REPORT TO THE SUMICH COMPANY

2014

BIO Monitoring international

Terrestrial invertebrates, are "the little things that run the world"
says the eminent scientist E O Wilson

PREMIUM SUMICH EST. 1944

www.sumich.com

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REPORT ON RESTRICTIONS FOR EXPORTING CELERY (*APIUM GRAVEOLENS*)

Prepared Report for: North East Equity Pty Ltd

Prepared by: BioMonitoring International Pty. Ltd., March 2014

Report Status		
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ABBREVIATIONS AND ACRONYMS

DAFF	Department of Agriculture, Food and Forestry (now Commonwealth Department of Agriculture)
ICON	Import Conditions of DAFF
MICoR	Manual of Importing Country Requirements
PC	Phytosanitary Certificate
SPS	The WTO Sanitary and Phytosanitary Agreement
UAE	United Arab Emirates
WA	Western Australia

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EXECUTIVE SUMMARY

- Quarantine restrictions on exporting celery to United Arab Emirates (UAE) and certain other countries have been reviewed and evaluated for one of the banned taxa, Collembola.

- Collembola found by quarantine inspection officers in celery for export have been identified and found to comprise two species of the family Hypogastruridae.

- The species have not been recorded from the UAE yet but no targeted surveys have been carried out in these countries.

- The species are cosmopolitan or near cosmopolitan in distribution and have been recorded from several countries adjacent to the UAE and are likely to occur there as a consequence.

- Neither species is a pest of vegetable crops except for edible mushrooms. Even here, with modern hygienic production processes, they do not pose a problem.

- We recommend that Sumich approaches the Commonwealth Department of Agriculture (DAFF), either directly or through Horticulture Australia, requesting them to negotiate with the UAE quarantine regulating office to lift their no-hypogastrurid requirement for entry of celery or other produce to that country.

- Approaches to disinfest celery prior to export are discussed, but they would increase handling time and are considered to be unlikely to be effective.

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1 BACKGROUND

Biomonitoring International has been asked by North East Equity Pty Ltd (trading as Sumich) to examine the conditions for the export of celery, and possibly other vegetables in the future, to countries that impose specific quarantine restrictions on organisms in the consignment. The current concern is the export of celery, specifically to countries including United Arab Emirates (UAE), Kuwait, Qatar, Saudi Arabia, Oman, Jordan and Bahrain from Western Australia. Celery is currently being exported to Singapore or Malaysia without the quarantine controls operating for Arabian countries, although it was exported to the Arabian countries without restrictions from the 1980s until 2006.

1.1 QUARANTINE CONDITIONS

The Manual of Importing Country Requirements (MICoR) conditions for export of horticultural produce to the UAE state:

"*1. All shipments must be free from Red-back spiders (*Latrodectus hasselti*) at the time of export:*

- *Under the order Collembola (Springtails) – Suborder Arthropleona*
- *The family Isotomidae is of cosmopolitan distribution.*

2. The family Hypogastruridae and both of its genera are not present in the UAE.

3. Where springtails of the Hypogastruridae family are present in a consignment, the following MAXIMUM TOLERANCE is to be applied:

- *five (5) individuals or any stages of this family on any piece of fruit or vegetable; and*
- *a maximum tolerance of ten (10) individuals or any stage of this family in a carton (or equivalent) of*

fruit & vegetables.

The practical application of this advice for the export of fresh fruit and vegetables to the UAE, is that any live springtails detected upon arrival exceeding the above tolerance, may result in the consignment being rejected. It is recommended that this tolerance be applied to all springtails detected.

4. If springtails above the tolerance levels are detected in the export consignment, the exporter can elect to obtain an official identification by an entomologist to determine which family they belong to. "

Elsewhere in the MICoR conditions for UAE, it is stated that "*the consignment must be free from pests, soil, weed seeds and extraneous material."* The importing country requirements for the other countries listed above are less specific than for the UAE, although Commonwealth Department of Agriculture (DAFF) inspectors apply the same UAE criteria when making their inspections (Appendix 1).

1.2 COMMENT ON QUARANTINE CONDITIONS

Apart from the problems with syntax and bullet-pointing in the text of the conditions, there are a number of other issues.

- Firstly the "insect" listed is not in fact an insect, as Collembola are in a Class of their own and are members of the Superclass - Entognathus Hexapoda.
- Secondly, the threshold values for numbers of Collembola appear to have been taken from criteria designed for strawberries (see Taylor, D. *Western Australian (WA) Agri-Food Industry Outlook – August 2008*), which are grown under different conditions to celery.
- Thirdly, the regulations state that the whole family, Hypogastruridae is banned for exports and implies that the family only comprises two genera. This is incorrect as the family includes a worldwide total of around 40 genera, of which seven occur in Australia (Greenslade, 2013).
- Finally there is no rationale, implicit or stated, as to why this family of Collembola has been singled

out for control among the vast diversity of invertebrates that exist.

- DAFF inspectors are required therefore to continue to apply these conditions to all attempted celery exports.
- Sumich made a submission to DAFF requesting that they apply to the UAE quarantine authorities for a change in these conditions but they could provide no evidence that the species in question did, in fact, occur in the UAE.

2 METHODOLOGY

In an effort to provide evidence that DAFF could use to request the UAE to remove the quarantine controls on Hypogastruridae, a preliminary investigation has been carried out. The following questions were addressed:

1. **Which springtail species are present in celery grown for Sumich in Western Australia?**
2. **Are they still present after the celery has been prepared for export?**
3. **Are the species present members of the family Hypogastruridae?**
4. **Are they pestiferous?**
5. **Are the species identified already present in the countries to which Sumich wishes to export?**

2.1 FIELD INSPECTION

Professor Jonathan Majer visited the Mandogalup celery farm on 22 January 2014 with Mr Barry Buss, Export Manager of North East Equity Pty Ltd., trading as Sumich.

Mandogalup (32° 12' 31" S, 115° 50' 33" E) is about 40 km south of central Perth and is situated on

the Spearwood dune system. Nursery–reared celery is planted out in irrigated plots to which a range of fertilizers has been applied, including sulphate of potash, liquid nitrogen containing urea, ammonium nitrate, phosphorus pentoxide and calcium nitrate. The crop is also sprayed with a range of insecticides, including cypermethrin, methomyl, spirotetramal, and pirimicarb, plus fungicides, including chlorothalonil, carbendazin and manzocarb.

Figure 1. Newly planted out celery.

Figure 2. Mature celery.

The celery is cut just above ground level, leaving the roots in the soil. It is then taken to the packing shed where extraneous soil and detritus is removed with water using a hose-pipe.

Celery that has been produced for export is also cut at leaf level, leaving minimal leaves on the stems. The washed and cut celery is then placed into individual plastic sleeves and packed into cardboard cartons, which are then placed in a cold store at 1°C. The boxes are shipped in cold chambers at 0°C, either by sea or less often by air. Shipping takes approximately 21 days to UAE and approximately 28 days to Doha, Kuwait and Bahrain.

Figure 3. Dirt on base of newly cut celery.

Figure 4. Washed celery.

Figure 5. Sleeved celery ready for export.

Figure 6. Boxed, sleeved celery, ready to place in cold store.

Prior to export, a Phytosanitary Certificate (PC) must be issued by DAFF. DAFF inspectors visit the packing shed and examine a set number of items (lots) in the consignment. Celery is inspected by inverting the bunch over a white tray and banging it in a downward direction, thus dislodging anything that might be present inside of the bunch. In the case of the inspection carried out while we were present, black springtails fell from the bunch so a PC was not issued.

Figure 7. Inspection of celery being carried out by a DAFF inspector.

2.2 EXAMINATION OF CELERY BY BIOMONITORING INTERNATIONAL

Celery bunches were systematically dismantled over a white tray and any invertebrates found were picked up with a fine brush and placed in vials of 70% alcohol (ethanol). The following samples were taken:

1. Unwashed, recently harvested celery stems;
2. Unwashed, recently harvested celery leaves;
3. Washed celery; and
4. Washed and cold-stored celery from the batch inspected by DAFF.

Approximately 50 springtails were collected from unwashed celery bunches. Although numbers were reduced by the washing process, there were still about 25 springtails per bunch, including bunches that had

been in the cold store ready to export. The collected material was sent to Australia's leading Collembola specialist, Dr Penelope Greenslade, for identification and commentary. The following are her diagnoses.

3 IDENTIFICATIONS

The specimens were similar on superficial appearance. All were small and dark black in colour without any touch of red, pink or any mottling. About 20 individuals were mounted and examined under a high-powered microscope. Published keys and descriptions were used (Greenslade et al., 2013; Fjellberg, 1998; Jordana et al., 1993 and others) to identify the specimens. Two abundant species were identified. One was identified as *Ceratophysella denticulata* (Bagnall 1941) and the other *Hypogastrura vernalis* (Carl 1901). Both species belong to the family Hypogastruridae. A single member of the Entomobryidae family, *Entomobrya* sp. cf. *marginata,* was also found on unwashed celery but was not one of the major species on this crop.

3.1 ECOLOGY AND DISTRIBUTION OF *CERATOPHYSELLA DENTICULATA*

There are records of this species from all continents except Antarctica, although it does occur on all subantarctic islands. It is therefore considered to be cosmopolitan or near cosmopolitan in distribution and is known to occur on disturbed land, including that used for horticulture, throughout southern Australia. *Ceratophysella denticulata* has not been recorded from arid regions or from the tropical zone. Although the species name is still valid, it has been shown recently to comprise several genetically distinct lineages, only one of which has been recorded outside Europe (Canada, New Zealand, Australia) (Porco et al., 2012). We assume here that, although specimens from Western Australian horticultural land have not been bar-coded, the lineage which occurs there and the one present on celery, is the widespread lineage already recorded from Australia. One difference is that *C. denticulata* is normally pinkish brown, mottled in life,

greyish in alcohol but the specimens collected here were black. It is known, however that intensity of pigment can vary with temperature and other abiotic factors during development.

3.2 PEST STATUS OF *CERATOPHYSELLA DENTICULATA*

Greenslade et al. (2013) document the ecology of the species in Australia. Feeding habits are varied, but individuals show a preference for bacteria and nematodes when they are available; fungi and other microorganisms are also consumed. Other worms are also preyed upon. The species can also be a pest of cultivated mushrooms (Greenslade and Clift, 2004). However, it is not a primary consumer of horticultural crops, except for mushrooms, but instead is a secondary invader, only colonising the crop after primary decay organisms, such as fungi and bacteria, have invaded. The pest status therefore of the species is restricted to edible fungi of various species (Greenslade and Ireson, 1986; Greenslade et al., 2002). Even so, with current hygienic production processes, they do not pose any problem to mushroom production (Greenslade et al., 2014). This has been confirmed by an approach by Biomonitoring International to the largest Western Australian mushroom producer, situated only a few kilometres from the Mandogalup celery farm, which confirmed that they experience absolutely no problems with springtails in their production facility.

3.3 PRESENCE OF *CERATOPHYSELLA DENTICULATA* IN THE UAE

This species has not been recorded from the UAE (A van Harten pers. comm.) although it has been recorded from other countries on the Arabian Peninsula (Ethiopian region). Weiner et al. (2012) recorded it from the Yemen, (Sana'a in leaf litter under coffee trees). It may also occur in Saudi Arabia (Al-Khalifa and Bayoumi, 1983) misidentified as *Hypogastrura armata.* These samples were taken under pine trees near Riyadh. *Ceratophysella denticulata* is frequently recorded as *H. armata* in the older literature. It is

probable therefore that *C. denticulata* occurs in the UAE around oases or on irrigated land where horticultural crops are grown.

3.4 ECOLOGY AND DISTRIBUTION OF *HYPOGASTRURA VERNALIS*

Hypogastrura vernalis is known throughout Eurasia (Babenko et al., 1994), is moisture-loving (Gisin, 1960) and common in meadows in Norway (Fjellberg, 1998). It is the most frequently encountered species in urban areas in southern Australia and is sometimes found in large aggregations floating on water surfaces after heavy rain. It is considered to be cosmopolitan or near cosmopolitan but has not been recorded from arid regions or from the tropical zone. This species has not been subject to barcoding. It is black in alcohol.

3.5 PEST STATUS OF *HYPOGASTRURA VERNALIS*

Greenslade et al. (2013) documents the ecology of the species. Feeding habits are not known but diet mainly is believed to consist of microorganisms. It has also been reported to be a pest of cultivated mushrooms (Greenslade and Clift, 2004). The records indicated that this species is also not a primary pest of crops but only a secondary invader (Greenslade and Ireson, 1986). Its pest status therefore is restricted to edible fungi of various species (Greenslade et al., 2002) and, even here, it is not a pest if modern hygiene conditions are provided.

3.6 PRESENCE OF *HYPOGASTRURA VERNALIS* IN THE UAE

This species has not been recorded from the UAE (A van Harten pers. comm.) although it has been recorded from Iran (Shayanmehr et al., 2013) and possibly from countries on the Arabian Peninsula. It may

also occur in Saudi Arabia (Al-Khalifa and Bayoumi, 1983) misidentified as *Hypogastrura manubrialis.* These samples were taken under pine trees near Riyadh. *Hypogastrura vernalis* is frequently recorded as *H. manubrialis* in the older literature. It is probable therefore that *H. vernalis* occurs in the UAE around oases or on irrigated land where horticultural crops are grown.

4 SUMMARY AND RECOMMENDATIONS

We have sighted the response of DAFF to Sumich's concerns and believe that they are accurately citing the current regulations and the actions taken as a result of them. On the evidence of the species identified, it is probable that: a) these two springtail species do not pose a pest threat to importing countries, either to green plants or to the edible mushroom industry, and b) they are almost certainly already present there. Field surveys in the importing country would conclusively establish whether these species are present. However, the weight of evidence suggests that they are almost certainly present there.

Some comments follow concerning the current regulations.

- Three species were found in the collections; the most abundant specimens belonged to two species of Hypogastruridae, *Ceratophysella denticulata* and *Hypogastrura vernalis.*
- A brief review of the literature indicates that Collembola are generally not plant pests – they are mostly detritivores and are rarely significant agricultural plant pests.
- Both species have been reported as being pests of edible mushrooms but not of other crops. There is a cultivated mushroom industry in certain Middle Eastern countries but, with modern farming techniques involving higher degrees of hygiene, springtails do not pose a serious problem. They would not be feeding on any part of the celery plant but only on the microorganisms on it.
- Recent correspondence to Sumich from DAFF states that "… springtails are a pest of concern for the UAE …". We do not know on what evidence UAE quarantine has come to this conclusion. The UAE is subject to the SPS Agreement, including "…that any phytosanitary measure is applied only to the extent necessary to protect" and "is based on scientific principles and is not maintained

without sufficient evidence." The SPS Agreement goes further to say that where a country wishes to maintain a higher level of protection than provided by an international standard, member countries must base their SPS measures on scientific assessment of the risks. It is possible that that the species found in the Australian celery are present in UAE and would only present a potential risk to any edible mushroom industry.

- It is probable that, based on records of their distributions in Middle East, both species recorded on celery in WA do occur in the UAE in favourable locations. The absence of records certainly reflects the lack of survey data for Collembola in this region. The *Terrestrial Environments of Abu Dhabi Emirate, United Arab Emirates* (Environment Agency, Abu Dhabi, 2008) suggests that the region has 4 to 5,000 species of terrestrial invertebrates, but lists no species of Collembola (Appendix 2). Tourenq et al. (2009) document only two Collembola families (unspecified) in the Wadi Wurayah, Fujairah, UAE, of which one Entomobryidae is new to science.

5 ADDITIONAL COMMENTS

5.1 IMPORT CONDITIONS FOR OTHER COUNTRIES

In regards to other markets, we are advised that export to some other countries (Kuwait, Qatar, Saudi Arabia, Oman, Jordan and Bahrain to name the most important markets) has also been refused after inspection by DAFF officers, while Singapore and Malaysia has not. The MICoR conditions for celery for these countries are:

- Kuwait – requires PC, must be free from pests, soil, weed seeds and extraneous material;
- Qatar – as for Kuwait;
- Saudi Arabia – as for Kuwait;
- Oman – as for Kuwait, plus sand and fertilisers;

- Jordan – only has specifications for beets, turnips and carrots amongst fresh vegetables, no comment or requirement for celery;
- No PC should be required for celery to Jordan;
- Bahrain – as for Kuwait.

There seem to be no quarantine controls on exporting celery containing Collembola to these countries but export is still being refused after inspection, even though none of them specifically prohibit Hypogastruridae. Therefore, if export to the UAE is resolved, it should also apply to these countries. Furthermore, Sumich or its representative should ask DAFF why celery exports are being refused an export permit on the grounds that Collembola are present, even though the countries listed above make no such import requirement.

5.2 REDUCING INFESTATION IN THE CELERY

The other option, which has not been openly explored at this time, is to look into ways of eliminating live springtails from the export produce. This is possible, but not easy in view of the large number of tight cavities between stems in the celery bunches.

Reducing infestation is clearly difficult, given that celery grows in the soil surface. It's very unlikely the growers could control Collembola in the soil, as they may well be tolerant of insecticides. If Collembola fall out when DAFF inspect, could the Collembola be shaken and washed out before the inspection by improving the post-harvest processing? Another possibility, which would be effective, is to cut a wash and pack the individual stems. However, this would increase handling time and cost, and may well affect the shelf-life of the product.

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APPENDIX ONE – EXAMPLES OF CONDITIONS FOR ISSUING PHYTOSANITARY CERTIFICATES FOR EXPORT OF VEGETABLES TO THREE IMPORTING COUNTRIES

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BIO Monitoring international

Australian Government
Department of Agriculture, Fisheries and Forestry

Manual of Importir

United Arab Emirates (AE)

All

Vegetables - Fresh

NPPO details: Ministry of Environment & Water
Relevant web addresses: http://moew.gov.ae/portal/en/home.aspx

Documentation

Document Type	Required?
Import Permit	No
Phytosanitary Certificate	Yes
Additional Declaration/Endorsement	No

General

Consignments are to be free from pests, soil, weed seeds and extraneous material

The following are classed as fruits (as they develop from a flower) and any specifically listed conditions or generic Phyto case conditions apply.

- Avocado
- Capsicum
- Chillies
- Cucumber
- Eggplant
- Melons
- Olives
- Pumpkin
- Squash
- Tomato
- Zucchini

For all areas other than the Western Australian growing areas of Carnarvon, Swan, Kununurra and areas north of Kununurra, a mandatory 2% destructive sample for mango seed weevil (Sternochetus mangiferae) must be undertaken in addition to the normal inspection for phytosanitary certification.

The exporter may calculate the number of fruit that shall be required to be cut and include this extra fruit in the consignment / lot and on the RFP/NOI. The inspector will select the required sample from the consignment as per phytosanitary sampling procedures

Any cut fruit may be discarded and the remaining quantity of fruit will be certified on the Phytosanitary certificate.

The Ministry of Environment & Water, United Arab Emirates (UAE) has advised the following:

1. All shipments must be free from Red-back spiders (Lactrodectus hasselti) at the time of export.
   - Under the Order Collembola (Springtails) - Suborder Arthropleona
   - The family Isotomidae is of cosmopolitan distribution
2. The family Hypogastruridae and both of its genera are not present in the UAE
3. Where springtails of the Hypogastruridae family are present in a consignment, the following MAXIMUM TOLERANCE is to be applied:
   - five (5) individuals or any stages of this family on any piece of fruit or vegetable; and
   - a maximum tolerance of ten (10) individuals or any stage of this family in a carton (or equivalent) of fruit & vegetables.

   The practical application of this advise for the export of fresh fruit and vegetables to the UAE, is that any live springtails detected upon arrival exceeding the above tolerance, may result in the consignment being rejected. It is recommended that this tolerance be applied to all springtails detected.
4. If springtails above the tolerance levels are detected in the export consignment, the exporter can elect to obtain an official identification by an entomologist to determine which family they belong to.

Treatment

Reference

Existing market

Initial Upload: 23 Feb 2010
Reviewed: 23rd Feb 2010

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p://www.daff.gov.au/micor/plants/united_arab_emirates_ae/all2

Australian Government
Department of Agriculture, Fisheries and Forestry

Manual of Importing Country Re

Brunei (BN)

All Vegetables - Fresh

NPPO details: Department of Agriculture and Agrifood, Ministry of Industry & Primary Resources
Relevant web addresses: http://www.agriculture.gov.bn/

Documentation

Document Type	Required?
Import Permit	Yes
Phytosanitary Certificate	Yes
Additional Declaration/Endorsement	No

General

Copy of the Import permit must be presented to the AQIS inspector at the time of inspection.

Consignments are to be free from soil, weed seeds and extraneous material

Phytosanitary certificates must be issued within 14 days prior to export.

The following are classed as fruits (as they develop from a flower) and any specifically listed conditions or generic Phyto case conditions apply:
Avocado , Capsicum , Chillies Cucumber
Eggplant Melons , Olives Pumpkin
Squash Tomato , Zucchini

Treatment

Reference

Import permit date unknown

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Australian Government
Department of Agriculture, Fisheries and Forestry

Japan (JP)

Other — Vegetables - Fresh

NPPO details: Ministry of Agriculture, Forestry & Fisheries
Relevant web addresses: www.maff.go.jp
www.pps.go.jp

Documentation

Document Type	Required?
Import Permit	No
[illegible]	Yes
Additional Declaration/Endorsement	No

General

Consignments are to be free from pests, soil, weed seeds and extraneous material

The following are classed as fruits (as they develop from a flower) and any specifically listed conditions or generic Phyto case conditions apply.
. Avocado . Capsicum . Chillies . Cucumber
. Eggplant . Melons . Olives . Pumpkin
. Squash . Tomato . Zucchini

Treatment

Reference

NPPO regulations

Initial Upload: 24 Nov 2011
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APPENDIX TWO – RECOGNIZED HEXAPODA TAXA AND THEIR OCCURRENCE IN ABU DHABI. BLANK CELLS MEAN 'NO DATA' (FROM ENVIRONMENT AGENCY, ABU DHABI, 2008)

Order	Common Name	Families	*Species*
Thysanura	Bristletails/Firebrats	1	*3*
Diplura	Two-tailed Bristles	None	*0*
Protura	Proturans	None	*0*
Collembola	Springtails		*0*
Ephemeroptera	Mayflies	1	*2*
Odonata	Dragonflies/Damselflies	6	*24*
Plecoptera	Stoneflies	None	*0*
Grylloblattodea	Ice- Crawlers	None	*0*
Orthoptera	Crickets/Grasshoppers	8	*78*
Phasmatodea	Stick and Leaf Insects	1	*1*
Dermaptera	Earwigs	2	*2*
Embioptera	Web-spinners	1	*3*
Blattaria	Cockroaches	3	*7*
Mantodea	Mantids	3	*15*
Isoptera	Termites	3	*4*
Zoraptera	Zorapterans	None	*0*
Psocoptera	Booklice	1	*1*
Phthiraptera	Lice	2	*3*
Heteroptera	True Bugs	15	*50>*
Homoptera	Aphids/Cicadas	18	*50>*
Thysanoptera	Thrips	2	*7*
Neuroptera	Lacewings/Antlions	7	*60>*
Mecoptera	Scorpion flies	None	*0*
Trichoptera	Caddis flies	None	*0*
Lepidoptera	Butterflies/Moths	30	*360>*
Diptera	True flies	31	*150>*
Siphonaptera	Fleas	1	*2*
Hymenoptera	Ants/Bees/Wasps	20	*400>*
Coleoptera	Beetles	37	*300>*
Strepsiptera	Heel-walkers or GladiatorsTwisted Wing Parasites	1	
Mantophasma-todea	*Heel-walkers or Gladiators*	None	*0*

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