



**Opinion of the Panel on plant health of  
the Norwegian Scientific Committee for Food Safety  
02.07.08**

**Pest risk assessment concerning import of  
“Jumping Beans” into Norway**

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## SUMMARY

Commercial products sold as “Jumping Beans” are seed capsules of the desert scrubs *Sebastiania pavoniana*, *S. palmeri* or *S. bilocularis* containing larvae of the insect *Cydia deshaisiana* (commonly called *Cydia saltitans*). The larva makes the capsule move when heated, and “Jumping Beans” are popular as a toy or a curiosity.

In the autumn of 2006 a shipment of 1000 “Jumping Beans” from USA into Norway was stopped by The Norwegian Food Safety Authority (the Authority) because the damage potential of the insect *C. deshaisiana* in Norway was unclear. To ensure a satisfying basis for a decision whether to allow import and sales of “Jumping Beans” in the future, the Authority, in a letter of 21<sup>st</sup> February 2008, requested a pest risk assessment (PRA) of “Jumping Beans” from the Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM).

VKMs Panel on plant health has the following main conclusions of the PRA: 1) The moth *C. deshaisiana* depends on a host plant not present in Norway (the PRA area) to complete its life cycle. Consequently *C. deshaisiana* is unable to establish in the PRA area. It is therefore concluded that *C. deshaisiana* does not have the potential to be a plant pest in the PRA area. 2) The host plants are the desert scrubs *S. pavoniana*, *S. palmeri* and *S. bilocularis*. They are distributed in Mexico and in Southern USA, and are absent in the PRA area. The plants cannot grow outdoors in Norway, and have no commercial value for glasshouse production. It is therefore concluded that the three plant host species *S. pavoniana*, *S. palmeri*, and *S. bilocularis* do not have the potential to become invasive species in Norway. 3) As the host plants only grow under extreme hot, desert conditions, the expected climate changes in northern Europe will not lead to an establishment and spread of *C. deshaisiana* in Norway in the foreseeable future. 4) The current PRA of “Jumping Beans” end at the stage of pest categorization. This is according to the international standard ISPM No. 11 (FAO, 2004). 5) There is very low uncertainty in the current PRA.

## **ASSESSED BY**

Persons working for the Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM), either as appointed members of the Committee or as ad hoc-experts, do this by virtue of their scientific expertise, not as representatives for his/her employers. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

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## CONTENTS

1. Background .....	5
2. Terms of reference .....	5
3. Initiation .....	6
3.1. Initiation points .....	6
3.1.1. PRA initiated by the identification of a pathway that presents a potential pest hazard .....	6
3.2. Identification of PRA area.....	6
3.3. Information.....	6
3.3.1. Previous PRA .....	6
3.4. Conclusion of initiation.....	6
4. Pest risk assessment .....	7
4.1 Pest categorization of the moth <i>C. deshaisiana</i> .....	8
4.1.1. Identity of pest.....	8
4.1.1.1 Name .....	8
4.1.1.2 Synonym.....	8
4.1.1.3 Taxonomic position.....	8
4.1.1.4 Methods for detection and identification of <i>C. deshaisiana</i> .....	8
4.1.1.5 Biological information of <i>C. deshaisiana</i> .....	9
4.1.2 Presence or absence of <i>C. deshaisiana</i> in PRA area .....	10
4.1.3 Regulatory status of <i>C. deshaisiana</i> .....	11
4.1.4 Potential for establishment and spread of <i>C. deshaisiana</i> in PRA area .....	11
4.1.5 Potential for economic consequences of <i>C. deshaisiana</i> in PRA area.....	11
4.1.6 Conclusion of pest categorization of <i>C. deshaisiana</i> .....	11
4.2 Pest categorization of the host plants <i>Sebastiana</i> spp. ....	12
4.2.1. Identity of pest.....	12
4.2.1.1 Name .....	12
4.2.1.2 Synonym.....	12
4.2.1.3 Taxonomic position.....	12
4.2.1.4 Biological information of <i>Sebastiana</i> spp. ....	12
4.2.2 Presence or absence of <i>Sebastiana</i> spp. in PRA area.....	13
4.2.3 Regulatory status of <i>Sebastiana</i> spp.....	13
4.2.4 Potential for establishment and spread of <i>Sebastiana</i> spp. in PRA area.....	13
4.2.5 Potential for economic consequences of <i>Sebastiana</i> spp. in PRA area .....	15
4.2.6 Conclusion of pest categorization of <i>Sebastiana</i> spp.....	15
4.3. Degree of uncertainty .....	15
5. Conclusion.....	16
6. References .....	17

## 1. BACKGROUND

Commercial products sold as “Jumping Beans” or “Mexican Jumping Beans” (“Hoppebønner” in Norwegian) are seed capsules of the desert scrubs *Sebastiania pavoniana*, *S. palmeri* or *S. bilocularis* containing larvae of the insect *Cydia deshaisiana* (commonly called *Cydia saltitans*). The larva of *C. deshaisiana* makes the capsule move when heated. This “jumping” quality is the reason why “Jumping Beans” are popular as a toy or a curiosity.

Commercialised “Jumping Beans” are sold in boxes containing 5-10 “beans” to ensure that at least one will jump. The infested seed capsules appear to jump around under their own power, at least for a few weeks, before the larvae becomes pupae.

In the autumn of 2006 a shipment of 1000 “Jumping Beans” from USA was stopped by the customs service in Oslo and controlled by the Norwegian Food Safety Authority (the Authority). The shipment was stopped because the damage potential of the insect *C. deshaisiana* in Norway was unclear. The importer protested the decision to the Authority, but the decision was sustained.

To ensure a satisfying basis for a decision whether to allow import and sales of “Jumping Beans” in the future, the Authority needs a pest risk assessment (PRA) of the commodity. On this basis the Authority, in a letter of 21<sup>st</sup> February 2008, requested a PRA of “Jumping Beans” from the Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM). The current PRA was prepared by VKM’s Panel on plant health on a meeting 9<sup>th</sup> June 2008.

## 2. TERMS OF REFERENCE

The Authority requests a risk assessment concerning a possible future import and sales of “Jumping Beans” from USA, with regard to *C. saltitans* and *S. pavoniana* and according to ISPM No. 11 (FAO 2004).

The Authority wishes VKM to assess the following aspects in particular:

1. The probability of *C. saltitans* establishment in agriculture, greenhouse crops or nature in Norway. What will be the economic, agronomic and environmental consequences of a possible introduction and spread of the insect?
2. The probability of *S. pavoniana* establishment in Norway. What will be the agronomic or environmental consequences of an introduction and spread of the plant?
3. How will the expected climate changes influence a possible future establishment and spread in Norway?

## **3. INITIATION**

### **3.1. Initiation points**

#### *3.1.1. PRA initiated by the identification of a pathway that presents a potential pest hazard*

This assessment was commenced by the Authority as international trade has been initiated on “Jumping Beans”, a commodity not previously imported into the PRA area. The commodity “Jumping Beans” is identified as a pathway that presents a potential pest hazard. A shipment of “Jumping Beans” (*S. pavoniana* seed capsules containing larvae of the insect *Cydia deshaisiana*, commonly called *Cydia saltitans*), arrived Oslo 8<sup>th</sup> August 2006, but was stopped by the Authority. For more background information, see chapter 1.

### **3.2. Identification of PRA area**

The PRA area is Norway.

### **3.3. Information**

Information sources utilised for this PRA are published material available in international scientific journals and on the Internet.

The current PRA is made according to the international standard ISPM No. 11. (FAO 2004).

#### *3.3.1. Previous PRA*

No PRAs are known from the PRA area or other countries, neither of the commodity nor of possible pests following the commodity

### **3.4. Conclusion of initiation**

This PRA is initiated by the identification of a pathway that presents a potential pest hazard. The commodity “Jumping Beans” is the pathway identified. No PRAs of the commodity or possible pests following the commodity are known from the PRA area or other countries. The PRA area is Norway.

## 4. PEST RISK ASSESSMENT

Common names of the commodity of concern in this PRA are as follows:

Norwegian: Hoppebønner

English: Mexican Jumping Beans, Jumping Beans

There are two possible pests of concern in “Jumping Beans”: The first one is the plant pest *C. deshaisiana*. This species is commonly called *C. saltitans*. However, the valid name is *C. deshaisiana*, which will be used throughout the current PRA document. *C. deshaisiana* is a moth that infests the capsules and inhabits the seed coats of the desert scrubs *S. pavoniana*, *S. palmeri*, and *S. bilocularis*. These three *Sebastiana* species are considered as the second possible pest of concern in this PRA as they might be potential invasive species to the PRA area.

Introduction of an insect species could also result in introduction of already parasitized specimens and consequently additional alien species of primary parasitoids or hyperparasitoids. This should be one factor taken into consideration, when focusing on invasive species and biodiversity. The threat could be of serious consequences for native species, when the introduced parasitoid species are defined as polyphagous. However, little information of parasitoids or hyperparasitoids on *C. deshaisiana* can be found in international literature. The probability of introducing parasitoids by larvae of *C. deshaisiana* is considered as very low because the “jumping” behaviour of the larva within the capsules probably also effectively prevents parasitoid wasps from getting a purchase on the capsule and drilling their ovipositor into it (Grimaldi & Engel 2005). Parasitoids or hyperparasitoids are therefore not considered as pests of concern in “Jumping Beans”, and they are not assessed in this PRA.

In the following sections pest categorization is performed for the moth *C. deshaisiana* (section 4.1) and for the three species of *Sebastiana* desert shrubs (section 4.2).

## 4.1 Pest categorization of the moth *C. deshaisiana*

### 4.1.1. Identity of pest

#### 4.1.1.1 Name

*Cydia deshaisiana* (Lucas, 1858)

#### 4.1.1.2 Synonym

*Cydia saltitans* (Westwood, 1858)

#### 4.1.1.3 Taxonomic position

Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Lepidoptera
Superfamily	Tortricoidea
Family	Tortricidae
Subfamily	Olethrentinae
Genus	<i>Cydia</i>
Species	<i>Cydia deshaisiana</i>

#### 4.1.1.4 Methods for detection and identification of *C. deshaisiana*

All commercial products sold as “Jumping Beans” are seed capsules of three plant species in the genus *Sebastiania* (mainly *S. pavoniana*) infested by the moth *C. deshaisiana* and containing a larva or a pupa of this moth. No other insects are known to infest the seed capsules of these plants.

The adult moth that eventually hatches from a capsule is greyish brown (Figure 1).





Figure 1. Adult *Cydia deshaisiana* (Lepidoptera: Tortricidae). Wing span: 18-25 mm. (Svenska fjärilar).

#### 4.1.1.5 Biological information of *C. deshaisiana*

The pest *C. deshaisiana* is dependent on the host plants *S. pavoniana*, *S. palmeri*, or *S. bilocularis* for its life cycle. The host plants are distributed in Mexico and USA. In USA they grow in southwest in the state of Arizona (see 4.2 for more details on the host plants). *C. deshaisiana* is distributed in the same area as its host plants. The insect is found in Mexico and in USA, within the deserts of southern Arizona (Armstrong 1981, Kingsley 1998).

*C. deshaisiana* can be defined as a monophagous insect species, since it is a very specialized seed-feeding species living only on three species of host plants within the *Sebastiania* genus. Very few phytophagous insects can be characterized as monophagous species.

The moth *C. deshaisiana* deposits its eggs on the green, immature seed capsules of the host plant. After a few weeks the eggs hatch and the tiny larvae bore their way through the young capsules and into the seeds. As with many Euphorbiaceae the seeds are often forcibly ejected when the capsules split apart. The ground beneath the shrub becomes littered with intact capsules and seeds, many containing the *C. deshaisiana* larvae (Armstrong 1981).

The capsules that contain the larvae become hard and change to a brownish colour. The yellowish larvae consume the seed content. Thus, the so-called “Jumping Beans” are neither beans nor seeds, but seed capsules and seed coats inhabited by *C. deshaisiana*. The larva inside an infested seed capsules anchors itself with silken threads to the inside wall. When the seed capsule is abruptly warmed, for instance by being held in the palm of the hand or being heated by the sun, the larva twitches, pulling on the threads and causes the capsule to move. “Jumping” is an overstatement, but the capsules are mobile. The larvae may live for months inside the seed coats.

Before pupation the larva cuts a circular escape hatch pathway for the adult moth through the wall of the capsule. The adult moth has, as all Lepidoptera, no mouthparts which can be used for cutting, so the emergence hole for the adult has to be made by the larva. The fully grown larva then pupates after spinning a cocoon-like lining which houses the pupa. The adult moth

emerges from the pupal case and exits through the circular hole in the capsule wall. Often the thin, transparent pupal case is left protruding through the emergence hole (Figure 2) as the adult moth crawls out (Armstrong 1981).



Figure 2. The pupal case of *C. deshaisiana* sticking out the emergence hole in a capsule of *Sebastiana* spp., better known as “Jumping Beans” (Svenska Fjärilar)

The flowering and seed formation of the host plants and the deposition of the eggs of the adult moth take place during the late spring or summer months. During late summer in southern Arizona, adult emerging moths, active larvae, and pupae may be found in capsules, depending upon when the eggs were laid during the long flowering season. The adult moths will die within a short period, and no eggs will be deposited if host plants in the genus *Sebastiana* are absent. The larvae and pupae contained within the capsules during the winter months are the vital connecting link with the next season’s crop of capsules (Armstrong 1981).

The “jumping” behaviour of the larva of *C. deshaisiana* within the seed coat has been interpreted as an adaptation for escaping hot ground for cool shade and has been evolved in a few species of Tortricidae (Grimaldi & Engel 2005).

#### 4.1.2 Presence or absence of *C. deshaisiana* in PRA area

The moth *C. deshaisiana* is not present in the PRA area. The commodity “Jumping Beans” is the only potential pathway for *C. deshaisiana* into Norway. “Jumping Beans” are not known to be imported into Norway.

#### 4.1.3 Regulatory status of *C. deshaisiana*

Norway: No regulation.

EU: No regulation.

Canada: No regulation

South Korea and Australia: Import of “Jumping Beans” is not permitted.

USA: No regulation.

- List of Approved Products from Mexico: “Mexican Jumping Beans” (USDA 2001). Although infested with the larvae of *C. deshaisiana*, the seeds of *Sebastiana* spp. are admissible. These seeds may be released without an import permit. Nevertheless, some states regulate these infested seeds (USDA 2004).
- State of Hawaii, USA: *C. deshaisiana*, “Mexican jumping bean”, is on List of Prohibited Animals, November 28, 2006 (Department of Agriculture - State of Hawaii 2006).

#### 4.1.4 Potential for establishment and spread of *C. deshaisiana* in PRA area

“Jumping Beans” are legally imported into several European countries, including Sweden. The pest *C. deshaisiana* depends on a host plant to complete its lifecycle. The host plant is a desert scrub of three *Sebastiana* species: *S. pavoniana*, *S. palmeri* or *S. bilocularis*. The host plants are distributed in Mexico and USA, and are absent in the PRA area. Therefore the pest is unable to complete its life cycle and establish in the PRA area. See pest categorization of the host plants in section 4.2.

*C. deshaisiana* is not dependent on any vector for spreading.

#### 4.1.5 Potential for economic consequences of *C. deshaisiana* in PRA area

Economic consequences in the PRA area are unlikely, since *C. deshaisiana* cannot establish. The moth *C. deshaisiana* infests only plants of the three following *Sebastiana* species: *S. pavoniana*, *S. palmeri* or *S. bilocularis*. These host plants are not present in the PRA area, and are of no commercial interest in agriculture, greenhouse crops or nature in the PRA area.

With the documented host specificity of *C. deshaisiana*, the Euphorbiaceae species cultivated in Norwegian greenhouses are not endangered by the pest.

The environment is unsuitable for the host plants *S. pavoniana*, *S. palmeri* and *S. bilocularis* to establish in the PRA area, see pest categorization of the host plants in section 4.2.

#### 4.1.6 Conclusion of pest categorization of *C. deshaisiana*

The pest *C. deshaisiana* depends on a host plant (*S. pavoniana*, *S. palmeri* or *S. bilocularis*) not present in the PRA area. Consequently the pest is unable to complete its life cycle and establish in the PRA area. It is therefore concluded that *C. deshaisiana* does not have the potential to be a quarantine pest in the PRA area.

Thus, the PRA of *C. deshaisiana* ends at this point. This is according to the international standard ISPM No. 11 (FAO, 2004).

## 4.2 Pest categorization of the host plants *Sebastiana* spp.

### 4.2.1. Identity of pest

#### 4.2.1.1 Name

*Sebastiana pavoniana* (Muell. Arg.) Muell. Arg.

*Sebastiana palmeri* Riley

*Sebastiana bilocularis* S. Wats.

#### 4.2.1.2 Synonym

*Sebastiana bilocularis* S. Wats. is synonymous to *Sapium biloculare* S. Wats.

#### 4.2.1.3 Taxonomic position

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Malpighiales
Family	Euphorbiaceae
Genus	<i>Sebastiana</i>
Species	<i>Sebastiana pavoniana</i> (Muell. Arg.) Muell. Arg. <i>Sebastiana palmeri</i> Riley <i>Sebastiana bilocularis</i> S. Wats. (syn. <i>Sapium biloculare</i> S. Wats.)

#### 4.2.1.4 Biological information of *Sebastiana* spp.

The hosts of the *C. deshaisiana* moth are the plants *S. pavoniana*, and *S. palmeri* which belong to the Euphorbiaceae, the spurge family. Another lesser known host plant is *S. bilocularis*. Like many other species in the same family they are included in the USDA Poisonous Plant Database because of the production of yellow latex. The latex is bitter and herbivores avoid the plants.

*S. pavoniana* is a desert plant growing naturally in the deserts along the Rio Mayo in the Mexican states of Sonora and Chihuahua extending into the Cape Region of Baja California. In USA it grows southwest in the state of Arizona. The two other species, *S. palmeri* and *S. bilocularis*, have similar distribution. Also, *S. bilocularis* is growing on some of the islands in the Gulf of California (Armstrong 1981). The commercial product “Jumping Beans” contains infested and non-infested seed capsules, mainly of *S. pavoniana*.

The biology and geographical distribution of the three *Sebastiana* spp. are similar, and in the following only *S. pavoniana* will be described in more detail. *S. pavoniana* is classified as a tropical, deciduous desert scrub (De Bano 1999). The plant grows best in full sun on well drained soil and produces dark green, leathery leaves, which turn brilliant red during the dry winter months and drop in the spring. The leaves are alternate, shiny, and lanceolate in shape and with serrated edges. *S. pavoniana* is very drought tolerant and grows to a height of up to 4

m and a diameter of 3 m. Typically it is found scattered along washes and on rocky hillside at altitudes of 300 m to 750 m. When it is cultivated as a hedge plant in Southern USA, watering once or twice a month is recommended during summer (Mielke 1993).

When the summer rains arrive in the desert, *S. pavoniana* blooms from March to November in southern Arizona (Armstrong 1981). The flowers are small, not much bigger than a pinhead. Male and female flowers are separate. Stamens are borne on slender, terminal spikes that extend beyond the branch tips, while the female flowers have one or several pistils in a cluster at the base of the male spike or in the axils of the upper leaves. Petals are lacking, and the flowers are not easy to recognize (Armstrong 1981).

Following pollination *S. pavoniana* will produce wedge-shaped capsules, usually composed of three sections, technically known as carpels, each containing a single seed.

#### 4.2.2 Presence or absence of *Sebastiania* spp. in PRA area

Plants of the three species *S. pavoniana*, *S. palmeri* and *S. bilocularis* are not present in the PRA area, neither in nature nor in agriculture or greenhouse industry. The commodity “Jumping Beans” might contain noninfested viable seeds, but “Jumping Beans” are not known to be imported into Norway.

#### 4.2.3 Regulatory status of *Sebastiania* spp.

Norway: No regulation.

EU: No regulation.

Canada: No regulation

South Korea and Australia: Import of “Jumping Beans” is not permitted.

USA: No regulation.

- List of Approved Products from Mexico: “Mexican Jumping Beans” (USDA 2001). Although infested with the larvae of *C. dehaiana*, the seeds of *Sebastiania* spp. (syn. *Sapium* spp.) are admissible. These seeds may be released without an import permit. Nevertheless, some states regulate these infested seeds (USDA 2004).
- State of Hawaii, USA: *C. dehaiana*, “Mexican Jumping Beans”, is on List of Prohibited Animals, November 28, 2006 (Department of Agriculture, State of Hawaii 2006).

#### 4.2.4 Potential for establishment and spread of *Sebastiania* spp. in PRA area

The climate in the PRA area is very different from the temperature and precipitation conditions in the area of natural distribution of *S. pavoniana*. In the Sonoran Desert the average winter temperature is 10°C and the average summer temperature is 30°C. During winter the temperature may drop to 0°C during nights at some locations. In the warmest region the temperature may reach 55°C in the summer. The Sonoran Desert is one of the wettest deserts in North America with annual precipitation of 75 to 400 mm. It has two rainy seasons, one short and heavy during summer and a longer and lighter rainy season during winter (see figures 3 and 4). The latitude of the Sonoran Desert ranges from 25° to 33° North, and the longitude ranges from 105° to 110° West (McGinnies 1976).

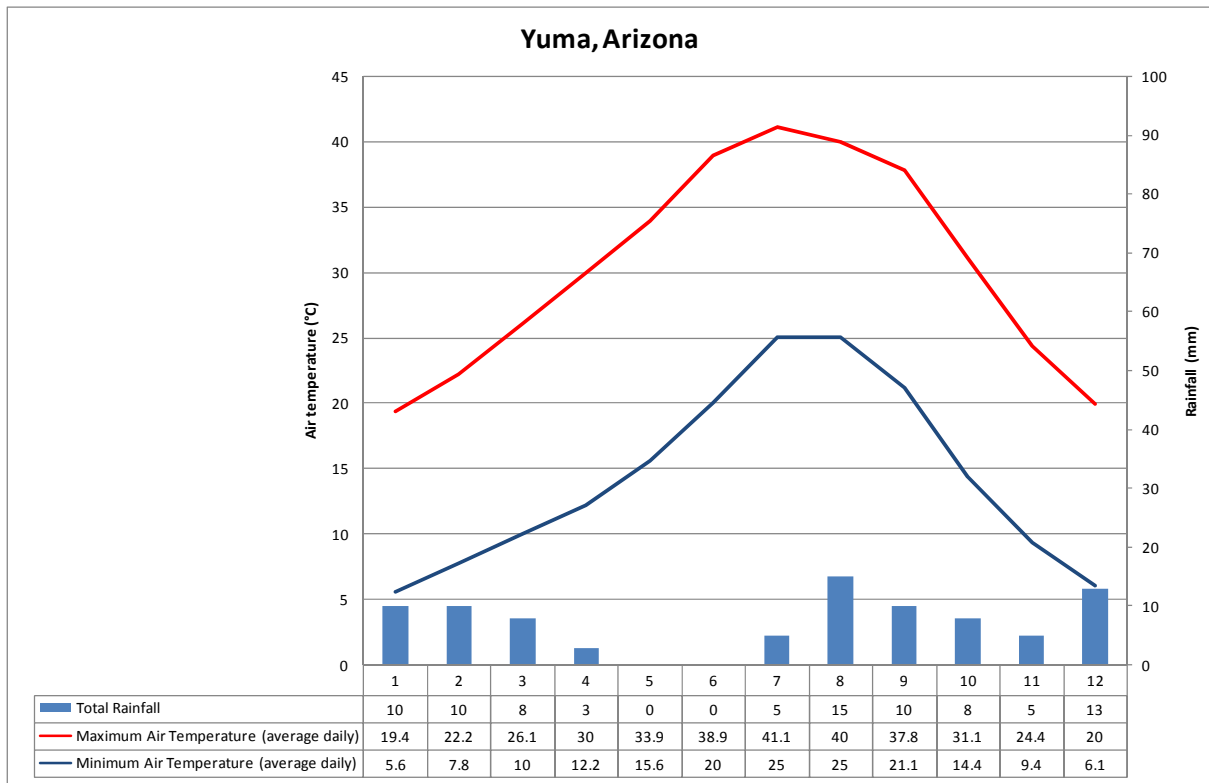


Figure 3. Monthly climate normal (1931-1960) for Yuma (32.7 N,-114.6 E), Arizona (Sutherst & Maywald, 2001).

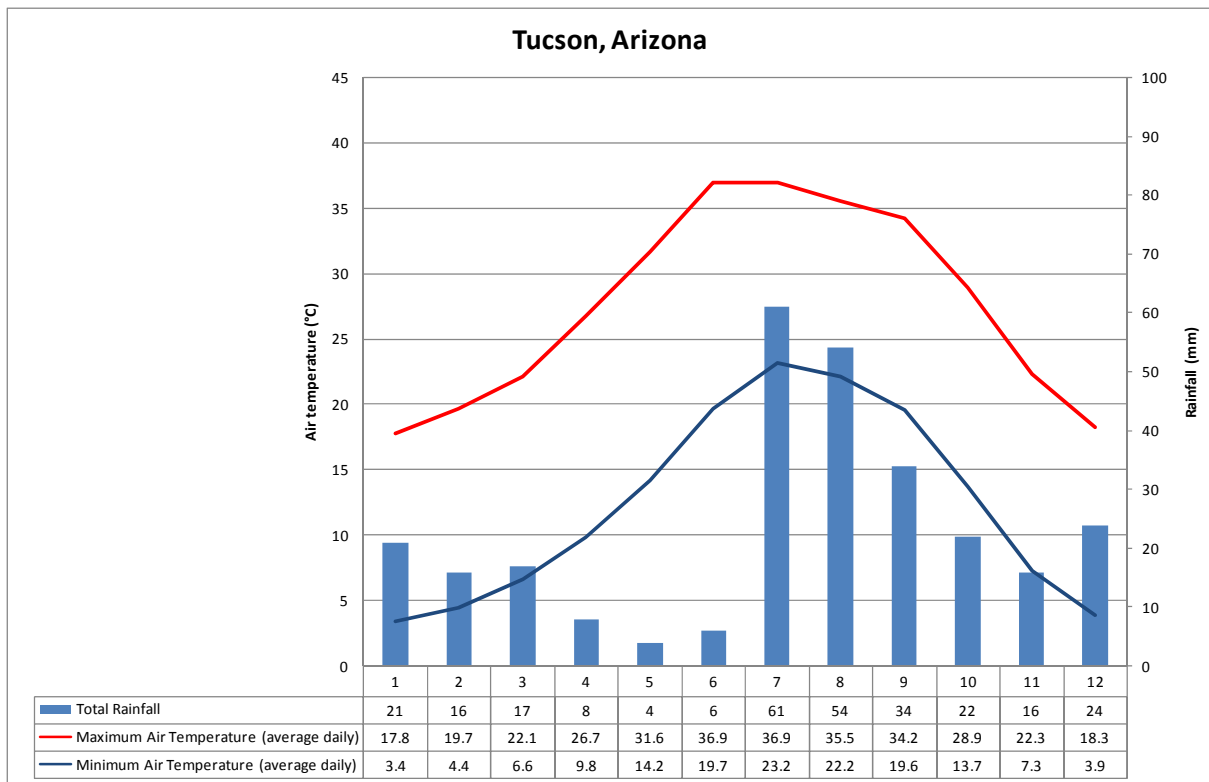


Figure 4. Monthly climate normal (1931-1960) for Tucson (32.3 N,-110.9 E), Arizona (Sutherst & Maywald, 2001)

Outside its natural distribution *S. pavoniana* is planted in gardens in the Southern states of USA, the West Indies, Brazil, Paraguay, and Argentina, and in some other warm climate countries.

There is very low probability for establishment of *S. pavoniana* in the PRA area. Only if hot, desert conditions are created in a glasshouse, will it be possible to grow *S. pavoniana* to flowering in the PRA area.

The climatic conditions in the area of natural distribution of *S. pavoniana* and the warmest climatic zones of the PRA area are so different, that there is very low probability for establishment and spread of *S. pavoniana* following climatic changes in the foreseeable future.

#### *4.2.5 Potential for economic consequences of Sebastiana spp. in PRA area*

Economic consequences in the PRA area are unlikely. The desert shrubs *S. pavoniana*, *S. palmeri*, and *S. bilocularis* are not present in the PRA area, and the probability of their establishment is very low.

#### *4.2.6 Conclusion of pest categorization of Sebastiana spp.*

The host plants *S. pavoniana*, *S. palmeri*, and *S. bilocularis* are not present in the PRA area. Due to the big differences in climatic conditions between the PRA area and the areas of natural distribution of these three plant species, there is very low probability for establishment and spread of *S. pavoniana*, *S. palmeri*, and *S. bilocularis* in the PRA area today or following climatic changes in the foreseeable future. It is therefore concluded that the three plant species do not have the potential to be quarantine pests in the PRA area.

Thus, the PRA of the host plants *S. pavoniana*, *S. palmeri*, and *S. bilocularis* ends at this point. This is according to the international standard ISPM No. 11 (FAO, 2004).

### **4.3. Degree of uncertainty**

There is very low uncertainty in the current PRA.

## 5. CONCLUSION

The moth *C. deshaisiana* depends on a host plant not present in the PRA area to complete its life cycle. Consequently *C. deshaisiana* is unable to establish in the PRA area, both in agriculture, greenhouse crops and nature. It is therefore concluded that *C. deshaisiana* does not have the potential to be a plant pest in the PRA area.

The host plants are the desert scrubs *S. pavoniana*, *S. palmeri* and *S. bilocularis*. They are distributed in Mexico and in Southern USA, and are absent in the PRA area. The plants cannot grow outdoors in Norway, and have no commercial value for glasshouse production. It is therefore concluded that the three plant host species *S. pavoniana*, *S. palmeri*, and *S. bilocularis* do not have the potential to become invasive species in Norway.

As the host plants only grow under extreme hot, desert conditions, the expected climate changes in northern Europe will not lead to an establishment and spread of *C. deshaisiana* in Norway in the foreseeable future.

Thus, the current PRA of “Jumping Beans” end at the stage of pest categorization. This is according to the international standard ISPM No. 11 (FAO, 2004).



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