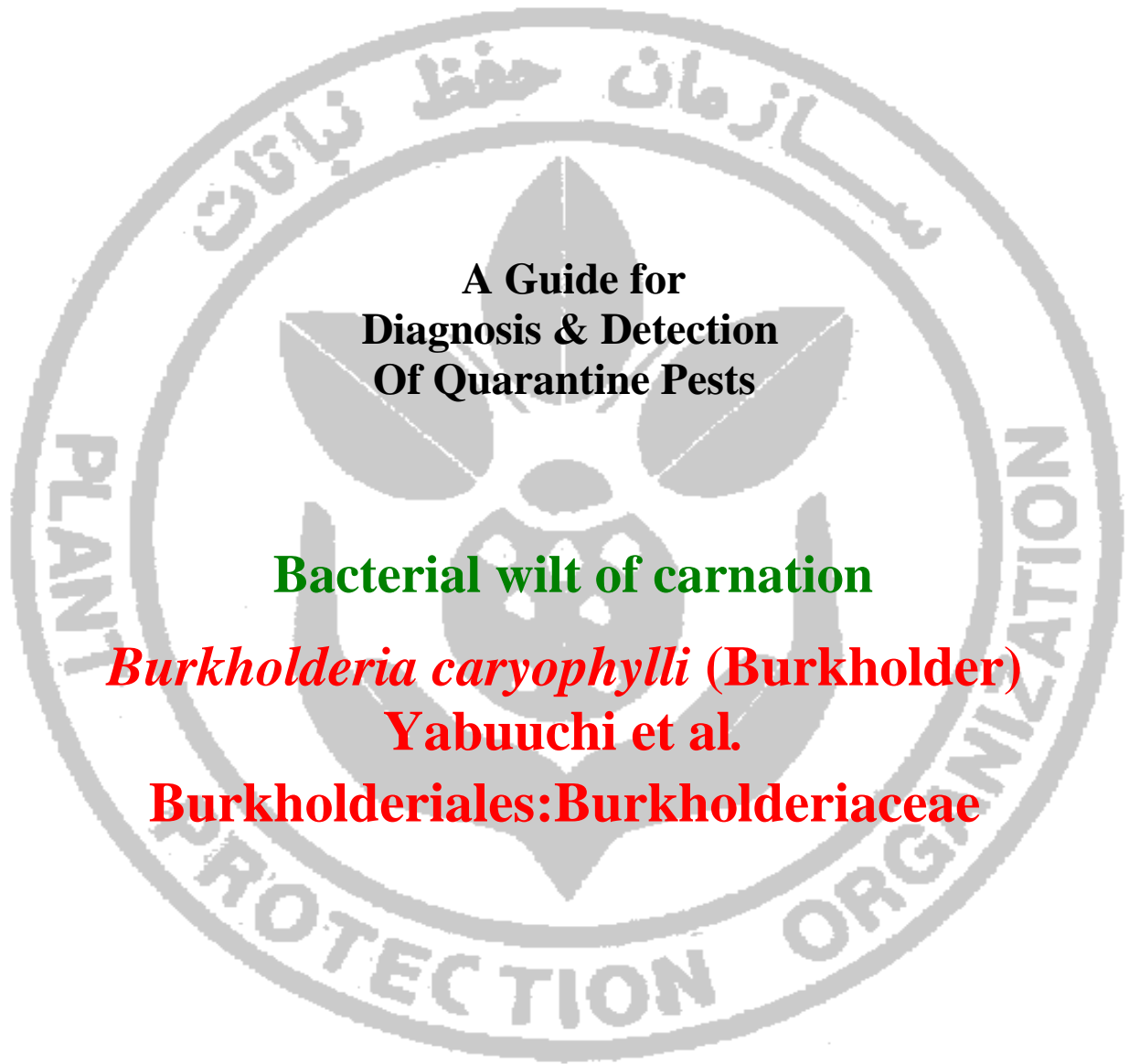




Islamic Republic Of Iran  
Ministry of Jihad-e-Agriculture  
Plant Protection Organization



**A Guide for  
Diagnosis & Detection  
Of Quarantine Pests**

**Bacterial wilt of carnation**

***Burkholderia caryophylli* (Burkholder)**

**Yabuuchi et al.**

**Burkholderiales:Burkholderiaceae**

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*Burkholderia caryophylli* (Burkholder) Yabuuchi et al.

**Domain: Bacteria**

**Phylum: Proteobacteria**

**Class: Betaproteobacteria**

**Order: Burkholderiales**

**Family: Burkholderiaceae**

**Other scientific names:**

*Pseudomonas caryophylli* (Burkholder) Starr & Burkholder

*Phytomonas caryophylli* Burkholder

**Common names:**

bacterial wilt of carnation

bacterial stem crack of carnation

carnation: bacterial wilt

carnation: bacterial stem crack

**Economic impact:**

*B. caryophylli* has caused serious damage in the USA since its first report in 1940. Only minor losses occur in Europe and the Mediterranean region at present (EPPO/CABI, 1996c). *B. caryophylli* causes a wilt of carnation. It also may cause stem cracking and a progressive rot of stems and roots. It used to be a major problem in carnation production in the USA (Jones, 1941; Gregory, 1942) and occasionally in the EPPO region (Hellmers, 1958) *B. caryophylli* has been recorded in a number of countries around the world, including the EPPO region (EPPO/CABI, 1998).

**Hosts:**

**Major hosts:**

*Dianthus caryophyllus* (carnation)

**Minor hosts:**

*Gypsophila paniculata* (babysbreath), *Helianthus annuus* (sunflower), *Limonium sinuatum* (sea pink)

**Geographic distribution:**

**Europe:** Former Yugoslavia, Italy, Serbia and Montenegro

**Asia:** China, Taiwan, India, Japan

**North America:** USA

**South America:** South America, Brazil, Colombia, Uruguay

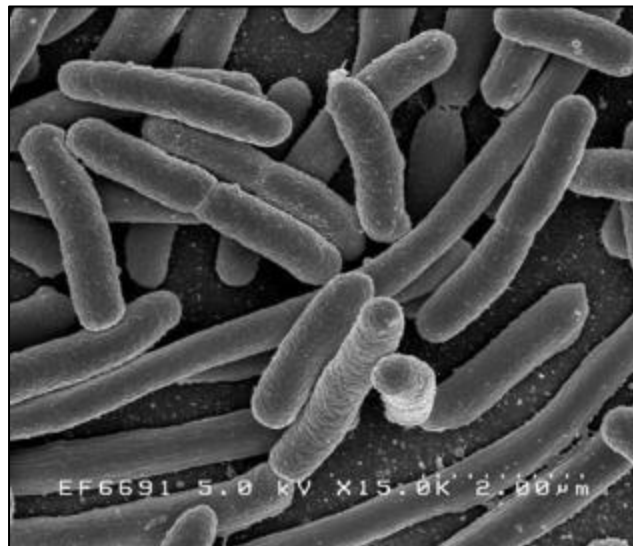


**Distribution map of *Burkholderia caryophylli***

### **Morphology:**

*B. caryophylli* is a straight or slightly curved rod with rounded ends, occurring singly or in pairs; it is aerobic, non-sporing, motile with one or several polar flagella, Gram-negative, sudanophilic, 0.35-0.95 x 1.05-3.18  $\mu\text{m}$ .

In PDA culture, colonies are round, smooth and shining with regular margins: while cream-coloured at first, colonies darken with age. On nutrient agar, growth is slow and cells die rapidly; subculturing is not possible after about a week.



**Bacterial cells of *Burkholderia caryophylli***

### **Biology and ecology:**

The bacterium can only enter plants through wounds, and subsequently colonizes the vascular system of the stem and roots. The primary infection source is infected cuttings taken from mother plants with a latent infection. Bacteria can pass from one cutting to another in the water of the propagating bed or, if the cuttings are held in water, before planting out. The observed slow, scattered spread of the disease indicates that spread occurs only from one root system to another. Bacterial slime is exposed when stems crack and this inoculum may be transferred from one plant to another. Temperatures over 20°C accelerate bacterial growth and therefore symptom expression, while at low temperatures infected plants may show no symptoms. For more information, see Dowson (1929), Burkholder (1942), Dimock (1950), Hellmers (1958), Garibaldi (1967).

### **Symptoms:**

Symptoms may take 2-3 years to manifest themselves, particularly when cuttings are mildly infected and maintained at relatively low temperatures. Foliage becomes greyish-green, later yellowing and wilting and then death may occur.

In stems, at soil temperatures below about 17°C, a rapid multiplication of cells leads to tension around the vessels and longitudinal, internodal stem cracks appear, usually at the base of the plant, and later develop into deep cankers. Initially, this cracking is very similar to the physiological cracking observed in certain cultivars. However, in pathogen-induced cracks, a brownish-yellow bacterial slime is visible, often overgrown with saprophytic fungi such as *Cladosporium herbarum* [*Mycosphaerella tassiana*]. In some cases, the extrusions from the cankers leave the stems hollow. At 20-25°C, cankers are more rare and wilting is the common symptom. Visual observation of peeled stems reveals sticky, brownish-yellow, narrow or broad, longitudinal stripes in the vascular tissue; in cross section, these appear as irregular brownish spots with a water-soaked margin.

Roots of infected plants, once wilting occurs, are more or less rotten, the plants being easily pulled out of the soil and, on cutting, roots show discontinuous brown spots which distinguish the disease from that caused by *Phialophora cinerescens* which leaves the roots apparently symptomless (EPPO/CABI, 1996a.)

Plants may survive about 1-2 months, but secondary invasion by fungi, such as *Fusarium* spp., accelerates death. Heavily infected cuttings wilt and die before roots are formed. For more information, see Dimock (1950), Hellmers (1958), Lemattre et al. (1964), Garibaldi (1967), Lemattre (1969) and Saddler (1994).



**Bacterial stem crack of carnation**





Yellow foliage and wilting of carnation caused by *Burkholderia caryophylli*



Foliage becomes greyish-green caused by *Burkholderia caryophylli*

## Symptoms by affected plant part

**Leaves:** abnormal colours

**Roots:** rot

**Stems:** abnormal exudates

## Means of movement and dispersal

**Plant parts liable to carry the pest in trade/transport**

- **Leaves:** borne externally; visible under light microscope.
- **Seedlings/Micropropagated Plants:** borne externally; visible under light microscope.
- **Roots:** borne externally; visible to naked eye.
- **Stems (above Ground)/Shoots/Trunks/Branches:** borne externally; visible under light microscope.

**Plant parts not known to carry the pest in trade/transport**

- Bark
- Bulbs/Tubers/Corms/Rhizomes
- Fruits (inc. Pods)
- Growing Medium Accompanying Plants
- Flowers/Inflorescences/Cones/Calyx
- True Seeds (inc. Grain)
- Wood.





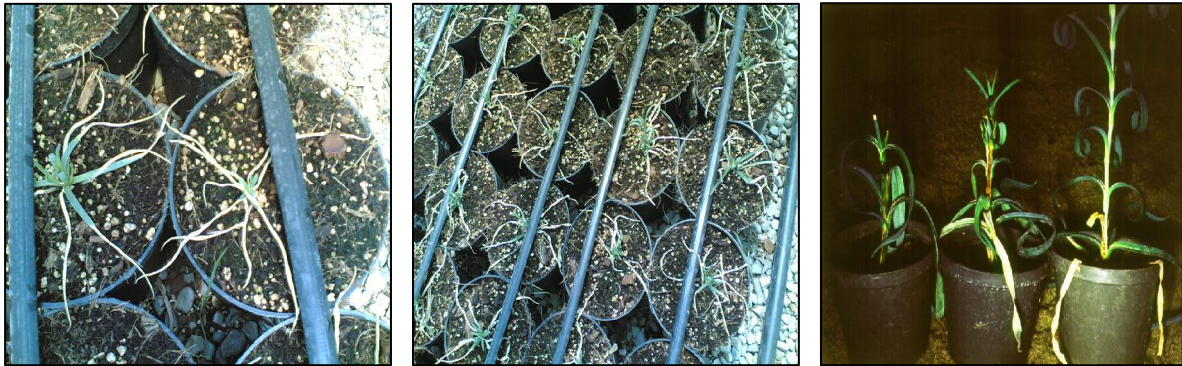
### Phytosanitary significance

*B. caryophylli* is an EPPO A2 quarantine pest (OEPP/EPPO, 1978), in view of the limited number of EPPO countries in which it has been reported, and the fact that it is readily carried on cuttings in international trade. However, the lack of recent publications on this organism and the disease it causes indicate that its importance is now very minor. It is also of quarantine significance for JUNAC. *B. caryophylli* is also listed as a quarantine pest for Iran

### Detection and inspection

To make a reliable diagnosis, many old and young stems should be examined and isolations made from diseased tissue. Microscopic observation of stem sections shows neoformations around infected vessels, plugging of vessels, hyperlignification of their walls and necrosis. Since latent infections on cuttings cannot be readily detected, cuttings should be kept at a relatively high temperature to ensure maximum symptom expression.

The bacterium can be reliably detected by immunofluorescence staining (IFAS) and direct isolation even in material with latent infection (Muratore et al., 1986)



### Detection and inspection of bacterial wilt of carnation

## References:

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3. [http://www.eppo.int/QUARANTINE/bacteria/Burkholderia\\_caryophilli/PSDMCA\\_ds.pdf](http://www.eppo.int/QUARANTINE/bacteria/Burkholderia_caryophilli/PSDMCA_ds.pdf)
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