Japanese apple rust

*Gymnosporangium yamadae* belongs to the Pucciniales, an order that includes rust fungi that cause diseases on plants. *Gymnosporangium yamadae* has been limited in distribution to Asia (China, Japan and Korea) where it can be a serious pathogen of cultivated apples, especially if the host of the telial state, *Juniperus* spp., occurs in close proximity. This fungus was recently reported from the United States (DE, PA) in its aecial state on the ornamental tree, *Malus toeringo* (Yun et al. 2009).

*Gymnosporangium yamadae* Miyabe ex G. Yamada 1904

**Aecia** on *Malus*, foliicolous, then hypophyllous, also less commonly caulicolous, fructicolous; initially developing in a whitish leaf spot that becomes rose red with a distinct margin.

**Peridium** cornute to tubular, 3-7(-8) mm high, retaining this shape at maturity but with lacerate sides that often form a reticulate pattern, apex typically closed to occasionally dehiscent, yellow-brown to brown; peridial cells long-narrow rhomboid to linear-rhomboid, 59-115 µm long, pale yellow, appearing verrucose with long papillae to tuberculate, outer walls smooth, inner and side walls sparsely echinulate.

**Aeciospores** globoid, 16-26 × 18-27 µm, walls dark yellow, 1.0-2.5 µm thick, rarely up to 3.5 µm thick, sparsely echinulate, 4-7 pores scattered on surface.

**Telia** on *Juniperus*, caulicolous, rarely foliicolous, produced on globose swellings or small galls, telial horns cylindric-acuminate, 1-3 mm diam, 5-8 mm high or more, orange, gelatinous.

**Teliospores** two-celled, oblong, ellipsoid or obovoid, 15-28 x 32-56 µm, walls 0.8-2.0 µm thick, yellow or orange, with two pores near septum and one pore toward apex in upper cell, frequently with an obtuse, hyaline papilla at apex.

**Hosts** Aecial state - *Malus asiatica, Malus baccata, Malus halliana, Malus micromalus, Malus platycarpa, Malus prunifolia, Malus pumila var. domestica, Malus scheideckeri, Malus spontanea, Malus theifera, Malus toeringo, Malus transitoria, Malus yannanensis*. Telial state - *Juniperus chinensis, Juniperus chinensis var. procumbens, Juniperus chinensis var. sargentii, Juniperus squamata*.

**Geographic distribution** Asia: China (Gansu, Guangxi, Hebei, Henan, Hunan, Jilin, Jiangsu, Liaoning, Shandong, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang); Japan (Hokkaido, Honshu), and Korea (North Korea, South Korea). Recently reported from the United States (Delaware, Pennsylvania).

**Note** *Gymnosporangium yamadae* is morphologically similar to *G. globosum*, cause of American hawthorne rust. *Gymnosporangium globosum* occurs primarily on *Crataegus*, rarely on *Malus* and other hosts of Rosaceae. Differences exist in shape and size of the aecia, peridial cells and telia. In *G. globosum* the peridial cells are 44-95 µm long, somewhat smaller than those of *G. yamadae*. The inner and side walls of the peridial cells of *G. globosum* are ridged rugose rather than verrucose-tuberculate as in *G. yamadae*. The telia of *G. globosum* are (3-)6-12 mm high, larger than those *G. yamadae* and the teliospores of *G. globosum* lack an apical papilla. For additional descriptions, see Hiratsuka et al. (1992), Kern (1973), and Laundon (1977a, b). *Gymnosporangium yamadae* is a serious pathogen of cultivated apple in Asia (Cummins and Hiratsuka1983, Kern 1973, Yun 2003). The telial host, *Juniperus chinensis*, occurs in native forests in China, Japan and Korea, and it is also cultivated in gardens (Yun 2007). The alternate hosts, *Malus baccata, M. domestica, M. prunifolia and M. toeringo* are often planted in the same place with *J. chinensis*. With the increased movement of juniper as nursery stock and cultivated apple as both nursery stock and fruits for consumption, the risk of introduction to other countries is high.
Aecia of *G. yamadae* on *Malus toringo*

Aeciospore and peridial cells of *G. yamadae* on *Malus sieboldii*

Aeciospore of *G. yamadae* on *Malus sieboldii*

Telia (big gall) of *G. yamadae* on *Juniperus chinensis L. var. kaizuka*
Teliospores of G. yamadae on Juniperus chinensis

Telia (big gall) of G. yamadae on Juniperus chinensis var. kaizuka