

## Goji Berry Gall Mite *Aceria kuko* Occurrence in the Czech Republic – Short Communication

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### Abstract

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Damage caused by the Goji berry gall mite, *Aceria kuko* (Kishida, 1927) was observed on the leaves of *Lycium chinense* Miller (Solanaceae) in Brno in August 2016 and on *L. barbarum* L. in Popovice in September 2016. *Aceria kuko* is a pest of Asian origin which is common in China and occurs only sporadically on Goji berry plants in the European Union. This is the first observation of the Goji berry gall mite occurrence in the Czech Republic.

**Keywords:** *Aceria kuko*; *Lycium* spp.; Asian origin

The Goji berry, *Lycium chinense* Miller (Solanaceae), is going to be a very popular plant for hobby growers in the Czech Republic. Its fruits are considered to be a “superfood” beneficial for health. Another species, *Lycium barbarum* L., which is common in the Czech Republic, usually occurs at ruderal sites. *L. barbarum* is used in the same way as *L. chinense* in some countries, and it is called Goji berry as well (TAO *et al.* 2004; MAUGHAN & BLACK 2015). Sometimes *L. barbarum* L. and *L. halimifolium* Mill. are considered to be different species, but these names are the synonyms (RIPKA *et al.* 2015; J. Uher 2016 – personal communication). Some species (*Capsicum annuum* L., *Solanum nigrum* L.) that belong to the family Solanaceae are considered to be feeding plants of *A. kuko* as well; infestation of *C. annuum* was confirmed (ANDERSON & OSTOJA-STARZEWSKI 2009).

The Goji gall mite, *Aceria kuko* (Kischida, 1927), is native to South-East Asia (MANSON 1972; HONG & ZHANG 1996; ANDERSON & OSTOJA-STARZEWSKI 2009). It was described infesting *Lycium chinense* in Japan in 1927. HONG *et al.* (2006) suggested that *A. kuko* may be invasive in China. Thereafter it has been introduced into other countries through the global trade – into South Korea and China. In the

European Union, the presence of *A. kuko* was confirmed for the first time in 2008, then it was intercepted in the United Kingdom, the Netherlands and in Germany (EPPO 2011). In Greece and Slovenia its occurrence was reported in 2012 by CICEOI and MARDARE (2016), in 2015 in Hungary by RIPKA *et al.* (2015), and in Romania by CHIRECEANU *et al.* (2015).

The host range of *A. kuko* is limited. This mite forms foliar galls on wild *Lycium barbarum*, *L. chinense* and *Solanum nigrum*, and on glasshouse culture of *Capsicum annuum*. As ANDERSON and OSTOJA-STARZEWSKI (2010) stated, susceptibility of other species belonging to the family Solanaceae is possible.

The biology of *A. kuko* was studied in Japan (CHINONE 1968) and Korea (KIM 1968). The extremely small pale salmon-pink adult mite (160–250 µm in length) has elongated worm-like or fusiform body, having only two anterior pairs of legs. Juvenile stages are cream-colored to white. Mature females produce about 28–30 colourless transparent eggs (AMRINE & STASNY 1994; OSTOJA-STARZEWSKI 2009). Generation time (egg to adult) is 7.5 to 12 days, and adult longevity 25 to 30 days. There are approximately 6–7 overlapping generations per year at temperatures of 25–35°C (CHINONE 1968; OSTOJA-STARZEWSKI

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2009). ANDERSON and OSTOJA-STARZEWSKI (2009) described the activity of gall mites below 0°C. The presence of the pest is indicated by symptoms on the host leaves. A high population density of gall mites may cause plant damage.

There is another habitually similar mite *Aceria eucricotes* (Nalepa, 1892), which is a pest of *Lycium arabicum* Schweinf. ex Boiss., *L. barbarum*, *L. europaeum* L., and *L. intricatum* Boiss. (PIRONE 1978). XUE *et al.* (2009) showed *L. mediterraneum* Dunal and *Solanum nigrum* as its host plants too. The galls of *A. eucricotes* have sunken centres (PIRONE 1978). This species absents in central Europe including the Czech Republic (EPPO 2015; MAGOWSKI 2017).

## MATERIAL AND METHODS

The galls and adults of *Aceria kuko* (Kishida, 1927) on Goji berry plants (*Lycium chinense* Miller) were observed at first in a private garden (49°7'53"N, 16°39'22"E) in Brno-Chrlice in August 2016. The potted plants were purchased from a local garden centre in Brno in 2013. Chrlice are located south of the confluence of the Svatka and Svitava rivers. Another collection comes from Popovice (49°10'31.594"N, 16°60'.56.144"E, 159 m a.s.l.) and was gathered from wild *Lycium barbarum* L. plants in September 2016. Both these territories have a character of lowland (190–228 m a.s.l.) and they belong to the warmest and driest areas of the Czech Republic. In this region, the growing season is longer than 180 days and rainfall is 500–650 mm per year.



Figure 1. The galls on the *Lycium chinense* leaves

The host plant determination as *Lycium barbarum* was confirmed by J. Winkler (2016 – personal communication). We used 25 adult mites for the identification which was based on a description provided by HUANG (2008) and RÍPKA *et al.* (2015).

The level of damage was assessed according to the number of galls per leaves of the host plants. A hundred sample leaves were taken from each observed plant to make a final count to determine the total number of average infestation of plants.

A possibility of the infestation of other Solanaceae plants was examined by the cultivation of tomato (*Solanum lycopersicum* L.), potato (*S. tuberosum* L.), and red pepper (*Capsicum annuum* L.) plants which are commonly grown by professional and amateur growers. *Solanum laxum* Spreng. (prev. syn. *S. jasminoides* Paxton) represented the ornamental plants of the family Solanaceae in this experiment.

## RESULTS AND DISCUSSION

The occurrence of the Goji gall mite *Aceria kuko* (Kishida, 1927) was observed on *Lycium chinense* Miller in August 2016 in Brno-Chrlice (Brno-City district) and on *L. barbarum* in Popovice (Brno-Country district) in September 2016. In Chrlice the *L. chinense* plants, with no visible symptoms, were planted in a private garden in autumn 2013. It is likely that the mites occurred already on purchased plants and galls appeared on the leaves in a small number earlier (2014, 2015), i.e. the mites successfully overwintered outdoors. Large numbers of galls on the leaves (Figures 1 and 2) of *L. chinense* were recorded in September 2016, when the count of galls on the host plant leaves was 1–9 (max. 14). The leaves of both observed *L. chinense* plants were infested by four and six galls per leaf on average. In Popovice



Figure 2. *L. chinense* sprout infested by *Aceria kuko*





Figure 3. The galls of *Aceria kuko* on upper side of the leaf

the galls of *A. kuko* were present on *L. barbarum*, but their occurrence was not uniform on all of the seven observed bushes. While three plants were heavily infested and the average number of galls per one leaf was between seven and nine, two plants showed six galls per leaf. The other two showed low infestations, only two or three galls per leaf.

The galls of the Goji gall mite *Aceria kuko* were present on each leaf surface and on petioles of *L. chinense* and *L. barbarum* plants. They were not present on buds and shoots of the observed plants. The blister galls protrude from the upper surface (Figure 3) of the leaf and their ostioles are opened to the lower surface (Figure 4). The galls occurred individually and/or in groups, they were green, later with reddish to greyish-brown coloured obverse, rounded (1.5–4 mm in diameter) and/or elongated (3–6 mm long and 2–3 mm wide). Small galls were hemispheric, the bigger ones were slightly bulging. The eriophyoid mites, females, and eggs were present in the majority of the galls. The mites were also present on bud surfaces and in bark cracks. The leaves bearing many galls were visibly deformed.

After identifying the mites as *Aceria kuko* (Figure 5), the infested Goji berry plants in a private garden were



Figure 4. The galls of *Aceria kuko* on lower side of the leaf

destroyed. Neither on other host plants (*Solanum nigrum* L. or *Capsicum annuum* L.) in private gardens nor on *C. annuum* plants in glasshouses *A. kuko* was found out. Laboratory transfer to *Solanum lycopersicum* L., *S. tuberosum* L., *Capsicum annuum* L., and *Solanum laxum* Spreng. was unsuccessful, although ANDERSON and OSTOJA-STARZEWSKI (2010) showed infestation on these Solanaceae plants.

Neither chemical nor biological protection against this pest is sufficiently resolved in the Czech Republic. Only the mites outside of the galls are affected by acaricides but others staying inside the galls are protected and the preparations against them seem to be ineffective. The majority of mites overwinter inside the galls, only some of them overwinter on the sprout surface. Removing fallen leaves helps reduce an overwintering mite population, but eradication of this invasive species is not feasible. In the USA, where Goji berry is commercially planted, the Goji berry gall mite is considered to be an important pest and the control measures such as using sulphur, insecticidal soap and horticultural oils for protection is recommended by MAUGHAN and BLACK (2015).

The mites are spread by infested plants and they may be carried by wind as aerial plankton, by insects (e.g. bee, bumble bee) and on clothing (ALBERT 2012).

*Lycium barbarum* is common in the Czech Republic. It occurs at different sites e.g. ruderal ones, along the roads and other routes, often close to gardens. The presence of *A. kuko* on these plants may serve as a primary source of infestation by this mite.

In the Czech Republic Goji berry (*Lycium chinense*) plants are grown only in private gardens. There is no information about its growing in commercial orchards here. The reasons for *A. kuko* occurrence in the Czech Republic seem to be similar to those in the United Kingdom, i.e. the pest might have been introduced with imported Goji berry plants. Large

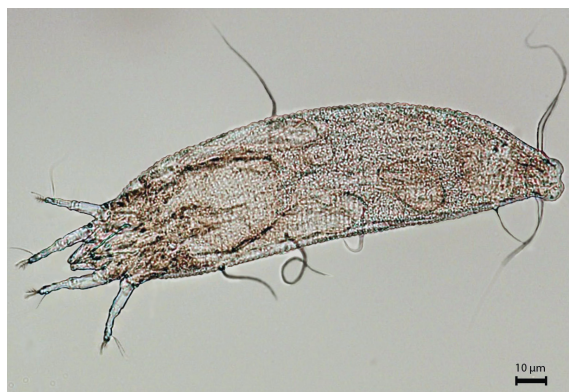


Figure 5. Adult of *Aceria kuko*

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numbers of Goji berry plants were imported to the UK from China in 2007 and 2008 (EPPO 2011). A part of them was growing outdoors during the 2007/2008 winter and symptoms of mite infestation did not appear until 2008. It is apparent that the mites successfully overwintered outdoors. In the Czech Republic hobby growers usually obtain plants from garden centres via mail and exchanging plants between hobby growers is widespread. Especially the latter one represents a risk of pest and pathogen introduction, because the phytosanitary control of these plants is limited or impossible.

There is a separate problem, which is a possibility of obtaining infested Goji berry plants via direct marketing, when the plants are sold by companies specialized in this type of trading. While the plants sold in the EU are or may be inspected by a competent control authority, these companies are hardly regulated and some of them come from the third countries and their inspection is impossible. The illegal import of Goji berry plants from the third countries into the EU is deemed a main problem (GILTRAP *et al.* 2009).

In the Czech Republic, the Goji berry gall mite is not currently considered a pest of commercial crops, but monitoring its occurrence is necessary.

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