roots	323 out of stock	
I 1, I 4	Primary root stunted; missing	324 295	
I 6	Primary root split form tip	325	
I 12	Primary root decayed	296	
II 9	Hypocotyl cracked	326 out of stock	
II 12	Hypocotyl bent over	253 254	
V 2	Terminal bud damaged	255 out of stock	
V 19	Seedling decayed	327 out of stock	

PLANT SPECIES: **ASPARAGUS OFFICINALIS**

Category	Description	Slide Number	Order
	Seedling development	365 out of stock	
I 1	Primary root stunted	256 358	
I 2	Primary root stubby	206	
V 3	Shoot missing	191 329 out of stock	



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V 3	Shoot missing, two secondary shoots	330	
VII 9	Hypocotyl bent over	208	

PLANT SPECIES: **ASPARAGUS PLUMOSUS**

Category	Description	Slide Number	Order
	Seedling development	187 out of stock	
I 1	Primary root stunted	188 out of stock	

PLANT SPECIES: **ASPARAGUS SPRENGERI (A. DENSIFLORUS)**

Category	Description	Slide Number	Order
	Seedling development	138	
	Without a storage- root	139	
I 1	Primary root stunted	328	
II 12	Hypocotyl decayed	143	
V 3	Shoot missings	142	

PLANT SPECIES: **BETA**

Category	Description	Slide Number	Order
I 3	Primary root retarded	173	
VII 9	Primary infection	192	
	Secondary infection	193 out of stock 232	



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PLANT SPECIES: **BRASSICA**

Category	Description	Slide Number	Order
I 1	Primary root stunted	198 out of stock 197 out of stock	
I 3	Primary root retarded	199 out of stock	
I 4	Primary root missing	174	
II 8	Hypocotyl bent over	175 out of stock	

PLANT SPECIES: **CICHORIUM**

Category	Description	Slide Number	Order
I 1	Primary root stunted	20a out of stock 54	
I 3	Primary root retarded	11 out of stock 21 out of stock	
I 4	Primary root missing	22	
I 12	Primary root decayed	78 out of stock 23	
II 1	Hypocotyl short	24 14	
III 1	Cotyledons swollen and curled	238	
III 2	Cotyledons deformed	25	
V 2	Terminal bud damaged	15	
VII 1	Seedling deformed	26	
VII 6	Seedling yellow	56	
VII 8	Seedling glassy	27 28	
VII 9	seedling decayed	29 80 out of stock	



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PLANT SPECIES: CUCUMIS OR CUCURBITA

Category	Description	Slide Number	Order
	Primary root stunted secondary roots sufficient	363	
I 1	Primary root stunted secondary roots insufficient	265	
	Primary root stunted sufficient; insufficient	336 297	
II 1	Hypocotyl short and thick	266 out of stock 366	
III 8	Cotyledons decayed	338 300	

PLANT SPECIES: CYCLAMEN

Category	Description	Slide Number	Order
	Seedling development	209 210 out of stock	
	Two cotyledons (normal)	211	
I 13	Seminal root only one or missing	212	
II 2	Hypocotyl not forming a tuber	292	
VII 9	Seedling decayed	213	

PLANT SPECIES: DAUCUS

Category	Description	Slide Number	Order
I 1	Primary root stunted	30 out of stock	
I 12	Primary root decayed	32 31	
II 1	Hypocotyl short and thick	33	
II 12	Hypocotyl decayed	34	
VII 9	Seedling decayed	36	



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PLANT SPECIES: **DIANTHUS**

Category	Description	Slide Number	Order
	Three cotyledons (normal)	303 out of stock 194 out of stock	
I 1	Primary root stunted	258	
I 3	Primary root retarded	259 out of stock	
I 4	Primary root missing	304	
VII 1	Seedling deformed	196 out of stock	

PLANT SPECIES: **FREESIA**

Category	Description	Slide Number	Order
	Seedling development	359	
I 4	Primary root missing	361	

PLANT SPECIES: **GOSSYPIUM**

Category	Description	Slide Number	Order
I 1	Primary root stunted	340 out of stock	
I 3	Primary root retarded	341 out of stock	
I 9	Primary root trapped in seed coat	342 out of stock	
I 12	Primary root decayed	343 out of stock	
III	Cotyledons partly necrotic	302 out of stock	



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PLANT SPECIES: **GRASSES**

Category	Description	Slide Number	Order
I 4	Primary root missing	164	
VI 1	Coleoptile deformed	215 214	
VI 8	Coleoptile split	268 165	
VI 13	Leaf missing	269	
VI 16	Seedling yellow or white	344 309	

PLANT SPECIES: **HELLIANTHUS**

Category	Description	Slide Number	Order
I 1	Primary root stunted	239 271 out of stock	
I 3	Primary root retarded (secondary roots: abnormal)	216	
I 4	Primary root missing (secondary roots: abnormal)	270 out of stock	
II 3	Hypocotyl deeply cracked	218 242	
II 6	Hypocotyl constricted	219	
II 9	Hypocotyl forming a spiral	220	
II 12 , I 12	Hypocotyl; primary root decayed	273 out of stock	

PLANT SPECIES: **HOREDUM**

Category	Description	Slide Number	Order
III 17	Cotyledons loosely twisted (normal)	179	
III 18	Cotyledons split more than 1/3	180 / 88	
VII 6	Seedling yellow or white	90	



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PLANT SPECIES: **LACTUCA**

Category	Description	Slide Number	Order
II 1	Hypocotyl short and thick	114	
II 1, III 1	Hypocotyl short, cotyledons swollen and curled	93 out of stock 92 out of stock	
II 1, III 6	Hypocotyls short, cotyledons necrotic	274	
II 8	Hypocotyl bent over	115 out of stock	
II 9	Hypocotyl forming a spiral	94 out of stock	
III 1	Cotyledons swollen and curled	147 out of stock	
III 1	Cotyledons swollen and curled and discoloured	221 out of stock	
III 2	Cotyledons deformed	222	
III 5	Cotyledons discoloured	276 out of stock 225 out of stock	
VII 1	Seedling deformed	226 out of stock	

PLANT SPECIES: **LEPIDIUM**

Category	Description	Slide Number	Order
I 1	Primary root stunted	71 out of stock	
I 3	Primary root retarded	96	
II 8	Hypocotyl bent over	72 out of stock 98	
III 5	Cotyledons discoloured	100 out of stock	
VII 9	Seedling decayed	101	



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PLANT SPECIES: **LYCOPERSICON**

Category	Description	Slide Number	Order
I 1	Primary root stunted	318	
I 1	Primary root stunted, secondary roots	201	
I 3	Primary root retarded	202	
VII 2	Seedling fractured	204	

PLANT SPECIES: **ORYZA**

Category	Description	Slide Number	Order
	Seedling development	347	
I 4	Primary root missing	311 244	
I 4, VI 1	Primary root missing, coleoptile deformed	345 out of stock	
VI 11	Coleoptile decayed	346 out of stock	
VII 9	Seedling decayed	313 312	

PLANT SPECIES: **PHASEOLUS**

Category	Description	Slide Number	Order
II 1	Hypocotyl short	278	
II 1, II 9	Hypocotyl thick; forming a spiral healed cracks & breaks (normal)	279 116	
II 4	Hypocotyl split right though	118 out of stock	
II 5	Hypocotyl missing	227	
II 8	Hypocotyl bent over	316 out of stock	
II 9, II 1	Hypocotyl forming a spiral; short and thick	280 out of stock	
III 3	Cotyledons broken	281 out of stock	



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III 3, III 5	Cotyledons broken, discoloured	282 out of stock	
IV 1	Primary leaves deformed	119	
IV 1, IV 3	Primary leaves deformed; missing	283 out of stock 103	
IV 3	Primary leaves missing	120	
V 2	Terminal bud damaged	284 out of stock 285	
VII 6	Seedling yellow	104	

PLANT SPECIES: **PISUM**

Category	Description	Slide Number	Order
III 6	Cotyledons necrotic	166	
V 1	Terminal bud deformed	169 167 out of stock	
V 3	Terminal bud missing (secondaries shoots)	247 246	
VII 6	Seedling yellow	248	

PLANT SPECIES: **RAPHANUS**

Category	Description	Slide Number	Order
I 1	Primary root stunted (secondary roots: abnormal)	307	
I 9	Primary root trapped in seed coat	308	
I 1, II 1	Primary root stunted, hypocotyl short	122	
II 1, II 8	Hypocotyl short, bent over	124	
II 8	Hypocotyl bent over	125	
III 5	Cotyledons discoloured	126	



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PLANT SPECIES: **SECALE**

Category	Description	Slide Number	Order
VI 8, VI 9	Coleoptile split more than 1/3; split at base	261	
VI 9	Coleoptile split at base	181	
VI 14	Leaf shredded	263	

PLANT SPECIES: **SORGHUM**

Category	Description	Slide Number	Order
I 4	Primary root missing	229 286	
VI 1, VI 3	Coleoptile deformed; damaged	230	
VII 9	Seedling decayed	287	

PLANT SPECIES: **SPINACIA**

Category	Description	Slide Number	Order
I 1	Primary root stunted	38 out of stock 57 out of stock	
I 3	Primary root retarded	4 out of stock	
I 4	Primary root missing	40	
I 9	Primary root trapped in seed coat	19 out of stock	
I 12	Primary root decayed	6 out of stock	
I 13	Hypocotyl deeply cracked	60 out of stock 41 out of stock	
VII 2	Seedling fractured	20	
VII 9	Seedling decayed	9 out of stock	



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PLANT SPECIES: TAGETES

Category	Description	Slide Number	Order
I 1	Primary root stunted	305 out of stock	
I 12	Primary root decayed	306 out of stock	
III 5	Cotyledons discoloured	331	

PLANT SPECIES: TRIFOLIUM

Category	Description	Slide Number	Order
I 1	Primary root stunted	150 out of stock	
I 3	Primary root retarded	151 out of stock	
I 6	Primary root split from the tip	106 350	
I 9	Primary root trapped in seed coat	288 319 out of stock	
II 3	Hypocotyl deeply cracked	351	
II 4	Hypocotyl split right through	152 out of stock 62	
II 9	Hypocotyl forming a loop	289 352	
II 9	Hypocotyl forming a spiral	320	
III 5	Cotyledons discoloured	290	
VII 2	Seedling fractured	353 153 out of stock	
VII 8	Seedling glassy	291 out of stock	

PLANT SPECIES: TROPAEOLUM

Category	Description	Slide Number	Order
	Seedling development	334	
I 4	Primary root missing	335	



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PLANT SPECIES: VALERIANELLA

Category	Description	Slide Number	Order
I 3	Primary root retarded	44 out of stock 43	
I 12	Primary root decayed	45 out of stock	
II 1, II 8	Hypocotyl short, bent over	46	
VII 8	Seedling glassy	48	
VII 9	Seedling decayed	49	

PLANT SPECIES: VICIA FABEA

Category	Description	Slide Number	Order
I 1	Primary root stunted, secondary roots	321 out of stock	
I 12	Primary root decayed	354	
VII 2	Seedling fractured	355	

PLANT SPECIES: VICIA SATIVA, VILLOSA

Category	Description	Slide Number	Order
I 1	Primary root stunted	368 out of stock 249	
I 1	Primary root stunted, secondary roots	127 out of stock	
I 3	Primary root retarded	128 out of stock	
I 4	Primary root missing	107	
I 4	Primary root missing sufficient; insufficient secondary roots	250	
I 6	Primary root split from the tip	108 out of stock	
I 12	Primary root decayed	110 out of stock 109 out of stock	
V 1	Terminal bud deformed	130 out of stock 129 out of stock	



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V 2	Terminal bud damaged	369 251	
VII 2	Seedling fractured	131 out of stock	

PLANT SPECIES: ZEA

Category	Description	Slide Number	Order
I 1, I 4	Primary root stunted, missing	161	
I 4	Primary root missing	162	
I 12, I 4	Primary root decayed; missing	154	
II 9	Mesocotyl forming a spiral	155 322	
II 9, VI 1	Mesocotyl forming a spiral, coleoptile deformed	132	
II 9, VII 4	Mesocotyl forming a spiral, leaves deformed	156	
VI 1, VI 1	Coleoptile deformed and leaves deformed	157	
VI 4	Coleoptil split	160 159	

PLANT SPECIES: ZINNIA

Category	Description	Slide Number	Order
I 1	Primary root stunted	332 out of stock	
VII 9	Seedling decayed	333	