PROKON

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Onion Training Manual

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Onion

The onion (Allium cepa L.) (Latin cepa = onion), also known as the bulb onion or common onion, is a vegetable and is the most widely cultivated species of the genus Allium.

This genus also contains several other species variously referred to as onions and cultivated for food, such as the Japanese bunching onion (A. fistulosum), the Egyptian onion (A. ×proliferum), and the Canada onion (A. canadense). The name "wild onion" is applied to a number of Allium species, but A. cepa is exclusively known from cultivation. Its ancestral wild original form is not known, although escapes from cultivation have become established in some regions.[2] The onion is most frequently a biennial or a perennial plant, but is usually treated as an annual and harvested in its first growing season.

The onion plant has a fan of hollow, bluish-green leaves and the bulb at the base of the plant begins to swell when a certain daylength is reached. In the autumn, the foliage dies down and the outer layers of the bulb become dry and brittle. The crop is harvested and dried and the onions are ready for use or storage. The crop is prone to attack by a number of pests and diseases, particularly the onion fly, the onion eelworm, and various fungi cause rotting. Some varieties of A. cepa, such as shallots and potato onions, produce multiple bulbs.

Onions are cultivated and used around the world. As a food item, they are usually served cooked, as a vegetable or part of a prepared savoury dish, but can also be eaten raw or used to make pickles or chutneys. They are pungent when chopped and contain certain chemical substances which irritate the eyes.

Onion

Scientific classification

Kingdom:	Plantae
Clade :	Angiosperms
Clade :	Monocots
Order:	Asparagales
Family:	Amaryllidaceae
Subfamily:	Allioideae
Genus:	Allium
Species:	A. cepa

Binomial name

Allium cepa

L.

Synonyms [1]

Species synonymy

Taxonomy and etymology

The onion plant (Allium cepa), also known as the bulb onion[3] or common onion,[4] is the most widely cultivated species of the genus Allium.[5][6] It was first officially described by Carl Linnaeus in his 1753 work Species Plantarum.[7] A number of synonyms have appeared in its taxonomic history:

- Allium cepa var. aggregatum – G. Don
- Allium cepa var. bulbiferum – Regel
- Allium cepa var. cepa – Linnaeus
- Allium cepa var. multiplicans – L.H. Bailey
- Allium cepa var. proliferum – (Moench) Regel

Allium cepa var. solaninum – Alef

Allium cepa var. viviparum – (Metz) Mansf.[8][9]

Roots, leaves and developing bulb

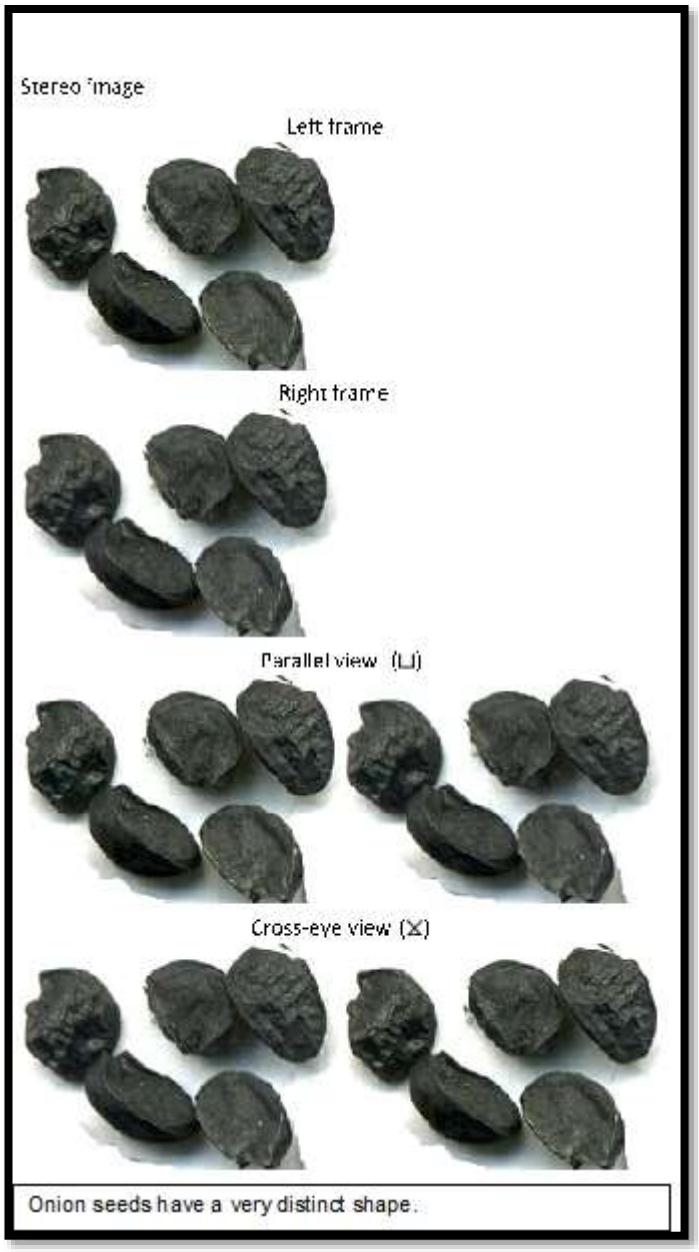
A. cepa is known exclusively from cultivation,[10] but related wild species occur in Central Asia. The most closely related species include A. vavilovii (Popov & Vved.) and A. asarense (R.M. Fritsch & Matin) from Iran.[11] However, Zohary and Hopf state that "there are doubts whether the A. vavilovii collections tested represent genuine wild material or only feral derivatives of the crop."[12

The vast majority of cultivars of A. cepa belong to the "common onion group" (A. cepa var. cepa) and are usually referred to simply as "onions". The Aggregatum group of cultivars (A. cepa var. aggregatum) includes both shallots and potato onions.[13]

Umbel of onion flowers

The genus Allium also contains a number of other species variously referred to as onions and cultivated for food, such as the Japanese bunching onion (A. fistulosum), Egyptian onion (A. ×proliferum), and Canada onion (A. canadense).[4]

Cepa is commonly accepted as Latin for "onion" and has an affinity with Ancient Greek: κάπια (kápia), Albanian: qepë, Aromanian: tseapã, Catalan: ceba, English: chive, Occitan: ceba, Old French: cive, and Romanian: ceapă.



Onion seeds have a very distinct shape.

Description

The onion plant is unknown in the wild, but has been grown and selec-tively bred in cultivation for at least 7,000 years. It is a biennial plant, but is usually grown as an annual. Modern varieties typically grow to a height of 15 to 45 cm (6 to 18 in). The leaves are yellowish-green and grow alternately in a flattened, fan-shaped swathe. They are fleshy, hollow, and cylindri-cal, with one flattened side. They are at their broadest about a quarter of the way up beyond which they taper towards a blunt tip. The base of each leaf is a flattened, usually white sheath that grows out of a basal disc. From the underside of the disc, a bundle of fibrous roots extends for a short way into the soil. As the onion matures, food reserves begin to accumulate in the leaf bases and the bulb of the onion swells.[14]

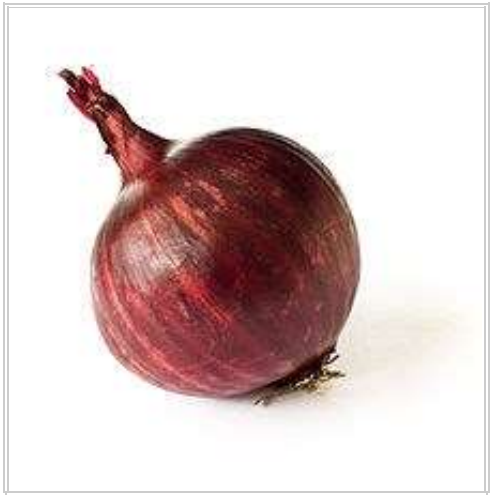
In the autumn, the leaves die back and the outer scales of the bulb become dry and brittle, and this is when the crop is normally harvested. If left in the soil over winter, the growing point in the middle of the bulb begins to develop in the spring. New leaves appear and a long, stout, hollow stem expands, topped by a bract protecting a develo-ping inflore-scence. The inflorescence takes the form of a globular umbel of white flowers with parts in sixes. The seeds are glossy black and triangular in cross section.[14]

Uses

Historical use

Bulbs from the onion family are thought to have been used as a food source for millennia. In Bronze Age settlements, traces of onion remains were found alongside date stones and fig remains that date back to 5000 BC.[15] However, it is not clear if these were cultivated onions. Archaeological and literary evidence such as the Book of Numbers 11:5 suggests that onions were probably being cultivated around 2000 years later in ancient Egypt, at the same time that leeks and garlic were cultivated. Workers who built the Egyptian pyramids may have been fed radishes and onions.[15]

The onion is easily propagated, transported, and stored. The ancient Egyptians worshipped it, believing its spherical shape and concentric rings symbolized eternal life.[16] Onions were even used in Egyptian burials, as evidenced by onion traces being found in the eye sockets of Ramesses IV.[17]



A red onion

In ancient Greece, athletes ate large quantities of onion because it was believed to lighten the balance of the blood.[16] Roman gladiators were rubbed down with onions to firm up their muscles.[16] In the Middle Ages, onions were such an important food that people would pay their rent with onions, and even give them as gifts.[16] Doctors were known to prescribe onions to facilitate bowel movements and erections, and to relieve headaches, coughs, snakebite, and hair loss.[16]

Onions were taken by the first settlers to North America, where the Native Americans were already using wild onions in a number of ways, eating them raw or cooked in a variety of foods. They also used them to make into syrups, to form poultices, and in the preparation of dyes. According to diaries kept by the colonists, bulb onions were one of the first things planted by the Pilgrim fathers when they cleared the land for cropping.[16]

Onions were also prescribed by doctors in the early 16th century to help with infertility in women. They were similarly used to raise fertility levels in dogs, cats, and cattle, but this was an error, as recent research has shown that onions are toxic to dogs, cats, guinea pigs, and many other animals.[18][19][20]

Culinary uses

Sautéing onions

Onions are commonly chopped and used as an ingredient in various hearty warm dishes, and may also be used as a main ingredient in their own right, for example in French onion soup or onion chutney. They are very versatile and can be baked, boiled, braised, grilled, fried, roasted, sautéed, or eaten raw in salads.[21] Their layered nature makes them easy to hollow out once cooked, facilitating stuffing them. Onions are a staple in Indian cuisine, used as a thickening agent for curries and gravies. Onions pickled in vinegar are eaten as a snack. These are often a side serving in pubs and fish and chip shops throughout the United Kingdom and the Commonwealth, usually served with cheese or ale in the United Kingdom. In North America, sliced onions are battered and deep-fried and served as onion rings.[22]

Onion types and products

Common onions are normally available in three colour varieties. Yellow or brown onions (called red in some European countries), are full-flavoured and are the onions of choice for everyday use. Yellow onions turn a rich, dark brown when caramelized and give French onion soup its sweet flavour. The red onion (called purple in some European countries) is a good choice for fresh use when its colour livens up the dish; it is also used in grilling.

Sliced red onions

White onions are the traditional onions used in classic Mexican cuisine; they have a golden colour when cooked and a particularly sweet flavour when sautéed.[23][24]

While the large, mature onion bulb is most often eaten, onions can be eaten at immature stages. Young plants may be harvested before bulbing occurs and used whole as spring onions or scallions.[25] When an onion is harvested after bulbing has begun, but the onion is not yet mature, the plants are sometimes referred to as "summer" onions.[26]

Jar of pickled onions

Additionally, onions may be bred and grown to mature at smaller sizes. Depending on the mature size and the purpose for which the onion is used, these may be referred to as pearl, boiler, or pickler onions, but differ from true pearl onions which are a different species.[26] Pearl and boiler onions may be cooked as a vegetable rather than as an ingredient and pickler onions are often preserved in vinegar as a long-lasting relish.[27]

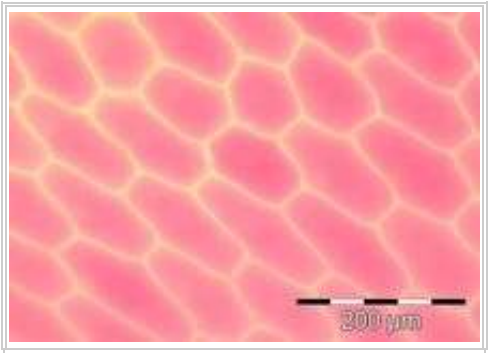
Onions are available in fresh, frozen, canned, carame-lized, pickled, and chopped forms. The dehydrated product is available as kibbled, sliced, rings, minced, chopped, granulated, and powder forms.[28]

Onion powder is a seasoning widely used when the fresh ingredient is not available. It is made from finely ground, dehydrated onions, mainly the pungent varieties of bulb onions, and has a strong odour. Being dehydrated, it has a long shelf life and is available in several varieties: yellow, red, and white.[29]

Non-culinary uses

Onions have particularly large cells that are readily observed under low magnification. Forming a single layer of cells, the bulb epidermis is easy to separate for educational, experimental, and breeding purposes.[30][31][32] Onions are, therefore, commonly employed in science education to teach the use of a

microscope for observing cell structure.[33]



The large size of onion cells makes them ideal for practicing microscopy. These cells from the epidermis of a red onion are naturally pigmented.

The pungent juice of onions has been used as a moth repellent and can be rubbed on the skin to prevent insect bites. When applied to the scalp, it is said to promote growth of hair and on the face to reduce freckling.[34] It has been used to polish glass and copperware and to prevent rust on iron. If boiling water is poured onto chopped onions and left to cool, the resulting liquid can be sprayed onto plants to increase their resistance to pests, and the onion plants when growing are reputed to keep away moles and insects.[34] Onion skins have been used to produce a yellow-brown dye.[35]

Historically, onions were often used for cromniomancy across Europe, Africa, and northern Asia, and they continue to be used for this practice in some rural areas.

Nutrients and phytochemicals

Most onion cultivars are about 89% water, 4% sugar, 1% protein, 2% fibre, and 0.1% fat.

Onions contain low amounts of essential nutrients (right table), are low in fats, and have an energy value of 166 kJ (40 kcal) per 100 g (3.5 oz). They contribute their flavor to savory dishes without raising caloric content appreciably.[24]

Onions contain phytochemical compounds such as phenolics that are under basic research to determine their possible properties in humans. [36][37][38][39]

Raw onions

Nutritional value per 100 g (3.5 oz)		
Energy	166 kJ (40 kcal)	
Carbohydrates	9.34 g	
Sugars	4.24 g	
Dietary fiber	1.7 g	
Fat	0.1 g	
Protein	1.1 g	
Vitamins		
Thiamine (B_1)	0.046 mg	4%
Riboflavin (B_2)	0.027 mg	2%
Niacin (B_3)	0.116 mg	1%
Pantothenic acid (B5)	0.123 mg	2%
Vitamin B_6	0.12 mg	9%
Folate (B_9)	19 µg	5%
Vitamin C	7.4 mg	9%
Minerals		
Calcium	23 mg	2%
Iron	0.21 mg	2%

Magnesium	10 mg	3%
Manganese	0.129 mg	6%
Phosphorus	29 mg	4%
Potassium	146 mg	3%
Zinc	0.17 mg	2%
Other constituents		
Water	89.11 g	
Fluoride	1.1 µg	

Units

µg = micrograms • mg = milligrams

IU = International units

Considerable differences exist be-tween onion varieties in polyphenol content, with shallots having the highest level, six times the amount found in Vidalia onions, the variety with the smallest amount. [36][37] Yellow onions have the highest total flavonoid content, an amount 11 times higher than in white onions. [36] Red onions have considerable content of anthocyanin pigments, with at least 25 different compounds identified representing 10% of total flavonoid content.[37]

Some people suffer from allergic reactions after handling onions.[5] Symptoms can include contact der-matitis, intense itching, rhinocon-junctivitis, blurred vision, bronchial asthma, sweating, and anaphylaxis. Allergic reactions may not occur in these individuals to Fluoride 1.1µg the consumption of onions, perhaps because of the denaturing of the proteins involved during the Link to USDA Data-base entry cooking process.[40]

While onions and other members of the genus Allium are commonly consumed by humans, they can be deadly for dogs, cats, guinea pigs, monkeys, and other animals.[5][18][19][20] The toxicity is caused by the sulfoxides present in raw and cooked onions, which many animals are unable to digest. Ingestion results in anaemia caused by the distortion and rupture of red blood cells. Sick pets are sometimes fed with tinned baby foods, and any that contain onion should be avoided.[41] The typical toxic doses are 5 g (0.2 oz) per kg (2.2 lb) bodyweight for cats and 15 to 30 g (0.5 to 1.1 oz) per kg for dogs.[18]

Eye irritation

Freshly cut onions often cause a stinging sensation in the eyes of people nearby, and often uncontrollable tears. This is caused by the release of a volatile gas, syn-propanethial-S-oxide, which stimulates nerves in the eye creating a stinging sensation.[5] This gas is produced by a chain of reactions which serve as a defense mechanism: chopping an onion causes damage to cells which releases enzymes called alliinases. These break down amino

acid sulfoxides and generate sulfenic acids. A specific sulfenic acid, 1-propenesulfenic acid, is rapidly acted on by a second enzyme, the lacrimatory factor synthase (LFS), producing the synpropanethial-S-oxide.[5] This gas diffuses through the air and soon reaches the eyes, where it activates sensory neurons. Tear glands produce tears to dilute and flush out the irritant.[42]

Cut onions emit certain compounds which cause the lacrimal glands in the eyes to become irritated, releasing tears.

Eye irritation can be avoided by cutting onions under running water or submerged in a basin of water.[42] Leaving the root end intact also reduces irritation as the onion base has a higher concentration of sulphur compounds than the rest of the bulb.[43] Refrigerating the onions before use reduces the enzyme reaction rate and using a fan can blow the gas away from the eyes. The more often one chops onions, the less one experiences eye irritation.[44]

The amount of sulfenic acids and LF released and the irritation effect differs among Allium species. In 2008, the New Zealand Crop and Food Institute created a strain of "no tears" onions by using genesilencing biotechnology to prevent synthesis by the onions of the LFS enzyme.[45]

Cultivation

Large-scale cultivation

Onions are best cultivated in fertile soils that are well-drained. Sandy loams are good as they are low in sulphur, while clayey soils usually have a high sulphur content and produce pungent bulbs. Onions require a high level of nutrients in the soil. Phosphorus is often present in sufficient quantities, but may be applied before planting because of its low level of availability in cold soils. Nitrogen and potash can be applied at regular intervals during the growing season, the last application of nitrogen being at least four weeks before harvesting.[46]

Bulbing onions are day-length sensitive; their bulbs begin growing only after the number of daylight hours has surpassed some minimal quantity. Most traditional European onions are referred to as "long-day" onions, producing bulbs only after 14 hours or more of daylight occurs. Southern European and North African varieties are often known as "intermediate-day" types, requiring only 12–13 hours of daylight to stimulate bulb formation. Finally, "short-day" onions, which have been developed in more recent times, are planted in mild-winter areas in the fall and form bulbs in the early spring, and require only 11–12 hours of daylight to

stimulate bulb formation.[47] Onions are a cool-weather crop and can be grown in USDA zones 3 to 9.[48] Hot temperatures or other stressful conditions cause them to "bolt", meaning that a flower stem begins to grow.[49]

Onions may be grown from seed or from sets. Onion seeds are short-lived and fresh seeds germinate better.[48][50] The seeds are sown thinly in shallow drills, thinning the plants in stages. In suitable climates, certain cultivars can be sown in late summer and autumn to overwinter in the ground and produce early crops the following year.[14] Onion sets are produced by sowing seed thickly in early summer in poor soil and the small bulbs produced are harvested in the autumn. These bulbs are planted the following spring and grow into mature bulbs later in the year.[34] Certain cultivars are used for this purpose and these may not have such good storage characteristics as those grown directly from seed.[14]

Routine care during the growing season involves keeping the rows free of competing weeds, especially when the plants are young. The plants are shallow-rooted and do not need a great deal of water when established. Bulbing usually takes place after 12 to 18 weeks. The bulbs can be gathered when needed to eat fresh, but if they will be kept in storage, they should be harvested after the leaves have died back naturally. In dry weather, they can be left on the surface of the soil for a few days to dry out properly, then they can be placed in nets, roped into strings, or laid in layers in shallow boxes. They should be stored in a well-ventilated, cool place such as a shed.[14]

Pests and diseases

Onions suffer from a number of plant disorders. The most serious for the home gardener are likely to be the onion fly, stem and bulb eelworm, white rot, and neck rot. Diseases affecting the foliage include rust and smut, downy mildew, and white tip disease. The bulbs may be affected by splitting, white rot, and neck rot. Shanking is a condition in which the central leaves turn yellow and the inner part of the bulb collapses into an unpleasant- smelling slime. Most of these disorders are best treated by removing and burning affected plants.[51] The larvae of the onion leaf miner or leek moth (Acrolepiopsis assectella) sometimes attacks the foliage and may burrow down into the bulb.[52]

Larvae of the onion fly

The onion fly (Delia antiqua) lays eggs on the leaves and stems and on the ground close to onion, shallot, leek, and garlic plants. The fly is attracted to the crop by the smell of damaged tissue and is liable to occur after thinning. Plants grown from

sets are less prone to attack. The larvae tunnel into the bulbs and the foliage wilts and turns yellow. The bulbs are disfigured and rot, especially in wet weather. Control measures may include crop rotation, the use of seed dressings, early sowing or planting, and the removal of infested plants.[53]

The onion eelworm (Ditylenchus dipsaci), a tiny parasitic soilliving nematode, causes swollen, distorted foliage. Young plants are killed and older ones produce soft bulbs. No cure is known and affected plants should be uprooted and burnt. The site should not be used for growing onions again for several years and should also be avoided for growing carrots, parsnips, and beans, which are also susceptible to the eelworm.[54]

White rot of onions, leeks, and garlic is caused by the soil-borne fungus Sclerotium cepivorum. As the roots rot, the foliage turns yellow and wilts. The bases of the bulbs are attacked and become covered by a fluffy white mass of mycelia, which later produces small, globular black structures called sclerotia. These resting structures remain in the soil to rein-
fect a future crop. No cure for this fungal disease exists, so affected plants should be removed and destroyed and the ground used for unrelated crops in subsequent years.[55]

Neck rot is a fungal disease affecting onions in storage. It is caused by Botrytis allii, which attacks the neck and upper parts of the bulb, causing a grey mould to develop. The symptoms often first occur where the bulb has been damaged and spread downwards in the affected scales. Large quantities of spores are produced and crust-like sclerotia may also develop. In time, a dry rot sets in and the bulb becomes a dry, mummified structure. This disease may be present throughout the growing period, but only manifests itself when the bulb is in store. Antifungal seed dressings are available and the disease can be minimised by preventing physical damage to the bulbs at harvesting, careful drying and curing of the mature onions, and correct storage in a cool, dry place with plenty of circulating air.[56]

Leek moth

The leek moth or onion leaf miner (Acrolepiopsis assectella) is a species of moth of family Acrolepiidae, genus Acrolepiopsis, a pest of leek crops. The species is found in Europe and Siberia. It was also recorded from Hawaii, but this was a misidentification of Acrolepiopsis sapporensis.

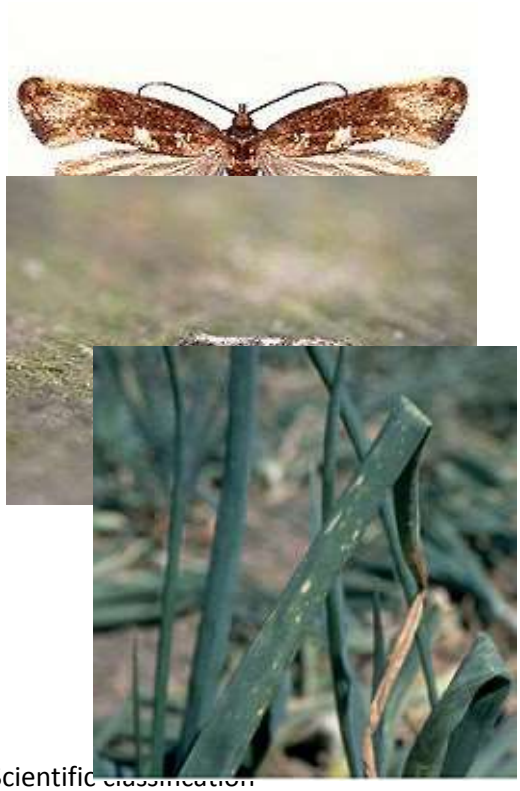
The wingspan is about 12 mm.

The larvae feed on Allium cepa, Allium cepa var. aggregatum, Allium fistulosum, Allium montanum and Allium porrum. They mine the leaves or bulbs of their host plants. The leaf mine is very variable, ranging from a corridor to a blotch, with or without frass and in the tubular leaves or in the stem. In the

case of onions and shallots, the larvae mine down into the bulb.

Pupation takes place in an open network cocoon, either on the food plant or close by.

Leek moth



Botrytis allii

Botrytis allii is a plant pathogen, a fungus that causes neck rot in stored onions (*Allium cepa*) and related crops. Its teleomorph is unknown, but other species of *Botrytis* are anamorphs of *Botryotinia* species.[3][4] The species was first described scientifically by Mancel Thornton Munn in 1917.[2]

Biology

There are seven different species of *Botrytis* associated with onions in storage but the rot induced by *B. allii* and *B. aclada* causes the greatest commercial loss. The two can be distinguished microscopically; the conidia of *B. allii* have a maximum length of 15 µm and mean size of 10.2 × 5.7 µm, while the conidia of *B. aclada* have a maximum length of 12 µm and mean size of 8.6 × 4.6 µm. The infection is present in the field but does not manifest itself until after harvest, however there may be a falling off of vigour while the crop is still growing, particularly in cool, moist weather. In the stored crop, the rot typically starts in the neck of the bulb but can occur in other parts if there is physical injury.[4] The scales inside the bulb become progressively translucent and watery and a mycelium develops between them. A mass of grey conidiophoresand conidia develop on the mycelium and blackish sclerotia form at the site of the initial infection.[4]

Scientific classification

Kindom: Animalia

Phylum:

Class:

Order:

Family:

Genus:

Species:

Binomia

Acrolepi

(Zeller, 1

Synonyn

- Roesle Zeller,
- Acrolepia assectella
- Digitivalva assectella
- Lita vigiliella Duponchel 1842

Scientific classification	
Kingdom:	Fungi
Division:	Ascomycota
Class:	Leotiomycetes
Order:	Helotiales
Family:	Sclerotiniaceae
Genus:	Botrytis
Species:	***B. allii***
Binomial name	
Botrytis allii Munn (1917)	
Synonyms[2]	
• *Botrytis aclada* Fresen. (1850)[1]	

In onion crops grown for the production of seed, *Botrytis allii* can cause spotting and girdling of the stipe (stem) and develop on the sheath that protects the inflorescence and on the flowers themselves. Concentric grey rings may form as the fungus sporulates and the crop may lodge (become flattened).[4]

It has been shown that a major source of the pathogen is infected seed. In 1973, 71% of commercially available seed was found to be contaminated and the infection was found to persist for over three years in seeds being stored. In the seedling, infection with *B. allii* does not produce any symptoms, but the fungus spreads between plants as the conidiophores release spores into the air. The leaf tips are invaded first, the infection spreading down the leaves and into the neck of the bulb where its presence only becoming apparent when the foliage dies down at the end of the season.[5]

Hosts

Botrytis allii grows on *Allium* species including onion (*A. cepa*), aggregating onion (*A. cepa* var. *aggregatum*), shallot (*A. cepa* var. *ascalonicum*), garlic (*A. sativum*) and leek (*A. porrum*). It may also infect wild *Allium* species and can grow saprophytically on decaying crop residues such as cereal, pea and bean straw. It is capable of colonizing and producing spores on sterilized poppy straw (*Papaver somniferum*).[4]

Commercial importance

Botrytis allii is cosmopolitan in distribution and occurs wherever onions are grown. It is difficult to distinguish in the field between *B. allii* and *B. aclada*, but both are more common in temperate regions. Losses during onion storage from neck rot have been reported as being greater than 50% in some locations on occasion.[4]

Delia antiqua

Delia antiqua, commonly known as the **onion fly**, is a cosmopolitan pest ofcrops. The larvae or maggots feed on onions, garlic, and other bulbous plants

D. antiqua larvae feeding on leeks(*Allium porrum*)

Scientific classification	
Kingdom:	Animalia
Phylum:	Arthropoda
Class:	Insecta

Morphology and biology

Onion damaged by D. Antiqualarvae

Order:	Diptera
Family:	Anthomyiidae
Genus:	*Delia*
Species:	***D. antiqua***
Binomial name	
Delia antiqua (Meigen, 1826)	
Synonyms	
Hylemya antiqua Meigen, 1826	

The onion fly has an ash-grey body and resembles a housefly. The male has a longitudinal stripe on the abdomen which is lacking in the female. The legs are black, the wings transparent, and the compound eyes brown. The eggs are white and elongated and are laid in groups on the shoots, leaves, and bulbs of host plants and on the ground nearby. The larvae are white and cylindrical and hatch in 3 to 8 days. Each batch of larvae tends to keep together and collectively create large cavities in bulbs. More than 50 maggots may feed on one bulb, sometimes originating from eggs laid by several females. The larvae moult three times, feed for about 20 days, and grow to about 1.0 cm long. The pupa is brown, ringed, and ovoid and measures 7 mm (0.28 in) long.Pupation occurs in the ground with the pupal phase from the spring generation lasting two or three weeks. Late-generation pupae overwinter in the soil.[1][2]

Distribution

The onion fly is found in North America, Western Europe, Russia, Central Asia, China, Japan, and Korea, but is absent from deserts. In the far north of its range, it has one generation per year, but further south, two, three, or four generations may occur in one year.[1]

Economic significance

The larvae damage bulbs of onions, garlic, chives, shallots, leeks, and flowering plants. The first generation of larvae is the most harmful because it extends over a long period owing to the females' longevity and occurs when the host plants are small. Seedlings of onion and leek can be severely affected as can thinned-out onions and shallots.[2] Less damage occurs in wet and cold springs, as this delays the development of the larvae. When plants are attacked, the leaves start to turn yellow and the bulbs rot quickly, especially in damp conditions. Control measures include crop rotation, the use of seed dressings, early sowing or planting, survey

and removal of infested plants, and autumn digging of the ground to destroy the pupae.[1]

Ditylenchus dipsaci

Ditylenchus dipsaci is an plant pathogenic nematode that primarily infects onion and garlic.[1] It is commonly known as the **stem nematode**, the **stem and bulb eelworm**, or **onion bloat** (in the United Kingdom). [2][3] Symptoms of infection include stunted growth, discoloration of bulbs, and swollen stems. *D. dipsaci* is a migratory endoparasite that has a five-stage lifecycle and the ability to enter into a dormancy stage. *D. Dipsaci* enters through stomata or plant wounds and creates galls or malformations in plant growth. This allows for the entrance of secondary pathogens such as fungi and bacteria. Management of disease is maintained through seed sanitation, heat treatment, crop rotation, and fumigation of fields. *D. dipsaci* is economically detrimental because infected crops are unmarketable.

Stem and bulb nematode	
Scientific classification	
Kingdom:	Animalia
Phylum:	Nematoda
Class:	Tylenchoidea
Subclass:	Diplogasteria
Order:	Tylenchida
Superfamily:	Tylenchoidea
Family:	Anguinidae
Subfamily:	Anguininae
Genus:	*Ditylenchus*
Species:	***D. dipsaci***
Binomial name	
Ditylenchus dipsaci Kuhn, 1857	

Stromatinia cepivora

Stromatinia cepivora	
Scientific classification	
Kingdom:	Fungi
Division:	Ascomycota
Class:	Ascomycetes
Order:	Helotiales
Family:	Sclerotiniaceae
Genus:	*Stromatinia*
Species:	***S. cepivora***
Binomial name	
Stromatinia cepivora Berk.[1]	
Synonyms[1]	
• *Sclerotium cepivorum* Berk. 1841	

Stromatinia cepivora is a fungus in the division Ascomycota. It is the teleomorph of ***Sclerotium cepivorum***, the cause of white rot in onions, garlic, and leeks. [2] The infective sclerotia remain viable in the soil for many years and are stimulated togerminate by the presence of a susceptible crop.

Biology

Sclerotium cepivorum is the asexual reproductive form of *Stromatinia cepivora* and is a plant pathogen, causing white rot in *Allium* species, particularly onions, leeks, and garlic. It is a soil-borne fungus and affects susceptible crops planted in infected soil. In the case of onions, the first symptoms of damage are wilting and yellowing of the foliage. The older leaves die first, followed by all the aerial parts of the plant. The scales of the bulb become watery and disintegrate. White mycelia appear at the base of the bulb, spreading over its surface and causing it to rot.[3] Black, globularsclerotia, 200-500 µm in diameter, appear on the fluffy white mould and sometimes larger, black sclerotic crusts also form. The sclerotia become detached and remain dormant in the soil for many years ready to infect a future *Allium* crop.[3]

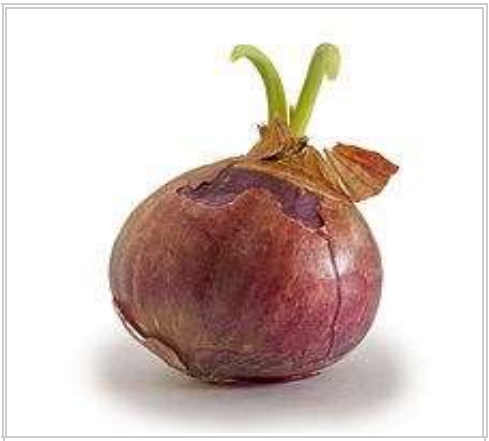
Sclerotinia germinate when in contact with chemicals emitted by the roots of *Allium* plants. They remain infective in the soil for 15 years or more. At low densities, clusters of affected plants develop as the infection spreads from plant to plant. At higher densities, the entire crop may be affected.[4] Sclerotia can be spread to other fields by farm machinery, vehicles, boots, wind-borne onion husks, or flood water. Infection can occur when the soil temperature is in the range 50 to 75°F (10 to 24°C).[5]

Storage in the home

Cooking onions and sweet onions are better stored at room temperature, optimally in a single layer, in mesh bags in a dry, cool, dark, well-ventilated location. In this environment, cooking onions have a shelf life of three to four weeks and sweet onions one to two weeks. Cooking onions will absorb odours from apples and pears. Also, they draw moisture

from vegetables with which they are stored which may cause them to decay.[48][57]

Sweet onions have a greater water and sugar content than cooking onions. This makes them sweeter- and milder-tasting, but reduces their shelf life. Sweet onions can be stored refrigerated; they have a shelf life around 1 month. Irrespective of type, any cut pieces of onion



Onion at end of storage life, beginning to sprout

are best tightly wrapped, stored away from other produce, and used within two to three days.[43]

Varieties

Common onion group (var. cepa)

Most of the diversity within A. cepa occurs within this group, the most economically important Allium crop. Plants within this group form large single bulbs, and are grown from seed or seed-grown sets. The majority o f cultivars grown for dry bulbs, salad onions, and

pickling onions belong to this group.[13] The range of diversity found among these cultivars includes variation in photoperiod (length of day that triggers bulbing), storage life, flavour, and skin colour.[58] Common onions range from the pungent varieties used for dried soups and onion powder to the mild and hearty sweet onions, such as the Vidalia from Georgia, USA, or Walla Walla from Washington that can be sliced and eaten raw on a sandwich.

Aggregatum group (var. aggregatum)

This group contains shallots and potato onions, also referred to as multiplier onions. The bulbs are smaller than those of common onions, and a single plant forms an aggregate cluster of several bulbs. They are propagated almost exclusively from daughter bulbs, although reproduction from seed is possible. Shallots are the most important subgroup within this group and comprise the only cultivars cultivated commercially. They form aggregate clusters of small, narrowly ovoid to pear-shaped bulbs. Potato onions differ from shallots in forming

larger bulbs with fewer bulbs per cluster, and having a flattened (onion-like) shape. However, intermediate forms exist.[13]

Rossa di Tropea onions for sale in Italy

I'itoi onion is a prolific multiplier onion cultivated in the Baboquivari Peak Wilderness, Arizona area. This small-bulb type has a shallot-like flavor and is easy to grow and ideal for hot, dry climates. Bulbs are separated,
and planted in the fall 1 in below the surface and 12 in apart. Bulbs will multiply into clumps and can be harvested throughout the cooler months. Tops die back in the heat of summer and may return with heavy rains; bulbs can remain in the ground or be harvested and stored in a cool dry place for planting in the fall. The plants rarely flower; propagation is by division.[59]

Hybrids with A. cepa parentage


A. ×proliferum, tree onion

A number of hybrids are cultivated that have A. cepa parentage, such as the diploid tree onion or Egyptian onion (A. ×proliferum), Wakegi onion (A. ×wakegi), and the triploid onion (A. ×cornutum).

The tree onion or Egyptian onion produces bulblets in the umbel instead of flowers, and is now known to be a hybrid of A. cepa × A. fistulosum. It has previously been treated as a variety of A. cepa, for example A. cepa var. proliferum, A. cepa var. bulbiferum, and A. cepa var. viviparum.[60]

The Wakegi onion is also known to be a hybrid between A. cepa and A. fistulosum, with the A. cepa parent believed to be from the Aggregatum group of cultivars.[61] It has been grown for centuries in Japan and China for use as a salad onion.[62]

Under the rules of botanical nomenclature, both the Egyptian onion and Wakegi onion should be combined into one hybrid species, having the same parent species. Where this is followed, the Egyptian onion is named A. ×proliferum Eurasian group and the Wakegi onion is named A. ×proliferum East Asian group.[4] The triploid onion is a hybrid species with three sets of chromosomes, two sets from A. cepa and the third set from an unknown parent.[61] Various clones of the triploid onion are grown locally in different regions, such as 'Ljutika' in Croatia, and 'Pran', 'Poonch', and 'Srinagar' in the India-Kashmir region. 'Pran' is grown extensively in the northern Indian provinces of Jammu and Kashmir. There are very small genetic differences between 'Pran' and the Croatian clone 'Ljutika', implying a monophyletic origin for this species.[63]

Some authors have used the name A. cepa var. viviparum (Metzg.) Alef. for the triploid onion, but this name has also been applied to the Egyptian onion. The only name unambiguously connected with the triploid onion is A. ×cornutum.

Spring onions or salad onions may be grown from the Welsh onion (A. fistulosum), as well as from A. cepa. Young plants of A. fistulosum and A. cepa look very similar, but may be distinguished by their leaves, which are circular in cross-section in A. fistulosum rather than flattened on one side.[64]

Onion and shallot output in 2005

Production and trade

An estimated 9,000,000 acres (3,642,000 ha) of onions are grown around the world, annually. About 170 countries cultivate onions for domestic use and about 8% of the global production is traded internatio-nally.[24

The Onion Futures Act, passed in 1958, bans the trading of futures contracts on onions in the United States. This prohibition came into force after farmers complained about alleged market manipulation by Sam Seigel and Vincent Kosuga at the Chicago Mercantile Exchange two years earlier. The subsequent investigation provided economists with a unique case study into the effects of futures trading on agricultural prices. The act remains in effect as of 2013.[66]

Top Ten Onions (dry) Producers — 2012 (metric tons)	
China	20,507,759
India	13,372,100
United States	3,320,870
Egypt	2,208,080
Iran	1,922,970
Turkey	1,900,000
Pakistan	1,701,100
Brazil	1,556,000
Russia	1,536,300
Republic of Korea	1,411,650
World Total	74,250,809
Source: UN Food & Agriculture Organisation (FAO) [65]	

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No. 192 **13 March 2015**

AGRICULTURAL PRODUCT STANDARDS ACT, 1990
(ACT No. 119 of 1990)

REGULATIONS RELATING TO THE GRADING, PACKING AND MARKING OF ONIONS AND SHALLOTS INTENDED FOR SALE IN THE REPUBLIC OF SOUTH AFRICA

The Minister of Agriculture has, under section 15 of the Agricultural Product Standards Act, 1990 (Act No. 119 of 1990)-

(a) made the regulations in the Schedule;

(b) determined that the said regulations shall come into operation 3 months after the date of publication; and

(c) read together with section 3(1) of the said Act, repealed the Regulations published by Government Notice No. R.621 of 5 June 2009.

SCHEDULE

Definitions

1. In these regulations, unless inconsistent with the context, a word or expression to which a meaning has been assigned in the Act, shall have a corresponding meaning, and-

"**address**" means a physical address in the Republic of South Africa and includes the street or road number or name, and the name of the town, village or suburb and, in the case of a farm, the name or number of the farm and of the magisterial district in which it is situated;

"**consignment**" means a quantity of onions or shallots of the same class which belongs to the same owner, delivered at any one time under cover of the same delivery note, consignment note or receipt note or delivered by the same vehicle, or if any such quantity is subdivided into different size groups or cultivars, each quantity of each of the different size groups or cultivars;

"**container**" means the immediate container in which onions and shallots are packed directly, the outer container in which pre-packed units are packed and bulk containers ,excluding prepacked units or shipping containers in which pallet loads are shipped;

"**diameter**" means the largest diameter of an onion or shallot, measured at right angles to a line running from the stem end to the root base;

"**decay**" means a state of decomposition, fungus development or internal insect infestation, that partly or completely detrimentally affects the quality of the onions and shallots;

"**double bulb**" means an onion which clearly consists of more than one bulb when adjudicated on external appearance;

"**shallot**" means bulbs of varieties (cultivars) of the plant *Allium cepa* L. Aggregatum Group excluding green shallots with full leaves and shallots intended for industrial processing;

"**the Act**" means the Agricultural Product Standards Act, 1990 (Act No. 119 of 1990); and

"**thick neck bulb**" means an onion or shallot whose neck in proportion to the bulb thereof, is abnormally thick.

Restrictions on the sale of onions and shallots

2. (1) No person shall sell onions or shallots in the Republic of South Africa-

(a) unless the onions or shallots are sold according to the classes as referred to in regulation 3;

(b) unless the onions or shallots comply with the standards regarding quality as referred to in regulations 4 and 5;

(c) unless such onions or shallots are packed in a container and in the manner as prescribed in regulations 6, 7 and 8;

(d) unless such onions or shallots are marked with the particulars and in the manner as prescribed in regulations 9, 10 and 11; and

(e) unless such onions or shallots are sampled in the manner as prescribed in regulation 12.

(2) The Executive Officer may grant written exemption, entirely or partially, to any person on such conditions as he deems necessary, from the provisions of sub regulation (1): Provided that such exemption is done in terms of section 3(1) (c) of the Act.

QUALITY STANDARDS

Classes for onions and shallots

3. There are four classes of onions and shallots, namely Class 1, Class 2, Class 3 and Lowest Class.

Standards for classes

4. (a) The classes mentioned in regulation 3 shall comply with the quality standards as set out in Table 1.

(b) Be fit for human consumption as prescribed in terms of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972).

Deviations

5. The classes mentioned in regulation 3 may deviate (m/m) from the standards prescribed in regulation 4, to the extent as set out in Table 2.

(b) not impart a taste or odour to onions or shallots; and

(c) in case of containers that are re-used, be of such materials that the container can be cleaned and disinfected prior to re-use.

Closing of containers

7. Containers shall be closed in any suitable manner.

PACKING REQUIREMENTS

8. (1) Onions or shallots shall, in the same consignment, in the case of Class 1 and Class 2 correspond in cultivar, size group and maturity.

(2) Each container of a type as prescribed in regulation 6 shall be packed as firmly as possible with onions or shallots without damaging the container or the onions or shallots concerned.

MARKING REQUIREMENTS

9. (1) Each container of onions or shallots destined for sale shall be marked clearly, legible, indelibly and not untidy, or askew by printing, stamping or by means of specially designed labels described in sub regulation (4) with the following particulars:

(a) The name or trademark and physical or postal address of either the producer or owner or importer or packer of the onions or shallots packed in that container.

(b) The expression "Class 1", "Class 2", "Class 3" and "Lowest Class", as the case may be.

(c) The expression "produce/product of" followed by the full name of the country of origin thereof or the country of origin declared as required by the regulations published in terms of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 54 of 1972).

(d) In the case of Class 1 and Class 2, the size group namely "Extra Large", "Large", "Medium", "Small" or "Pickles" as the case may be.

(e) The net mass of the contents as prescribed in terms of the Trade Metrology Act, 1973 (Act No. 77 of 1973).

(f) The name onions or shallots in the case of containers where the contents of which are not visible from outside.

(2) The particulars prescribed in sub regulation (1) shall be indicated on the container by stamping, printing or by affixing a label thereon.

(3) If at any stage the class or size designation should change the labels shall be replaced unless the new class or size designation is stamped across the old class or size designation, in clear legible block letters of at least 2 mm larger than the previous marks, with a suitable stamp.

(c) affixed firmly to the container and in such a manner that re-stamping is possible without opening or damaging the container.

Display

10. Wherever onions or shallots are displayed for sale in loose quantities-

(a) any quantity of a particular class, or a particular size group or cultivar shall not be displayed mixed with onions or shallots of any other class, size group or cultivar; and

(b) adherence to the marking requirements is optional: Provided that if marked, the class, and in the case of Class 1 and Class 2 also the size group of such quantity of onions or shallots, shall be indicated in clear legible block letters of at least 10 mm in height on a notice board prominently placed at such a quantity of onions or shallots.

Prohibited particulars

11. No wording, illustration or other means of expression which constitutes a misrepresentation or which directly or by implication, creates a misleading impression of the contents, or of the quality or the class thereof shall appear on a container containing onions or shallots or on a label attached thereto.

SAMPLING

12. An inspector shall draw at random, at least two percent of the containers or ten containers in a consignment for inspection purposes and an inspector shall be satisfied that the containers so drawn are representative of the consignment concerned: Provided that in the case of bulk containers at least 25 percent or two bulk containers, whichever is the greatest, shall be taken as sample from the consignment.

OFFENCE AND PENALTIES

13. Any person who contravenes or fails to comply with any provision of these regulations shall be guilty of an offence and upon conviction be liable to a fine or imprisonment in terms of section 11 of the Act.

TABLE 1

QUALITY STANDARDS

QUALITY FACTOR	CLASS 1	CLASS 2	CLASS 3	LOWEST CLASS
(a) Seed stems and sprouts	Shall not occur	Shall not occur	Shall not occur	*
(b) Appearance	Dry, firm, clean and well developed.	Practically dry, firm, clean and well developed.	Fairly dry, firm, clean and well developed.	*
(c) Insect damage	Shall not occur	Damage with a maximum depth of two fleshy bracts is permissible: Provided that not more than 15% of the bulb shall be cut away with straight cuts to remove the damaged portions.	Damage with a maximum depth of two fleshy bracts is permissible: Provided that not more than 25% of the bulb shall be cut away with straight cuts to remove the damaged portions.	*
(d) Insect infestation	Shall not occur	Shall not occur	Shall not occur	*
(e) Shape				
(i) Onions	Typical of the cultivar concerned.	As for Class 1	*	*
(ii) Shallots	May have cluster or connected clusters large and small in a sepcific size range.	As for Class 1	*	*
(f) Thick necks				
Onions:				
Small	Maximum diameter of	Maximum diameter	*	*

(g) Colour				
(i) Onions	Shall be of the same colour.	As for Class 1	*	*
(ii) Shallots	Characteristically of the cultivar concerned: Provided that red and brown shallots may be packed together, with exception of White Shallots.	As for Class 1	*	*
(h) Heat or cold damage	Shall not occur	Shall not occur	Practically free: Provided that the damage is not deeper than three fleshy bracts	*
(i) Roots	No roots longer than 30 mm	No roots longer than 40 mm	*	*
(j) Bracts	Shall be practically free from loose bracts	Shall be fairly free from loose bracts	*	*
(k) Double bulbs	Shall not occur	Double bulbs which are entirely covered with the same dry bract are permissible.	Double bulbs which are covered with loose dry bract.	*

		(ii) Not more than 10% of the surface of the bulb may be affected with a serious intensity of black mould.	(ii) Not more than with a serious intensity of black mould 20% of the surface of the bulb may be affected.	
(o) Greening	Light greening on not more than 50% of total area of the bulb is permissible: Provided that the greening is not deeper than one fleshy bract.	Light greening unlimited and dark greening not deeper than two fleshy bracts is permissible.	Dark greening not deeper than three fleshy bracts is permissible.	*
(p) Any other external or internal quality defects	Shall not occur.	Practically free	Fairly free	*
(q) Foreign matter	Shall not occur	Shall not occur	Shall not occur	*
(r) Size groups:				
Onions:				
(i) Extra large	At least 90 mm in diameter	As for Class 1	*	*
(ii) Large	At least 70 mm but not more than 90 mm in diameter	As for Class 1	*	*
(iii) Large-Medium	At least 60 mm but not more than 80 mm in diameter	As for Class 1	*	*
(iv) Medium	At least 40 mm but not more than 70 mm in diameter	As for Class 1	*	*

	in diameter.			
(iii) Medium/ Small	At least 15 mm but not more than 45 mm in diameter.	As for Class 1	*	*

* No specifications

TABLE 2

PERMISSIBLE DEVIATIONS (m/m)

Quality factor	Class 1	Class 2	Class 3	Lowest class
(a) Decay				
(i) Dry type decay	3%	5%	8%	*
(ii) Wet type decay	1%	2%	4%	*
(iii) (i) and (ii) collectively, provided that the individual limits are not exceeded	3%	5%	8%	*
(b) Black mould (#)	3%	5%	8%	*
(c) External and internal quality defects with the exception of decay and black mould	10%	15%	25%	*
(d) (a), (b) and (c) collectively, provided that the individual limits specified above are not exceeded	10%	15%	25%	*
(e) Size group deviations:				
(i) Too large or too small	10%	15%	*	*
(ii) Too large and too small collectively	10%	15%	*	*

* No specifications.
# In the case where black mould is wet or smutty, it shall be seen as wet type decay and be counted as such.

COLOUR CHARTS PRESCRIBED FOR EXPORT ONIONS

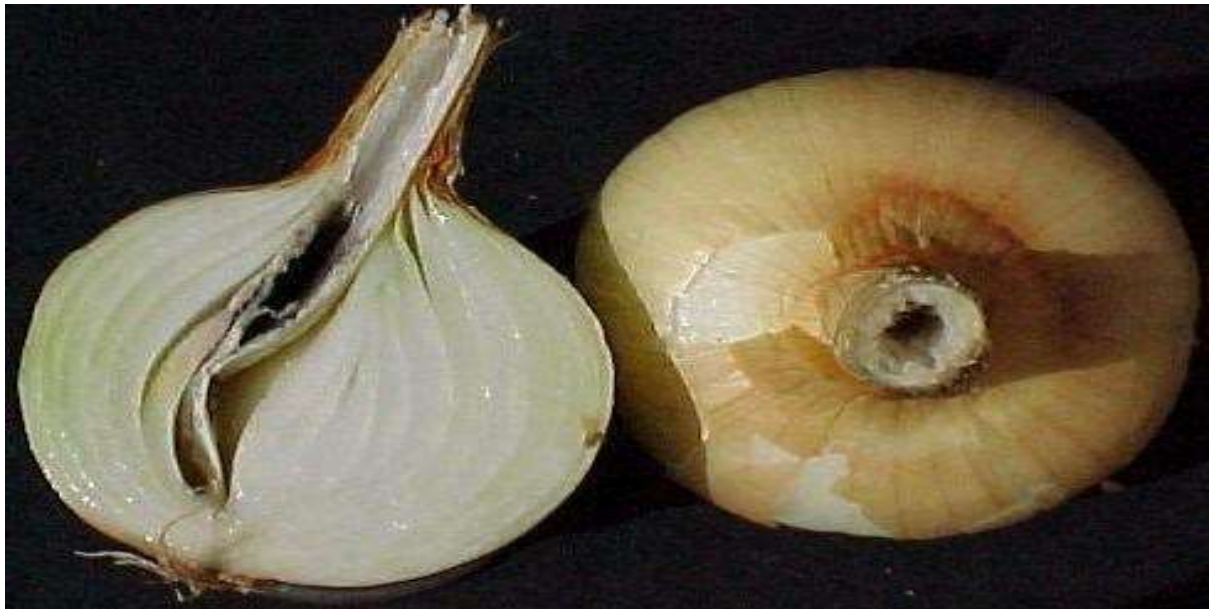
Set O.35

Important note:

The below colour charts should be read in conjunction with the export standards and requirements prescribed for fresh vegetables under the banner of the Agricultural Product Standards Act 119 of 1990.

Various photos obtained from the OECD brochure for onions

HOLLOW/SEED STEM



Onions	Class I	Class II	Out of Grade	Notes
Hollow/seed stem	x	x	1, 2	Class I: Shall not occur. Class II: Shall not occur.

Various photos obtained from the OECD brochure for onions

Set O.2

DAMAGE CAUSED BY PESTS

1

2

Onions	Class I	Class II	Out of Grade	Notes
Damage caused by pests	x	x	1, 2	Class I: Insect damage that affects the first fleshy bract, is not permissible. Class II: Damage to a maximum depth of two fleshy bracts is permissible: Provided that not more than 15% of the bulb shall be cut away with straight cuts to remove the damaged portions.

Set O.3

Various photos obtained from the OECD brochure for onions

LENGTH OF THE STEM/TOPS

1 2 3 4 5

Onions	Class I	Class II	Out of Grade	Notes
Length of the stem/Tops	1, 2, 3, 4	1, 2, 3, 4	5	Class I: Shall be cut or clipped off and may not be longer than 60 mm. Class II: Shall be cut or clipped off and may not be longer than 60 mm.

Set O.4

Various photos obtained from the OECD brochure for onions

SPROUTED

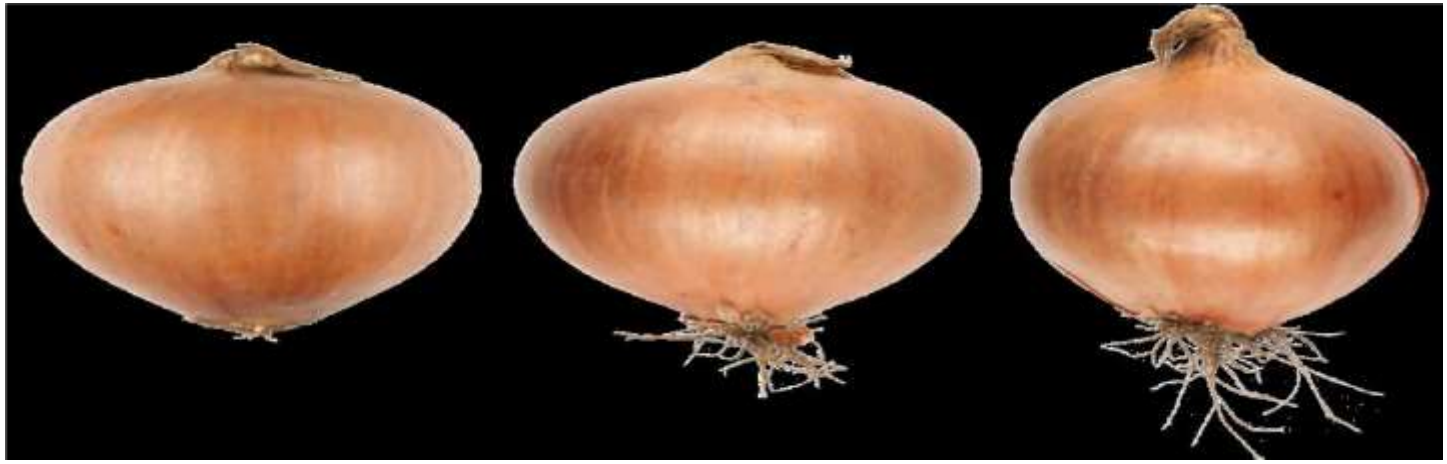
Set O.5

1 2 3 4 5 6

Onions	Class I	Class II	Out of Grade	Notes
Sprouts	1	1	2, 3, 4, 5	Class I: Sprouts (external visible sprouts) shall not occur. Class II: Sprouts (external visible sprouts) shall not occur.

Various photos obtained from the OECD brochure for onions

ROOT TUFTS



1 2 3

Onions	Class I	Class II	Out of Grade	Notes
Root tufts	1, 2	3	X	Class I: No roots longer than 20 mm. Class II: No roots longer than 30 mm.

Various photos obtained from the OECD brochure for onions

Set O.6

DEFECTS IN SHAPE (ROUND TYPE)

1 2 3 4

1 2 3 4

Onions	Class I	Class II	Out of Grade	Notes
Defects in shape (round type)	**1, 2, 6**	**3, 4, 5**	**7, 8**	**Typical of the cultivar concerned: Provided that onions with a shape which differ significant from the predominant shape of the rest of the onions in the container, shall be regarded as a deviation.**

Set O.7

Various photos obtained from the OECD brochure for onions

DEFECTS IN SHAPE (ELONGATED TYPE)

1 2 3 4 5 6

Onions	Class I	Class II	Out of Grade	Notes

Defects in shape (elongated type)	**1, 2, 3**	**4, 5**	**x**	**Typical of the cultivar concerned: Provided that onions with a shape which differ significant from the predominant shape of the rest of the onions in the container, shall be regarded as a deviation.**

Various photos obtained from the OECD brochure for onions

Set O.8

GREENISH DISCOLOURATION (BROWN ONIONS)

1

2

3

4

Set O.9

Onions	Class I	Class II	Out of Grade	Notes
Greenish discolouration (brown onions)	**1, 2**	**3**	**4**	Class I: **Light greening on not more than 50% of the total area of the bulb is permissible: Provided that the greening is not deeper than one fleshy bract.** Class II: **Light greening and dark greening not deeper than two fleshy bracts are permissible.**

Various photos obtained from the OECD brochure for onions

GREENISH DISCOLOURATION (WHITE ONIONS)

1 2 3 4

Onions	Class I	Class II	Out of Grade	Notes
Greenish discolouration (white onions)	**1, 2**	**3**	**4**	Class I: **Light greening on not more than 50% of the total area of the bulb is permissible: Provided that the greening is not deeper than one fleshy bract.** Class II: **Light greening and dark greening not deeper than two fleshy bracts are permissible.**

Various photos obtained from the OECD brochure for onions

Set O.10

CRACKS OF THE SKIN

1 2 3 4

5 6 7 8 9

Onions	Class I	Class II	Out of Grade	Notes
Cracks of the skin/bracts	**1,3, 4, 9**	**2, 5, 6**	**7, 8**	Class I: **Shall be covered with a dry bract. A crack of 5 mm wide is permissible: Provided that the flesh is not damaged.**

Set O.11

				Class II: **Shall be covered with a dry bract for at least 50% of the surface of the bulb and shall be fairly free from loose bracts:Provided that the flesh is not damaged.**

Various photos obtained from the OECD brochure for onions

STAINING (BROWN ONIONS)

Set O.12

1

2

3

4

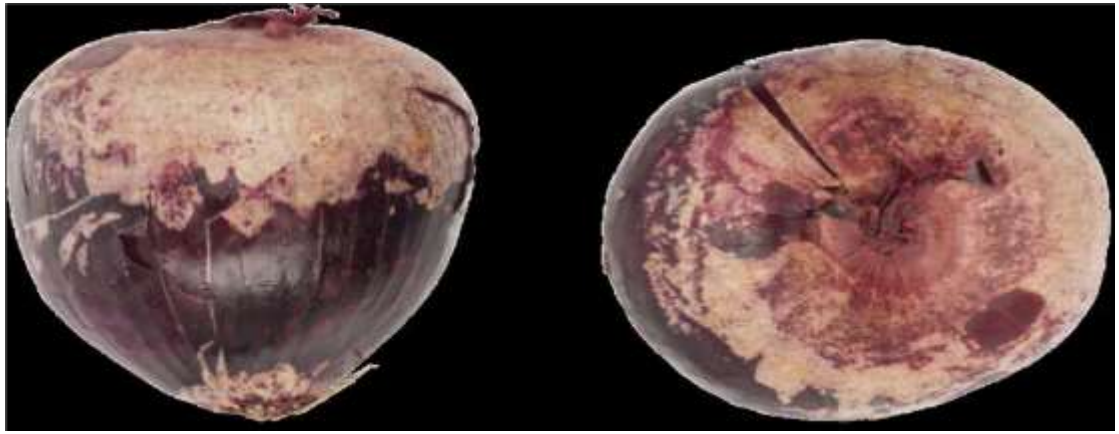
5

6

Onions	Class I	Class II	Out of Grade	Notes
Staining (brown onions)	**1, 2, 3**	**4**	**5, 6**	Class I: **Not more than 20% of the surface of the outer dry bracts of the bulb may show stains: Provided that the fleshy bracts shall show no stains.** Class II: **Not more than 50% of the surface of the dry bracts of the bulb may show stains: Provided that the fleshy bracts shall show no stains.**

Various photos obtained from the OECD brochure for onions

STAINING DUE TO SUNBURN (RED ONIONS)



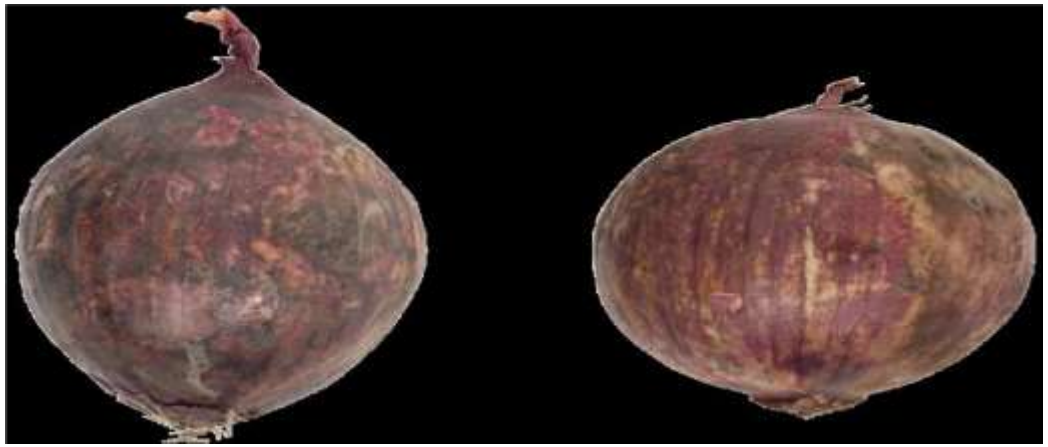
1 2

Onions	Class I	Class II	Out of Grade	Notes
Staining due to sunburn (red onions)	x	x	1, 2	Class I: **Not more than 20% of the surface of the outer dry bracts of the bulb may show stains: Provided that the fleshy bracts shall show no stains.** Class II: **Not more than 50% of the surface of the dry bracts of the bulb may show stains: Pro. vided that the fleshy bracts shall show no stains.**

Set O.13

Various photos obtained from the OECD brochure for onions

STAINING DUE TO WET WEATHER DURING HARVEST (RED ONIONS)



1 2

Onions	Class I	Class II	Out of Grade	Notes
Staining due to wet weather during harvest (red onions)	**x**	**x**	**1, 2**	Class I: **Not more than 20% of the surface of the outer dry bracts of the bulb may show stains: Provided that the fleshy bracts shall show no stains.** Class II: **Not more than 50% of the surface of the dry bracts of the bulb may show stains: Provided that the fleshy bracts shall show no stains.**

Set O.14

Various photos obtained from the OECD brochure for onions

BRUISING

Onions	Class I	Class II	Out of Grade	Notes

Set O.15

Bruising	**x**	**x**	**√**	Class I: **Bruise that affects the first fleshy bract, is not permissible.** Class II: **A maximum of 10% of the surface of the bulb may show bruises which are not deeper than two fleshy bracts: Provided that the damaged portions are not spongy and watery.**

Various photos obtained from the OECD brochure for onions

DOUBLE BULBS (EXTERNAL AND INTERNAL)

Set O.16

1

2

Onions	Class I	Class II	Out of Grade	Notes
Double bulbs 1. **External** 2. **Internal**	**x**	**x**	**x**	Class I: **Shall not occur.** Class II: **Double bulbs which are entirely covered with the same dry bract, are permissible.**

Various photos obtained from the OECD brochure for onions

EXAMPLE OF VARIATION IN SHAPE OF DIFFERENT VARIETIES

Set O.17

Various photos obtained from the OECD brochure for onions

UNHEALED INJURIES/MECHANICAL DAMAGE (BROWN ONIONS)

1 2 3

4 5

Onions	Class I	Class II	Out of Grade	Notes
Unhealed injuries/ mechanical damage (brown onions)	**x**	**x**	**1, 2, 3,4 5**	Class I: **Mechanical damage that affects the first fleshy bract, is not permissible.** Class II: **Damage to a maximum depth of two fleshy bracts is permissible: Provided that not more than 15% of the bulb shall be cut away with straight cuts to remove the damaged portions.**

Various photos obtained from the OECD brochure for onions

UNHEALED INJURIES/MECHANICAL DAMAGE (RED ONIONS)

Set O.18

1 2 3 4

Onions	Class I	Class II	Out of Grade	Notes
Unhealed injuries/mechanical damage (red onions)	**x**	**1**	**2, 3,4**	Class I: **Mechanical damage that affects the first fleshy bract, is not permissible.** Class II: **Damage to a maximum depth of two fleshy bracts is permissible: Provided that not more than 15% of the bulb shall be cut away with straight cuts to remove the damaged portions.**

Set O.19

Various photos obtained from the OECD brochure for onions

DRY MOULD GROWTH (BROWN ONIONS)

1 2

3

Onions	Class I	Class II	Out of Grade	Notes
Dry Mould growth (brown onions)	**x**	**x**	**1, 2, 3**	Class I: **Free from black mould.** Class II: **Not more than 10% of the surface area of the bulb may be affected with black mould.**

Set O.20

Various photos obtained from the OECD brochure for onions

MOULD GROWTH (RED ONIONS)

1 2

Onions	Class I	Class II	Out of Grade	Notes
Dry Mould growth (red onions)	**x**	**1**	**2**	Class I: **Free from black mould.** Class II: **Not more than 10% of the surface area of the bulb may be affected with black mould.**

Set O.21

Various photos obtained from the OECD brochure for onions

DRY MOULD ON THE FLESH (WHITE ONIONS)

1 2

Onions	Class I	Class II	Out of Grade	Notes
Dry Mould growth (white onions)	**x**	**x**	**1, 2**	Class I: **Free from black mould.** Class II: **Not more than 10% of the surface area of the bulb may be affected with black mould.**

Various photos obtained from the OECD brochure for onions

DECAY (RED ONIONS)

Set O.22

1 2

3

Onions	Class I	Class II	Out of Grade	Notes
Decay (red onions)	**x**	**x**	**1, 2, 3**	Class I: **Shall not occur.** Class II: **Shall not occur.**

Various photos obtained from the OECD brochure for onions

NOT SOUND (RED ONIONS)

Set O.23

1 2

Onions	Class I	Class II	Out of Grade	Notes
Not sound (red onions)	x	x	1, 2	Class I: Shall not occur. Class II: Shall not occur.

Set O.24

Various photos obtained from the OECD brochure for onions

FOREIGN MATTER (SOILED)

Onions	Class I	Class II	Out of Grade	Notes
Foreign matter (soiled)	x	x	1, 2, 3, 4, 5, 6	Class I: Shall not occur. Class II: Shall not occur.

Set O.25

Various photos obtained from the OECD brochure for onions

FOREIGN MATTER (NOT CLEAN)

1 2

Onions	Class I	Class II	Out of Grade	Notes
Foreign matter (not clean)	x	x	1, 2	Class I: Shall not occur. Class II: Shall not occur.

Various photos obtained from the OECD brochure for onions

Set O.26

FROST DAMAGE (EXTERNAL)

1 2

Onions	Class I	Class II	Out of Grade	Notes
Frost damage (external)	x	x	1, 2	Class I: Shall not occur. Class II: Shall not occur.

Set O.27

Various photos obtained from the OECD brochure for onions

HEAT DAMAGE

Onions	Class I	Class II	Out of Grade	Notes
Heat damage	x	x	√	Class I: Shall not occur. Class II: Shall not occur.

Various photos obtained from the OECD brochure for onions

Set O.28

TYPICAL CLASS I QUALITY

Onions	Class I	Class II	Out of Grade	Notes
Length of the stem/Tops	√	√	x	Class I: Shall be cut or clipped off and may not be longer than 60 mm. Class II: Shall be cut or clipped off and may not be longer than 60 mm.

Set O.29

Various photos obtained from the OECD brochure for onions

TYPICAL CLASS II QUALITY

Onions	Class I	Class II	Out of Grade	Notes
Length of the stem/Tops	x	√	x	Class II: Shall be cut or clipped off and may not be longer than 60 mm.

Set O.30

Various photos obtained from the OECD brochure for onions

EQUIPMENT FOR SIZING

Onions	Class I	Class II	Out of Grade	Notes

Set O.31

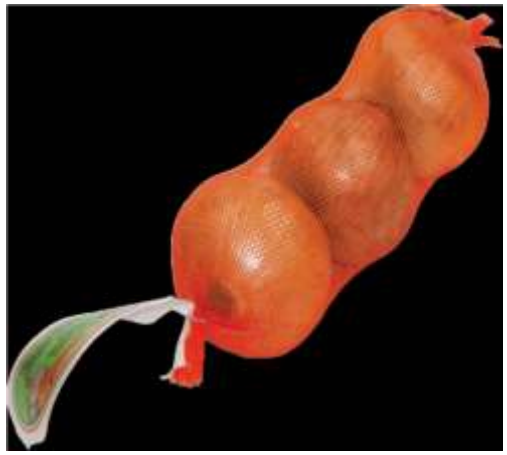
Sizing				Minimum size and uniformity should be done according to size ranges as set out in the Standards and Requirements.

Various photos obtained from the OECD brochure for onions

EXAMPLES OF TYPES OF PACKING








Various photos obtained from the OECD brochure for onions

Set O.32

MARKING REQUIREMENTS

ONIONS

Producer: **ABC Farming**

PO Box 1122

Douglas

0070

PUC: D 0980

Class 1	✓

Size	**40 – 60 mm**

Product of South Africa

Nett mass: 25 kilograms

Various photos obtained from the OECD brochure for onions