

CSL PEST RISK ANALYSIS FOR *ACERIA TULIPAE*

STAGE 1: PRA INITIATION

1. What is the name of the pest?

Aceria tulipae (Keifer) Acari Prostigmata Eriophyidae onion mite, dry bulb mite, garlic mite, tulip mite

Synonym

Eriophyes tulipae Keifer, 1938 BAYER CODE: ACEITU

Notes on taxonomy:

North American literature often mistakenly uses *Aceria tulipae* as the name for the mites found on cereals and related grasses, such as *A. tosichella* and *A. tenuis* (CABI, 2006).

2. What is the reason for the PRA?

Aceria tulipae is not known to occur in the UK, but was found on onion (*Allium cepa*) sets[1] from the Netherlands in February and March 2006 (Ostoja-Starzewski and Matthews, 2006). The onions had been sent to CSL to be screened for plant pathogens (Ostoja-Starzewski and Matthews, 2006; in prep.).

3. What is the PRA area?

Aceria tulipae occurs in the EPPO region and in the EU so this PRA considers the UK to be the PRA area.

STAGE 2: PEST RISK ASSESSMENT

4. Does the pest occur in the PRA area or does it arrive regularly as a natural migrant?

No. There is no evidence that *Aceria tulipae* occurs in the PRA area. It does not migrate into the PRA area.

5. Is there any reason to suspect that the pest is already established in the PRA area?

Yes. Given that onion and tulip bulbs have been imported for many years from countries where *A. tulipae* occurs, there has been ample opportunity for the organism to enter the UK, but if no damage is caused, *A. tulipae* could go un-noticed thus it may be present yet unrecorded. A previous report of *A. tulipae*

[1] Onion sets = onion bulbs for planting and propagating onions

in the UK (Chamberlain & Evans, 1980) is considered to be erroneous since the mite was found on grasses and was probably a misidentification (see above, "Notes on taxonomy") (Ostoja-Starzewski and Matthews, 2006; in prep).

In the 2006 growing season, all fields where potentially infested onion sets from the known infested batch were planted were monitored by the PHSI. Samples of onions were taken for laboratory examination. No *A. tulipae* were found (Ostoja-Starzewski and Matthews, 2006; in prep.).

6. What is the pest's status in the Plant Health Directive (Council Directive 2000/29/EC[2]) ?

Aceria tulipae is not listed in the Plant Health Directive.

7. What is the pest's status in the European and Mediterranean Plant Protection Organisation (EPPO)? (www.eppo.org)

EPPO List:	A1 regulated pest list	No	A2 regulated pest list	No	Action list	No	Alert list	No

Aceria tulipae is not on any EPPO list.

8. What are the pest's host plants?

Aceria tulipae has hosts are in the families Alliaceae and Liliaceae. Hosts include *Allium* species such as *A. ampeloprasum* (leek), *A. ascalonicum* (shallot), *A. cepa* (onion), *A. sativum* (garlic), *A. schoenoprasum* (chives), and *Tulipa* (tulip). *Allium chinense* (rakkyo) is a secondary host.

9. What hosts are of economic and/or environmental importance in the PRA area?

All hosts are of economic importance in the PRA area. Over the past 10 years, the UK area of onions and leeks has averaged approximately 13,000 ha with a value of just under £100 million. Although prices are variable, green (spring) onions have been worth approximately £1,200 /tonne; leeks £800 /tonne and dry bulb onions worth £80 to 120 /tonne (derived from Defra, Basic Horticultural Statistics, 2006. See Annex 1.).

10. If the pest needs a vector, is it present in the PRA area?

No vector is required. This is a free-living organism.

[2] http://europa.eu.int/eur-lex/en/consleg/pdf/2000/en_2000L0029_do_001.pdf

11. What is the pest's present geographical distribution?

Aceria tulipae is reported from all continents except Antarctica. Table 1 gives details.

Table 1: Distribution of *Aceria tulipae*

North America:	Canada, Mexico, USA (California, Georgia, Kansas, Nebraska, North Dakota, Oregon, South Dakota, Washington)
Central America:	Cuba
South America:	Brazil, Chile, Venezuela
Europe:	Bulgaria, Denmark, Finland, Germany, Hungary, Italy, Moldova, Netherlands, Poland, Spain
Africa:	Egypt, South Africa, Tanzania
Asia:	Bangladesh, Georgia, India, Indonesia, Japan, Philippines, Russian Federation, Tibet, Thailand, Vietnam
Oceania:	Australia, Fiji, New Zealand

Sources: CABI, 2006; Ostoja-Starzewski and Matthews, 2006.

12. How likely is the pest to enter the PRA area[3]?

Very Unlikely		Unlikely		Moderate likelihood	✓	Likely		Very Likely	

Despite the long history of importing onion sets from the Netherlands, neither the mite, that is very small and difficult to see with the naked eye, nor symptoms, have been reported in the UK previously. This could be because,

(i) the mite is not usually carried on imported onion sets (there are no records of *A. tulipae* causing problems on onions in the Netherlands (Ostoja-Starzewski and Matthews, in prep.)),

(ii) the mite is carried with onion sets but no perceivable damage is caused and due to the mites small size, it is not detected,

(iii) the mite is carried with onion sets and any damage done is mistakenly explained by other reasons.

Industry sources report that in 2006 just over 30% of the UK onion crop area was grown from sets (2,667 ha) and almost 70% grown from onion seed (5,745 ha). Of the area grown from sets, 2,109 ha were spring brown sets, 332 ha were overwintered brown sets; and 226 ha spring red sets. Around half of all sets would have been from the Netherlands (D. O'Connor, pers. comm. to Martin Ward, Defra). Since a large proportion of sets come from the Netherlands, where *A. tulipae* occurs, it is possible that the mite could be carried from the Netherlands into the UK, although as noted above, there are no records of *A. tulipae* causing problems on onions in the Netherlands.

If infested bulbs were planted out the mite could transfer to suitable hosts via aerial dispersal, as is common amongst other eriophyids (Jeppson *et al.*, 1975), although Conijn *et al*., (1996) indicate that the spread of this mite

[3] Pest entry includes an assessment of the likelihood of transfer to a suitable host (ISPM No. 11, FAO, Rome)

outdoors is limited. If *A. tulipae* was carried into onion stores, they could survive and transfer to other bulbs (Conijn *et al*., 1996).

13. How likely is the pest to establish outdoors in the PRA area?

Very Unlikely		Unlikely		Moderate likelihood		Likely	✓	Very Likely	

Based on the current known distribution of *A. tulipae*, the mite is likely to be able to establish outdoors in the UK. The developmental biology of *A. tulipae* has been studied by Manson (1970), Wahba *et al*., 1984 and Courtin *et al.,* (2000). Based on data in Courtin *et al*., (2000), the threshold temperature for development is approximately 6°C and approximately 188 degree days above the threshold are required to complete development from egg to adult. Optimum development occurs at around 25°C.

Infested bulbs planted in the UK could support *A. tulipae*. Depending upon temperature, there could be perhaps up to 9 generations per year in southern England. Cool temperatures would prevent population growth during the winter although eggs, nymphs and adults are able to survive in the bulbs for extended periods either in storage or in bulbs left in the soil during winter (Wahba *et al*., 1984; CABI, 2002).

14. How likely is the pest to establish in protected environments in the PRA area?

Very Unlikely		Unlikely		Moderate likelihood		Likely		Very Likely	✓

Although hosts are only grown outdoors, this pest could establish in the protected environments of *Allium* storage facilities. Eggs, nymphs and adults are able to survive in bulbs for extended periods in storage, and are the main source of infestation of the following year's crop (Wahba *et al*., 1984).

15. How quickly could the pest spread within the PRA area?

Very Slowly		Slowly	✓	Moderate pace		Quickly		Very quickly	

If infested bulbs were planted out the mite could disperse aerially, as is common amongst other eriophyids (Jeppson *et al.*, 1975), although Conijn *et al*., (1996) indicate that the spread of *A. tulipae* outdoors is limited.

Natural spread would be limited to the local environment (Ostoja-Starzewski and Matthews, 2006). Spread nationally would most probably be facilitated through trade in infested bulbs.

16. Without official control what level of economic and/or environmental impact is the pest likely to cause in the PRA area?

Minimal ☐ Minor ☑ Moderate ☐ Major ☐ Massive ☐

Aceria tulipae was reported as damaging Dutch tulip cultivation in the 1950s (Anon., 1951) but there are no records of it causing damage to onion crops in the Netherlands (Ostoja-Starzewski and Matthews, in prep.). In Hungary, where *A. tulipae* has been known from onion crops for many years, recent hot dry summers has made damage by the mite more conspicuous (Budai *et al.*, 1997). Elsewhere, also in warm regions, *A. tulipae* is primarily regarded as a pest of stored garlic, for example in the southern USA (Lange, 1955; Smalley, 1956) and southern France (Courtin *et al*., 2000). It can also be a pest of stored onions in warm climates such as Australia (Halliday & Knihinicki, 2004) and southern Africa (Daiber, 1996). Courtin *et al*. (2000) regard *A. tulipae* as the main invertebrate pest in all garlic production areas around the world.

A. tulipae feeds on the foliage of hosts and between the layers in bulbs. Feeding causes stunting, twisting, curling and discoloration of foliage and scarification and drying of bulb tissue (Lange, 1955; Smalley, 1956; Keifer *et al*.,1982). There is scant information quantifying the impact of this pest. However, what data there is suggests that when bulbs are severely infested, losses could be significant, for example approximately 30% losses have been reported from onions (Liro, 1942). In field trials, Larrain (1986) measured yield losses of 23% in garlic due to *A. tulipae*. However, lack of evidence as a pest on onions and leeks (the main hosts at risk in the UK) in cooler climates, suggest that if *A. tulipae* did establish in the UK, only minor impacts could be expected.

17. What is the pest's potential as a vector of plant pathogens?

Aceria tulipae can transmit *Onion Mite-borne Latent virus* and *Shallot Mite-borne Latent virus*. Neither of these viruses occurs in the UK (Ostoja-Starzewski and Matthews, 2006). Vectoring these viruses would not significantly increase any impact resulting from feeding damage caused by the mite since virus symptoms and damage resulting from mite feeding is very similar (Vandijk *et al*., 1991).

STAGE 3: PEST RISK MANAGEMENT

18. How likely is the pest to continue to be excluded from the PRA area?

	very Likely	Likely	Moderate likelihood	Unlikely	very Unlikely
Outdoors:	☐	☐	☑	☐	☐
In protection	☐	☐	☑	☐	☐

Despite the large volume of onion sets brought into the UK from overseas each year, the existing pest management measures used by the trade seem

to be effective at preventing this mite from reaching the UK. However, the system is not infallible given that this PRA was initiated following the detection of the mite on imported bulbs.

19. How likely are outbreaks to be eradicated?

Very Likely	Likely	Moderate likelihood	Unlikely	Very Unlikely
☐	☑	☐	☐	☐

Infested bulbs could be destroyed *in situ* or marketed for consumption rather than propagation. "Carry over" into subsequent crops could be prevented by the elimination and careful disposal of groundkeepers.

20. What management options are available for containment and control?

Before planting: Hot water treatment of bulbs (55 ºC for 10-20 min, or 60 ºC for 10–15 min) prior to planting can reduce mite populations, but such temperatures also reduce bulb germination. Soaking garlic for 24 h in 2% soap (not detergent) and 2% mineral oil has been reported to provide good mite control (Anon., 2004).

In the field: Flood irrigation is used to reduce populations in garlic fields in the USA (Anon., 2004).

Post harvest: *A. tulipae* requires high humidity to thrive, so following harvest, infestations can be controlled with the normal drying process prior to bulb storage (Anon., 2004). Measures to prevent the movement of infested bulbs, soil or foliage between growing sites and storage facilities would inhibit spread.

21. Further work that would reduce uncertainties

Area of PRA	Uncertainties	Further work that would reduce uncertainty
Taxonomy	Note confusion in older N. American literature with *A. tosichella* and *A. tenuis*	Confusion has now been resolved.
Pathway	Inspection effort of bulbs entering the UK is unknown. Checks made pre-export from NL unknown.	Ask PHSI about inspecting bulbs.
Distribution	Presence in UK is unknown. Could be more widespread in Europe.	UK survey. Check literature and note further spread.
Establishment	Ability to overwinter in UK conditions uncertain.	Could be determined by experiments.
Spread	Rate of spread within trade is unknown.	Map distribution and flows of bulbs. Info from NL could help.
Impact	Most impacts reported in storage in warmer countries. Population density that causes economic damage is uncertain. Damage in Europe is unknown.	Could be determined by experiments or data from countries reporting damage e.g. Australia, Hungary, southern Africa, perhaps NL

Management	Alternative measures to heat treatment may be available, e.g. space treatments	Investigate alternative measures.

22. Summary

Aceria tulipae is a mite that is present in many countries around the world and widespread in Europe. A previous record of this mite in the UK is considered erroneous and there is no evidence that *Aceria tulipae* is established in the UK (Ostoja-Starzewski and Matthews, 2006; in prep). *A. tulipae* is mainly regarded as a pest of bulbs in storage, especially in warmer countries where it is a significant pest of garlic bulbs in storage and one of several pests in stored onions. In the UK it is likely to be able to establish both outdoors and in storage facilities, although since impacts are mainly reported from warmer countries, significant damage is not expected in UK conditions.

23. Conclusion

Although there are no official records of *Aceria tulipae* in the UK, it has not been widely surveyed for and it is possible that populations are present yet remain undetected or un-noticed. In the absence of further surveys/sampling to more confidently establish its status in the UK, and considering the likelihood of no significant damage, no phytosanitary measures are recommended.

The Plant Pest Notice (Ostoja-Starzewski & Matthews, 2006) should be used to raise awareness of the pest within industry.

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ANNEX 1: *Allium* data from DEFRA Basic Horticultural Statistics 2006

http://statistics.defra.gov.uk/esg/publications/bhs/2006/default.asp

1) Area planted (ha)

CROP YEAR	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06		
Onions, Dry Bulb	8,202	9,325	8,845	9,529	9,228	9,058	8,603	8,387	8,480	8,592	8,561		
Onions, Green	2,146	2,455	2,313	2,298	2,549	1,739	1,363	1,318	1,987	1,808	2,069		
Leeks	3,042	2,617	2,477	2,776	2,645	1,978	2,068	1,717	2,010	2,005	1,696	Mean	
	13,390	14,396	13,634	14,603	14,422	12,775	12,034	11,422	12,477	12,404	12,326	13,080	ha

2) Tonnes harvested (000 tonnes)

CALENDAR YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005		
Onions, Dry Bulb	224.7	284.5	335.9	342.0	391.4	392.7	374.9	283.4	373.6	340.9	383.4		
Onions, Green	24.1	28.4	26.2	25.3	26.1	19.0	13.3	11.3	16.4	10.5	21.1		
Leeks	61.5	53.9	45.9	52.3	50.9	44.3	44.3	38.0	35.9	40.2	49.8	Mean	
	310.3	366.8	408.0	419.5	468.4	456.0	432.5	332.7	425.8	391.7	454.3	406	000 tonnes
yield (tonnes /ha)	27	31	38	36	42	43	44	34	44	40	45		
	11	12	11	11	10	11	10	9	8	6	10		
	20	21	19	19	19	22	21	22	18	20	29		

3) Value of Home prodn marketed (£'000)

CALENDAR YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005		
Onions, Dry Bulb	57,605	38,799	48,595	66,173	42,671	34,405	44,691	32,012	43,002	44,090	33,591		
Onions, Green	31,755	32,803	33,094	30,471	29,502	21,387	18,094	14,560	20,784	13,148	26,152		
Leeks	31,844	35,141	22,945	24,306	26,476	25,182	30,507	28,252	30,170	30,686	39,670		
	121,202.6	106,743.7	104,634.9	120,950.6	98,649.0	80,974.1	93,292.1	74,823.6	93,956.1	87,924.2	99,411.8	98,415	£'000
Value per tonne													
Onions, Dry Bulb	256	136	145	194	109	88	119	113	115	129	88	136	£/tonne
Onions, Green	1,318	1,153	1,261	1,204	1,130	1,126	1,360	1,293	1,270	1,252	1,242	1,237	£/tonne
Leeks	517	653	500	465	520	569	689	744	841	763	797	642	£/tonne