

A Pictorial Guide for Field Identification

Pests and Diseases of Rice, Maize and Potato

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Important insect pests of rice

STEM BORERS

Symptoms

Four species of stem borers attack rice crop on varying scales but probably never reaches pest status in Bhutan. Stem borers can infest rice plant from seedling stage to maturity. Injury to rice is caused by the larva which bores inside the stem (Figure 1). When young rice plant is attacked “dead-hearts” (Figure 2) are caused and when older rice is attacked this results in “white heads” (Figure 3).



Figure 1. *Stem borer feeding sign on rice stem*



Figure 2. *Dead heart*



Figure 3. *White head*



Figure 4. *Female yellow stem borer*



Figure 5. *Male Yellow stem borer*



Figure 6. *Eggs - laid near the tip of the leaf blade, covered in pale orange brown hairs*



Figure 7. *Larva- with cream coloured body and reddish brown head.*

1. YELLOW STEM BORER (YSB)

Pyralidae: Lepidoptera

Scirpophaga incertulas (Walker)

This is the most destructive and most predominant stem borer in south East Asia.

Identifying characters

Adult Moth

Male moths are light brown with numerous small brownish dots (Figure 5), along the subterminal area and near the tip of the forewing

Female moths are yellow, color deepening toward the tip (Figure 4), and has a very distinct black spot in the center of each forewing (Wingspan of 25-45 mm)

Eggs: White, oval, flat eggs are laid in groups (60-100 eggs) and covered with brownish hairs from the abdominal tuft on upper surface of leaf or near the tips of leaf blade (Figure 6).

Larva: The body of the larva is cream coloured and the head is reddish brown (Figure 7).

Pupa: The pupa is yellowish white which turns brown before adult emergence. Pupation takes place inside the stem and often below the soil surface.

2. ASIATIC PINK STEM BORER

Noctuidae: Lepidoptera

Sesamia inferens (Walker)

(Lepidoptera: Noctuidae)

The adult is light brown-colored moth with dark brown markings on the forewing (Figure 8). From a central point in the forewing radiation of greyish black spreads toward the wing tips, ending in a thin terminal line of dark spots. The wing span ranges from 28 mm in males to 35 mm in females. The hind wings are creamy white with light yellow scales along the major veins. The head and thorax have a thick brown hair tuft.

Eggs- beadlike eggs are laid in rows between the leaf sheath and the stem (Figure 9).

Larva-has an orange-red head (Figure 10) and a body which is purplish-pink dorsally and white ventrally.



Figure 8. *Adult pink stem borer*



Figure 9. *Eggs-laid in rows, bead like*



Figure 10. *Larva of pink stem borer*



Figure 11. *Adult moth*



Figure 12. *Larva with strips*

3. STRIPED STEM BORER (SSB)

(Lepidoptera: Pyralidae)

Chilo suppressalis (Walker)

The striped stem borer is quite common in the temperate regions of Asia. It also occurs throughout the tropical rice-growing areas of Asia, where it is generally second in abundance to the yellow stem borer. It is an important insect pest of rice in India, south-east Asia, China, Iran and southern Europe.

The adults are straw-colored to light brown with silvery scales and several black dots at the terminal margin of each forewing (Figure 11). The hind wing is yellowish-white.

The eggs are normally laid on the basal portion of the leaves or on the leaf sheath.

Mature larva has a yellowish brown head and 3 dorsal and 2 lateral brownish abdominal stripes (Figure 12) that runs the entire length of the body.

4. DARKHEADED STEM BORER

Lepidoptera: Pyralidae

Chilo polychrysus (Meyrick)

Adult moth - light yellow with scattered brownish scales and several tiny black dots near the tip of the forewings (Figure 13). The hind wing has a lighter color.

Mature larva -has a black head and thoracic plate. The dark-headed borer larva has 3 dorsal and 2 lateral brownish stripes on its abdomen (Figure 14).



Figure 13. *Adult moth*



Figure 14. *Larva*



Figure 15. *Adult Green leafhoppers with black spot on fore wings*



Figure 16. *Adult green leaf hopper without black spots on fore wings*



Figure 17. *A nymph of green rice leaf hopper*

LEAF HOPPERS

The leaf hoppers attack all the stages of the plant. Both adults and nymph cause direct damage by sucking plant sap leading to stunted growth and reduced tillering. At higher population level their direct feeding causes complete drying of rice plants a condition commonly known as “hopperburn”. Apart from direct damage, the hoppers are vectors of virus diseases

5. GREEN RICE LEAF HOPPER

(Hemiptera :Cicadellidae)

Nephotettix virescens (Distant)

Adults are wedge shaped insects pale green in colour (Figure 15) measuring up to 5 mm in length. A pair of black spots is either present or absent on the forewings (Figure 16). As the insect matures, blackish markings on the abdomen and blackish band on the last abdominal segment become more prominent.

Nymphs (Figure 17) and adults suck the sap of the rice plants that can result in browning of leaves or “hopper burn”. Potentially more important are the *Nephotettix* spp. as vectors of virus diseases like tungro, leaf yellowing, yellow dwarf and yellow orange leaf. Although the Green Leafhoppers are quite numerous in the Bhutan rice fields they do not do much damage. So far they have also not been implicated in the spread of any major disease in Bhutan.

6. ZIGZAG LEAFHOPPER

(Hemiptera :Cicadellidae)

Recilia dorsalis (Motschulsky)

Adult hoppers have characteristic zigzag white and brown pattern on the front wings (Figure 19 and 20). Mature nymphs are brown with darker brown markings (Figure 17). The adult female measures about 3.5-3.8 mm in length while the adult male is 3.1-3.4 mm long.

The zigzag leafhopper is known to transmit rice tungro, rice dwarf, and rice orange leaf viruses



Figure 18. *A nymph of Zigzag leafhopper*



Figure 19. *Adult zigzag leafhopper*



Figure 20. *Adult zigzag leafhopper*



Figure 21. *Adult BPH with reduced and normal wings.*



Figure 22.
Female BPH



Figure 23. *Male BPH*

7. BROWN PLANTHOPPER (BPH)

(Hemiptera: Delphacidae)

Nilaparvata lugens (Stal)

The Brown Planthopper is a major pest of rice in Asia. The Brown Planthopper has a brown body with chestnut-brown eyes and a body length of only 3 mm. The adults have two distinct winged forms, one with normal front and hind wings and one with reduced hind wings (Figure 21).

The sap loss caused by feeding of nymphs and adults, accompanied by injection of toxic saliva, results in the paddy leaves developing rusty spots and lines. This is followed by general drying of the tissues. This condition is known as “hopperburn”. Whole fields can be destroyed in this way, but often hopperburn is concentrated in patches in the field. The hopper is also a vector of grassy stunt virus disease.

8. WHITEBACKED PLANTHOPPER

(Hemiptera: Delphacidae)

Sogatella furcifera(Horvath)

The White-backed Planthopper has a yellowish pronotum while the rest of the body is blackish brown. The forewings are hyaline with dark veins. It is slightly smaller than the Green Leafhoppers. It is especially common in young rice and damage occurs as a result of sap loss. The plants do not grow well and yield and quality of grain is reduced in case of heavy attack. This hopper is also implicated in the transmission of virus diseases as rice yellows and stunt disease. In Bhutan this hopper is much less frequent than the green leafhoppers and does not appear to be of economic importance.



Figure 24. *A group of adult WBPH*



Figure 25. *Male whitebacked plant hopper*



Figure 26. *Female whitebacked plant hopper*



Figure 27. *Adult Rice Leaf folder*

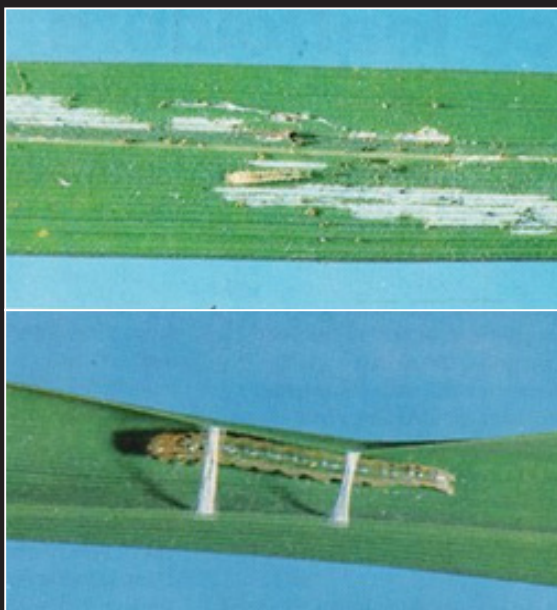


Figure 28. *Rice leaf folder larva and its damage symptoms*

9. RICE LEAF FOLDER

(Lepidoptera: Pyralidae)

Cnaphalocrocis mendinalis (Guenee)

Adult -light brown with shiny, brownish yellow wings adorned with three black bands on the forewings (Figure 27).

Larvae are transparent yellowish/green and spins the edges of the leaves together with silken thread folding the leaf to conceal themselves and feed inside the fold (Figure 28).

Feeding damage of the rice leaf folder includes folded leaves and removal of leaf tissue, leaving longitudinal and transparent streaks. The streaks are whitish.

Heavily infested fields show many folded leaves and a scorched appearance of leaf blades.

10. RICE SEED BUG (Gundy bug)

(Hemiptera: Alydidae)

Leptocorisa sp. Dallas

The presence of *Leptocorisa oratoria* and *Leptocorisa chinensis* has been confirmed for Bhutan.

Egg

The eggs are oval, shiny, and reddish brown in colour (Figure 29). Laid in batches of 10-20 in one to three rows along the midrib on the upper surface of the leaf.

The early nymphs are greenish but they become brownish as they grow. The adult bugs are 15-20 mm long, slender with long legs and antennae (Figure 30). Adult bugs can feed on rice stems and grasses. Nymphs and adults feed on the developing rice grains in the milky stage. As a result of the feeding panicles bear partially or entirely empty grains. Brown spots occur where the insects have fed (Figure 31). The bugs can also give an unpleasant smell to the rice and so lower the market value.



Figure 29. *Eggs of rice bug*



Figure 30. *Rice bug*



Figure 31. *Damage symptom on rice grain*



Figure 32. *Rice cases floating on water*



Figure 33. *Adult caseworm moth*

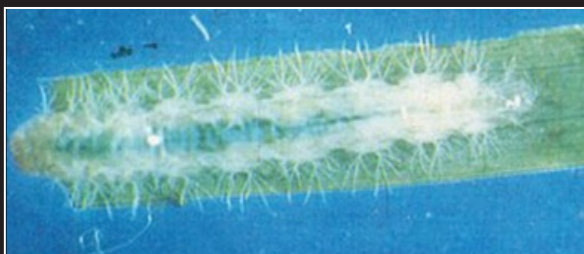


Figure 34. *Rice case worm larva*

11. RICE CASE WORM

(Lepidoptera: Pyralidae)

Nymphula depunctalis (Guenée)

The Caseworm is a pest of irrigated rice and rainfed rice with standing water during the vegetative stage.

Adult moth is bright white with light brown and black spots (Figure 33). It is about 5 mm long with a wing expanse of 15 mm.

The larva cuts off tips of leaves to make the cases in which it lives. These cylindrical case is either attached to the plant or seen floating on the water surface (Figure 32). Each larva constructs many cases before it pupates. The semi-aquatic larvae feed on the lower side of floating leaves and on submerged leaves.

The larva pupates in the final case and the adult is a small, delicate, white moth with pale brown spots on the wings (Figure 26).

Larva has transparent green body and a light brown head (Figure 34).

12. ARMYWORMS

Lepidoptera: Noctuidae

Mythimna separate (walker)

This is a sporadic pest and occasionally causes losses when an outbreak occurs. The young caterpillars feed on the leaves leaving only the midrib. The mature larva can cut off the panicles from the base or peduncles. The host plant may be totally devoured when populations are very high.

Eggs are white in color and laid in groups in-between the leaf sheaths or on the leaf blade. The mother moth uses a sticky secretion to hold the group in place.

Adult moths are pale and brick-red to pale brown with a very hairy body covered with dark specks and patches. Moths are nocturnal



Figure 35. *Adult moth*

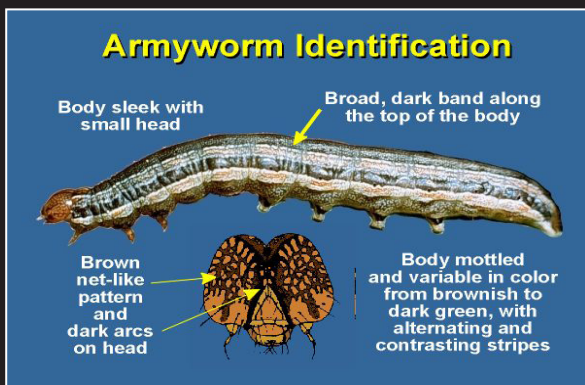


Figure 36. *Larva of armyworm*



Figure 37. *Brown spindle shaped lesions on leaf*



Figure 38. *Large blast lesions on young leaves*



Figure 39. *Node blast symptom*



Figure 40. *Broken rice haulm at the point of blast infection*

IMPORTANT RICE DISEASES

1. RICE BLAST

Causal organism

Pyricularia grisea (Cooke) Saccardo (anamorph)

P. oryzae Cavara (anamorph)

Magnaporthe grisea (T. T. Hebert) Yaegashi & Udagawa
(teleomorph)

Although chiefly a foliage disease, the fungus attacks also the leaf sheath, rachis, the joints of the culm and even the glumes.

Disease Symptoms:

Leaf blast.: The characteristic symptoms of the disease appear on the leaf and leaf sheath as brown spindle shaped lesions (Figure 37). The lesions are more or less eye or boat shaped with gray or dark brown margins. The lesions in older leaves remain circular but on young leaves they enlarge up to several centimeters long and about 1 cm broad (Figure 38). In older spots the center becomes gray or almost straw colored.

Collar blast: Collar refers to the junction of the leaf and leaf sheath. infected areas appear brownish black and may kill the whole leaf.

Node blast: Stem nodes may be attacked (Figure 39) as the plant approaches maturity, causing the plant to break at the point of infection (Figure 40) . Diseased nodes are brown or black.

Neck blast: Brown to black spots or rings are formed on the rachis of the maturing inflorescence (Figure 41 & 42). The neck becomes shriveled and covered with grey fluffy mycelium. If the infection has occurred much before the grain formation the latter are not filled and the panicles remain erect; but if the attack takes place after some grains have formed the panicle hangs down. This stage of the disease causes maximum damage. Panicle branches and glumes can also be attacked.



Figure 41. *Neck blast*



Figure 42. *Partially unfilled grains after neck blast*



Figure 43. *Disease symptoms on rice sheath*



Figure 44. *Disease symptom on rice leaf*



Figure 45. *Lesions on flag leaf*

2. SHEATH BLIGHT

Causal Organism

Rhizoctonia solani Kunh (anamorph), *Thanatephorus cucumeris* (Frank) Donk (teleomorph).

Symptoms. The lesions are usually observed on the leaf sheaths (Figure 43) although leaf blades may also be affected. The initial lesions are small, ellipsoid or ovoid, and greenish-gray and usually develop near the water line in lowland fields. Under favorable conditions, they enlarge and may coalesce forming bigger lesions with irregular outline and grayish-white center with dark brown borders (Figure 44). The presence of several large spots on a leaf sheath usually causes the death of the whole leaf.

3. BROWN SPOT

Causal organism:

Bipolaris oryzae (Breda de Haan) Shoemaker (Dela Paz et al 2006)

Cochliobolus miyabeanus (S. Ito & Kurib.) Drechsler ex Dastur

Symptoms:

The most conspicuous symptoms of the disease are on the leaves and glumes. Symptoms may also appear on the coleoptile, leaf sheaths, panicle branches, and more rarely on the roots of young seedlings, and stems.

Typical spots on the leaves are oval, about the size and shape of sesame seeds (Figure 46). They are relatively uniform and fairly evenly distributed over the leaf surface. The spots are brown with grey or whitish centres when fully developed (Figure 47). Young or underdeveloped spots are small and circular, and may appear as dark brown or purple brown dots. On susceptible cultivars, the spots are much larger and may reach 1 cm or more in length. Sometimes numerous spots occur and as result the leaf withers. Concentric lines or zones on the spot have been observed occasionally.

Black or dark brown spots appear on the glumes and in severe cases the greater portion or the entire surface of some glumes may be covered. Under favorable climatic conditions, dark brown conidiophores and conidia develop on the spots to give a velvety appearance.



Figure 46. *A typical brown spot lesion*

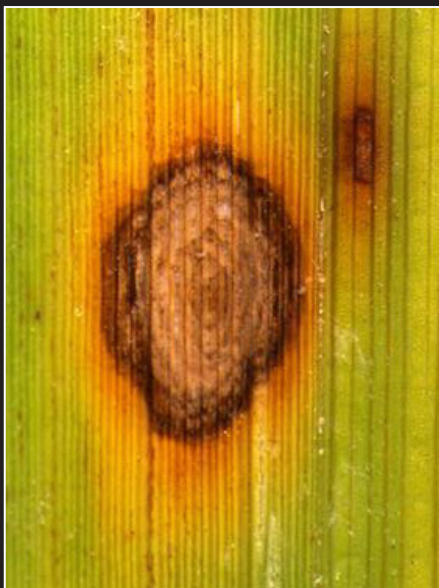


Figure 47. *Fully developed spot with grey centres*



Figure 48. *Hind wing pale patch*



Figure 49. *Adult moth*



Figure 50. *Mature larva*



Figure 51. *Pupa in a cell*

IMPORTANT PESTS OF MAIZE

1. CORN EAR WORM

Lepidoptera : Noctuidae

Helicoverpa armigera (Hubner)

The Corn earworm is a polyphagous pest that attacks crops like tomato, various vegetables, sorghum, soybean and maize. On maize the caterpillars are as leaf the cob feeders. They bore holes through the covering leaves of the cob and feed in their characteristic "half in/half out" way.

The larvae are usually greenish, but can be rather variable in colour and measure up to 5 cm when fully matured (Figure 50). Alternating light and dark stripes run the length of the body. Double dark stripes can usually be seen down the center of the back and the underside of the larva is light colored. Distinct tubercles are present with two or three large hairs protruding from each.

The adult is a brownish moth with light fawn forewings and a grey to grey-brown hind wing which has a broad dark band on the outer third of the wing (Figure 49). They also have a distinct kidney-shaped spot in the middle of the forewing and a pale patch in the dark marking on the hindwing (Figure 48) . Pupation takes place in a cell in the soil at a depth of 5 to 10 cm and reddish-brown in colour (Figure 51).

2. CORN APHID

Hemiptera : Aphididae

Rhopalosiphum maidis (Fitch)

The Maize Aphid is a more or less cosmopolitan pest and attacks besides maize many other gramineous crops. The aphids feed on leaves, leaf sheath and inflorescence. It is more a problem on young plants. Feeding causes mottling and leaf distortion.

The young aphids are light green in colour (Figure 52) while the adults are dark green (Figure 53) or bluish green with a slight whitish covering (Figure 54). The adults measure up to 2 mm in length. In Bhutan this aphid does not seem to present a big problem and chemical control should not normally be necessary.



Figure 52. *A young corn aphid*



Figure 53. *An adult corn aphid*



Figure 54. *A colony of corn aphid*



Figure 55. *Young turcicum leaf blight lesion*



Figure 56. *Sereval young lesions on the leaf*



Figure 57. *Mature TLB lesion*



Figure 58. *Susceptible variety showing sever blighting from TLB*

IMPORTANT MAIZE DISEASE

1. TURCICUM LEAF BLIGHT

Casual Organism: *Exserohilum turcicum*
(previously known as *Helminthosporium turcicum*)

This is the most common maize disease in Bhutan and prevalent in areas of high humidity and low temperature. Maize and Sorghum are primary host while millet and some other grass species are secondary hosts for this disease.

Symptoms: long elliptical, grayish lesions with pointed ends (Figure 55) measuring about 2-15 cm develop on the leaves. The spot develop first on the lower leaves and continue to increase in size and number (Figure 56) until complete “burning” of the foliage (Figure 58). These spots may extend into the leaf sheath also (Figure 57).

2. GRAY LEAF SPOT

Causal organism: *Cercospora zeae maydis*

Symptoms:

Early lesions of GLS appear as pin-point sized, olive green spots which later grow into elongated, roughly-parallel (rectangular) sided lesions with a yellow halo (yellow halo is more visible when the leaf is held up against the light (Figure 59). Similar to TLB, the lesions of GLS too start from the lower leaves and progress upwards. Older lesions are pale brown to reddish brown in color and blocky to rectangular in shape (Figure 60). They may range in size from 0.5 to 2 or more inches in length. During periods of wet weather or high humidity, the pathogen may sporulate across the lesion, giving the lesion a grayish cast. Lesions may merge, resulting in large areas of dead leaf tissue (Figure 61).



Figure 59. *Young grey leaf spot lesion*



Figure 60. *Mature GLS lesions*



Figure 61. *Large areas of leaf tissue killed by GLS*



Figure 62. *Adult PTM moth*



Figure 63. *Larva of PTM*



Figure 64. *PTM Infested potatoes- Larval excreta which are bound together by web like matter*

IMPORTANT INSECT PESTS OF POTATO

1. POTATO TUBER MOTH

Lepidoptera: Gelechiidae

Phthorimaea operculella (Zeller)

Identifying characters

Adult moth: Grey abdomen, antennae almost as long as the body. Very narrow wings, the anterior pair yellowish grey (Figure 62) sprinkled with little black spots; the grey hind wings bear long bristles

Egg - laid singly on foliage and exposed tubers, oval, smooth, milky white

Larva - develop through four instars and are rosy white in colour with a brown black head and prothorax (Figure 63)

Pupa: Very narrow, 12 mm long, brownish, cocoon: whitish

2. GREEN APHID

Hemiptera: Aphididae

Myzus persicae (Sulzer)

Important vector that transmit potato virus diseases. Adult aphids appear in the summer, and are 1.8 to 2.1 mm long; the head and thorax are black, and the abdomen yellow-green with a dark patch on the back.

Winged (alate) aphids (Figure 67) have a black head and thorax, and a yellowish green abdomen with a large dark patch dorsally



Figure 65. *Wingless peach aphid*



Figure 66. *Aphid colony*



Figure 67. *Winged alate*



Figure 68. *Adult cutworm moth*



Figure 69. *Larva*



Figure 70. *Pupa of cutworm*

CUTWORMS:

The cutworm refers to the larval stages of several species of the Noctuid family which are known for their notorious habit of cutting and felling seedlings to the ground. Although several crops are affected, the problems are more severe on vegetable crops, asparagus, maize and potato. There are also species of climbing cutworms that move up plants and feed upon foliage, buds and shoots

3. BLACK CUTWORM

Lepidoptera: Noctuidae

Agrotis ipsilon (Hufnagel)

Adults are brownish-gray with a spot and a light silvery band on the front wings (Figure 68). The wingspan is about 35 mm. The larva of this cutworm is sometimes called the “greasy cutworm”.

Larvae are about 30 to 40 mm long when mature. They are gray with a lighter brownish colored stripe down the back (Figure 69). The head is dark brown or black.

IMPORTANT DISEASES OF POTATO

1. LATE BLIGHT OF POTATO

Phytophthora infestans

Late blight is one of the most serious fungal diseases of potato in all major potato growing areas in Bhutan. The epidemic occurs during heavy monsoons, when the weather remains cloudy and misty with continuous drizzle for several days.

Symptoms.

The disease usually appears around the time when potatoes start blossoming; but it can also occur at any time during the growth of the plant so long as the weather conditions are favourable.

The blighted areas first appear as faded green patches which soon become brownish black lesions. Lesions begin frequently at leaf tips and margins (Figure 71). Under conditions of high humidity and cool temperatures, lesions expand rapidly and the entire leaf may be killed in 1 to 4 days. If dry weather follows the appearance of lesions, the infection advances slowly and the affected areas curl and shrivel, while under moist conditions they remain limp and even decay, giving offensive smell.

The lesions spread from the leaflets to the petioles and then to the stem. Infected stems are weakened (Figure 72) and may cause entire plants to collapse.

When the spots on individual leaflets are examined, especially when the leaves are still moist, a white mycelium may be visible at the lower surface of the leaves surrounding the lesions (Figure 73 and 74).



Figure 71. *Blighted potato leaf*



Figure 72. *Late blight lesions on the stem*



Figure 73. *Mildew visible on the lower surface of the lesion*



Figure 74. *Mildew on the underside of the lesion*



Figure 75. *Potato haulm completely destroyed by late blight*



Figure 76. *Wet rot of tubers*

Potato tubers are infected while in the field and still attached to the plant or they get the infection during the harvest and sometimes in storage. It can be either a dry rot or a wet rot (Figure 76) depending upon the prevailing weather conditions. The first sign of tuber infection is a brown to purple discoloration of the skin followed by a brownish dry rot which extends to about half an inch below the surface.

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