Scientific name:
Eurysacca

Some data sheets of species belonging to this genus:
- Eurysacca melanocampta (quinoa moth)
- Eurysacca quinoae (quinoa moth)

BASIC DATA SHEET: may include information downloaded from bibliographic databases held at CABI and elsewhere by a process of data mining, and automatically cross-checked. These data provide useful indications of the identity, distribution and relationships of these species, but DATA IN THIS FORM HAVE NOT BEEN MANUALLY CHECKED BY EXPERTS. CABI welcomes feedback from users.

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Selected sections for: *Eurysacca* ()

Preferred Scientific Name

Eurysacca
Taxonomic Tree
- Phylum: Arthropoda
  - Class: Insecta
    - Order: Lepidoptera
      - Family: Gelechiidae
        - Genus: Eurysacca

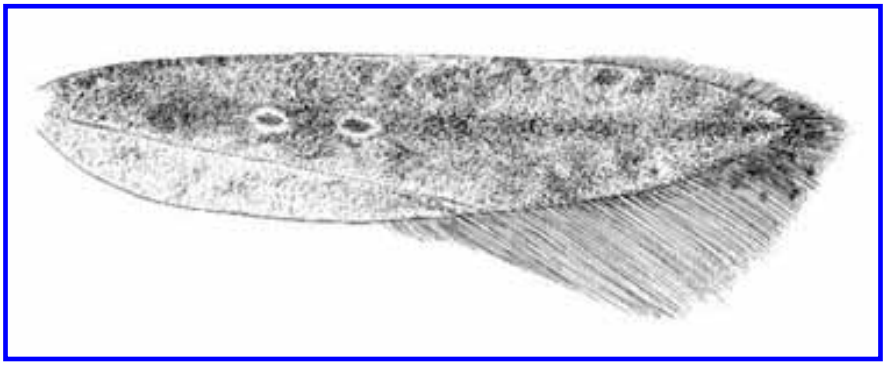
Last modified: 05/04/2004

Scientific name:
Eurysacca melanocampta (Meyrick, 1917)

Common name:
quinoa moth

Taxonomic position:
- Lepidoptera: Gelechiidae

Insect pest attacking:
- quinoa
- Chenopodium ambrosioides
- Goosefoot
- broad bean
- Groundsel



Click the Picture or Map for further information

Selected sections for: *Eurysacca melanocampta* (quinoa moth)

Preferred Scientific Name

Eurysacca melanocampta

Other Scientific Names

Gnorimoschema melanocampta
Phthorimaea melanocampta
Scrobipalpula melanocampta

Common Names
English
quinoa moth

Spanish
polilla de la quinua

Peru
q'hona q'hona

Taxonomic Tree
Species: Eurysacca melanocampta

Notes on Taxonomy and Nomenclature

Edward Meyrick described Eurysacca melanocampta from Peru in 1917 as Phthorimaea melanocampta. It was later transferred to Scrobipalpula melanocampta and Gnorimochema melanocampta (Clarke, 1969). Until finally Povolny (1979) erected the genus Eurysacca where it has since been included. The genus consists of more than 20 formally recognized species (Povolny 1986, 1994). A second species, Eurysacca quinoae, was described and reported by Povolny (1997) as a quinoa-feeding pest from La Paz in Bolivia. This second quinoa-feeding pest added some confusion as to the true identity of species treated in older crop literature in Peru and Bolivia, where both species are found together. Both species are covered together in this datasheet.

Host List

Major hosts
Chenopodium quinoa (quinoa)

Minor hosts
Chenopodium (Goosefoot), *Chenopodium ambrosioides*, *Senecio* (Groundsel), *Vicia faba* (broad bean)

Host Range

E. melanocampta has been reported from both Chenopodium quinoa and C. pallidicaule, which are cultivated in the higher parts of Peru and Bolivia. Zanabria and Banegas (1997) also found the larvae feeding on C. ambrosioides and other wild forms of Chenopodiaceae. To date, E. quinoae has only been reported from C. quinoa, despite attempts to locate alternative host plants (Rasmussen et al., 2001b). There are not many confirmed reports of these Eurysacca species feeding on other host families. Zanabria and Banegas (1997) referred to Vicia faba, Lupinus mutabilis and Senecio spp., which may constitute alternative host plants for E. melanocampta. Colombian and Peruvian records for Solanum tuberosum should be confirmed, however, species of Eurysacca are not likely to be severe pests in potato fields (Povolný, 1979; Povolný and Valencia, 1986).

In a revision of the host range for larvae of the tribus Gnoromoschemini, where Eurysacca belongs, the larvae were found mainly

on Asteraceae and to a lesser extent on Caryophyllaceae, Zygophyllaceae, Rhamnaceae, Poaceae, and a few halophilic families (Povolný, 1980). E. media, a related quinoa pest in Chile, has also been found to feed on Amaranthus cruentus (Amaranthaceae) (Lamborot et al., 1999; Guerrero et al., 2000).

Affected Plant Stages: Flowering stage, fruiting stage, seedling stage and vegetative growing stage.

Affected Plant Parts: Fruits/pods, growing points, inflorescence, leaves, stems and whole plant.

Morphology

Eggs

Eggs are relatively small (0.6 mm long), whitish in colour when newly laid, gradually turning cream-coloured, and finally grey before hatching. The eggs are laid singly in regular batches of up to 30-40 eggs, mainly on the undersides of leaves or in the inflorescence. The female has the ability to lay about 300 eggs in total (Flavio, 1997; Mujica et al., 1998).

Larvae

The green to yellow larvae is distinguished from other Gelechiidae by several narrow, red-maroon, longitudinal bands, or spots, that run the entire length of the body. Head and pronotum are dark brown. There are five instars. First-instar larvae are slightly more than 1 mm long, fourth-instar larvae are about 6 mm, and the fifth-instar larvae can reach 9 mm in length (Povolný and Valencia, 1986; Franco and Ochoa, 1996).

Pupae

The pupae are elongate, 7-9 mm long, dark maroon and glossy.

Adults

The adult moths have a wingspan of 14-18 mm. E. quinoae has light maroon anterior wings with two small dark spots towards the centre of the wing and dark scales at the apical region of the wing. The wings of E. melanocampta are dark maroon, with a dark, narrow band running the length of the wing; there are two dark spots bordered by light scales (Rasmussen et al., 2001b). The characteristics of the male genitalia for the two species are illustrated by Povolný (1997). Until recently, there has been little or no distinction between the damage and biology of the two species.

Similarities to other species/conditions

The two known Eurysacca species from quinoa in Peru and Bolivia (E. quinoae and E. melanocampta) are easily separated by habitus and genitalia characteristics as illustrated by Povolny (1997) and Rasmussen et al. (2001b). For further information, see Morphology.

Other quinoa-feeding species of Eurysacca may be present in other parts of South America, as reported by Lamborot et al. (1999) in Chile. Povolny (1994) produced a key with habitus characteristics of all the recognized species of Eurysacca. Other Lepidoptera larvae found on quinoa usually belong to Noctuidae or Geometridae; they are easy to distinguish by their larger size and characteristic movements.

Distribution List

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South America		
Argentina	localized	Povolný, 1997; Rasmussen et al., 2003
Bolivia	widespread	Povolný, 1997; Rasmussen et al., 2003
Chile	localized	Povolný, 1997; Lamborot et al., 1999
Colombia	localized	Povolný & Valencia, 1986
Ecuador	localized	Alissie & Onore, 1988; Rasmussen et al., 2003
Peru	localized	Povolný, 1997; Zanabria & Banegas, 1997; Rasmussen et al., 2001

Distribution Notes

E. melanocampta is distributed throughout xeromontane habitats (approximately between 1900 and 4350 m a.s.l.) from Argentina and Chile in the south to Colombia in the north (Povolný and Valencia, 1986; Povolný 1990, 1997; Lamborot et al., 1999; Rasmussen et al., 2003). E. quinoae is apparently more limited in its distribution. To date, it has been identified only from Bolivia and Peru (Povolný, 1997; Rasmussen et al., 2001b).

Biology and Ecology

Life Cycle

Adult moths emerge from pupae in the soil, although they can also be found in the inflorescence. Shortly after emergence the moths mate and the females lay regular batches of up to 30 or 40 eggs, mainly on the undersides of leaves or on the inflorescence. The eggs normally hatch in 9-10 days and the larvae immediately start to feed on the leaves.

Development and Survival

The effect of temperature on development has been described in an unpublished thesis by Flavio (1997) and further data on the development time is presented by Franco and Ochoa (1996) and in an unpublished thesis by Quispe (1978). Phenological data shows that the development time for this species, from egg to adult, ranges from 47 to 88 days in the field, depending on temperature. In a study by Flavio (1997), the development time was found to be either 28 days (24°C) or 56 days (5-22°C).

It is not known whether either species enters diapause; they may be facultative Rasmussen et al., 2001a, 2003).

Fecundity

The maximum number of eggs per female is about 300 (Flavio, 1997). Mean batch size is 30-40 eggs (Mujica, 1993). The effect of temperature on fecundity has not been described.

Phenology

Two to three moth generations are found during the quinoa field season in Peru from November to May, depending on the climatic conditions (Zanabria and Banegas, 1997; Mujica et al., 1998). The number of generations per year is not known, nor is it clear whether the second and third generation overlap. Mujica et al. (1998) indicated that the first generation is found from November to December, while second and third generations are found from March to May/June in the Altiplano of Peru.

Natural Enemy List

Pathogens

Granulosis virus attacking larvae

Symptoms Text

The larvae of both species are first found between the apical leaves of late emerging plants, though not usually on early emerging plants. The damage here is mainly on the panicle. More damage is seen as the plant grows due to the large number of larvae per plant. The larvae rasp or chew the foliage with a preference for the inflorescence and immature grains (Mujica et al., 1998; Rasmussen et al., 2003).

Symptoms by affected plant part

- Fruits/pods: internal feeding; external feeding.
- Growing points: external feeding.
- Inflorescence: internal feeding; external feeding.
- Leaves: external feeding; abnormal forms; internal feeding.
- Stems: external feeding.
- Whole plant: external feeding.

Notes on Natural Enemies

Total parasitism of Eurysacca in quinoa fields ranges from 15 to 45% throughout Peru (Delgado, 1989; Zanabria and Banegas, 1997; Rasmussen et al., 2001a). Povolny and Valencia (1986) recorded up to 60% parasitism of E. melanocampta collected from

potato in Colombia.

Rasmussen et al. (2001a) investigated the parasitoid complex of E. quinoae in Peru. They found that an undescribed species of Phytomyptera was the dominant species. Less important parasitoids were Copidosoma gelechiae, Diadegma sp. and a new species of an undescribed genus of Ichneumonidae. Significant differences were found between the parasitoid complex in the inter-Andean valleys and in the Altiplano. Whilst Phytomyptera was the most common parasitoid in the inter-Andean valley, the undescribed Ichneumonidae was the most common species in the Altiplano (Rasmussen et al., 2001a). The same parasitoid complex was later found to control E. melanocampta in the inter-Andean valleys (C Rasmussen, CIP, Peru, personal communication, 2000).

Predators may also be important natural enemies of Eurysacca. They include members from Coleoptera (Carabidae, Cicindelidae, and Coccinellidae), Hymenoptera (Sphecidae) and Neuroptera (Hemerobius tolimensis; Hemerobiidae) (Zanabria and Mujica, 1977; Rasmussen et al., 2003).

Experiments from Peru and Bolivia showed that the granulosis virus could reduce the numbers of E. melanocampta by up to 50% (Calderón et al., 1996; Zanabria and Banegas, 1997).

Control

Introduction

The timing of chemical and biological control is essential for the control of E. quinoae and E. melanocampta; however, little work has been done on the development of monitoring methods. Pheromones for attracting the adults have not been developed for either of the two species of Eurysacca. In a revision of previous studies, Rasmussen et al. (2003) found that the economic threshold level was from 3 to 15 larvae per plant in the Altiplano area of Peru.

Cultural Control

E. melanocampta has been found to carry-over out of the cropping season on volunteer quinoa plants, and their presence should be controlled (Rasmussen et al., 2001). Crop rotation and intercropping has also been recommended to break the continuity of the food chain for the pests in Peru and Bolivia (Mujica, 1993; Tapia, 1997; Zanabria and Banegas, 1997).

Host-Plant Resistance

Field observations indicate that white and sweet quinoa cultivars, with low saponin content, are more susceptible to pest attacks than bitter ones, and that cultivars with lax inflorescences show partial resistance to the Eurysacca moths (Mujica et al., 1998).

Biological Control

E. melanocampta and E. quinoae have a wide range of natural enemies, but their role in suppressing the population density is variable and unclear. However, natural enemies may play an important role in population regulation, and measures that preserve and encourage the build-up of natural enemies should be integrated into pest management programmes and production practices. None of the natural enemies have been used commercially or studied in detail. E. melanocampta larvae can be controlled by a baculovirus (Calderón et al., 1996; Zanabria and Banegas, 1997).

Chemical Control

The majority of the crop production in Bolivia and the Altiplano of Peru is organic. However, insecticides are often applied in the inter-Andean valleys of Peru. The insecticides currently in use are pyrethroids (Zanabria and Banegas, 1997). Formulations of natural plant extracts have not been tested thoroughly, though the use of antifeedants such as Minthostachys (Laminaceae) shows some control of the pests (Saravia, 1998).

Means of Movement and Dispersal

Plant parts liable to carry the pest in trade/transport
- Fruits (inc. Pods): Eggs, Larvae, Pupae; borne internally; borne externally; visible to naked eye.
- Flowers/Inflorescences/Cones/Calyx: Eggs, Larvae, Pupae, Adults; borne internally; borne externally; visible to naked eye.
- Leaves: Eggs, Larvae, Pupae; borne internally; borne externally; visible to naked eye.

Plant parts not known to carry the pest in trade/transport
- Bulbs/Tubers/Corms/Rhizomes
- Seedlings/Micropropagated Plants
- Roots
- Stems (above Ground)/Shoots/Trunks/Branches
- True Seeds (inc. Grain).

Impact

Both species of Eurysacca are considered very severe pests of quinoa in the main quinoa-producing countries, Bolivia and Peru. Eurysacca is probably responsible for yield losses of 15-18% rising to 50% or more in dry years in Peru, and even more in Bolivia (Mujica, 1993; Rasmussen et al., 2003). Reports from adjacent countries where quinoa is grown show that there is less susceptibility of the crop to Eurysacca, this is probably due to the less intensive production of quinoa (Rasmussen et al., 2003).

Detection and Inspection Methods

Crop scouting should be carried out on a number of plants per field at least weekly after plant emergence. The nocturnal or crepuscular adults may be detected with light traps.

Eggs are mostly found on the undersides of the leaves or in the inflorescence and may be very hard to see. Feeding perforations from the first-instar larvae are best noticed early in the season, when they mine fresh leaves. Later in the season, larvae are easily detected inside the inflorescence and may drop if the plant is shaken lightly. They may also be present feeding on the leaves. To accurately identify the Eurysacca species, larvae and/or pupae should be retrieved and adult moths reared for identification.

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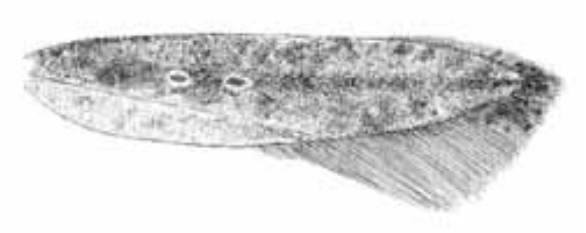

Title: Anterior wing

Caption: Anterior wing of E. melanocampta; note dark line.


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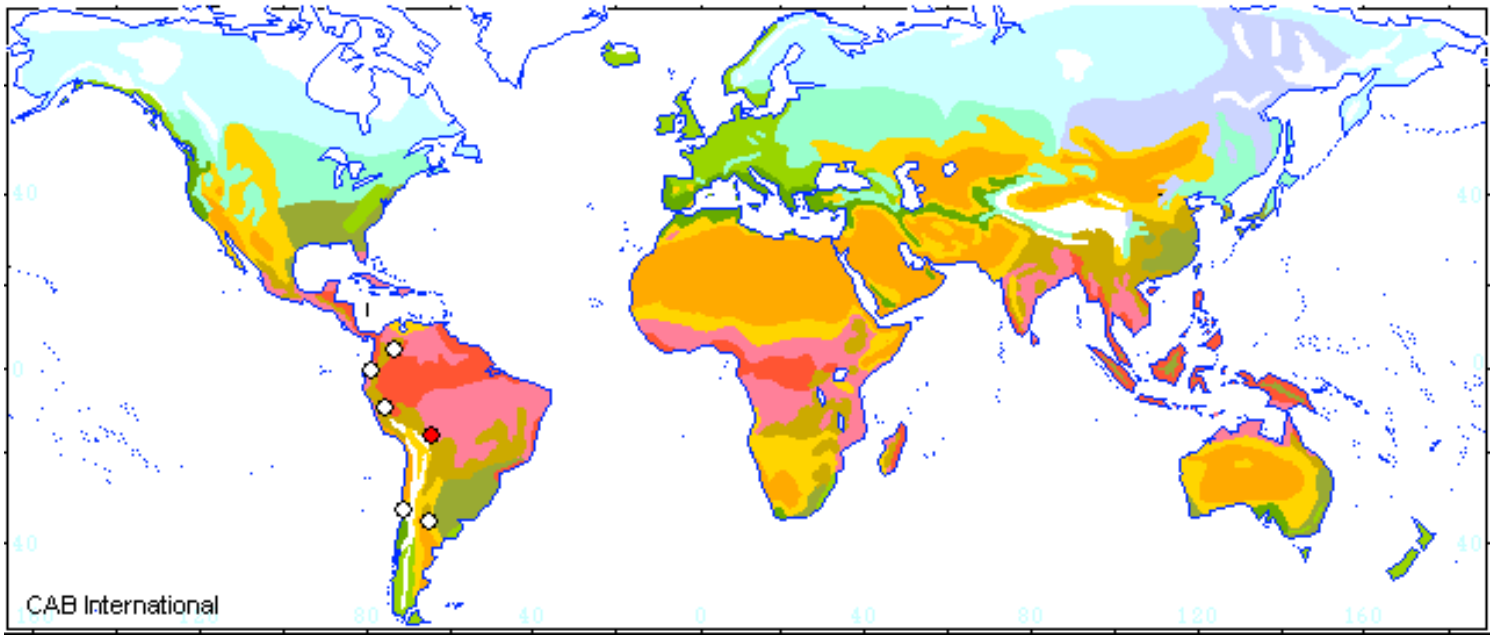
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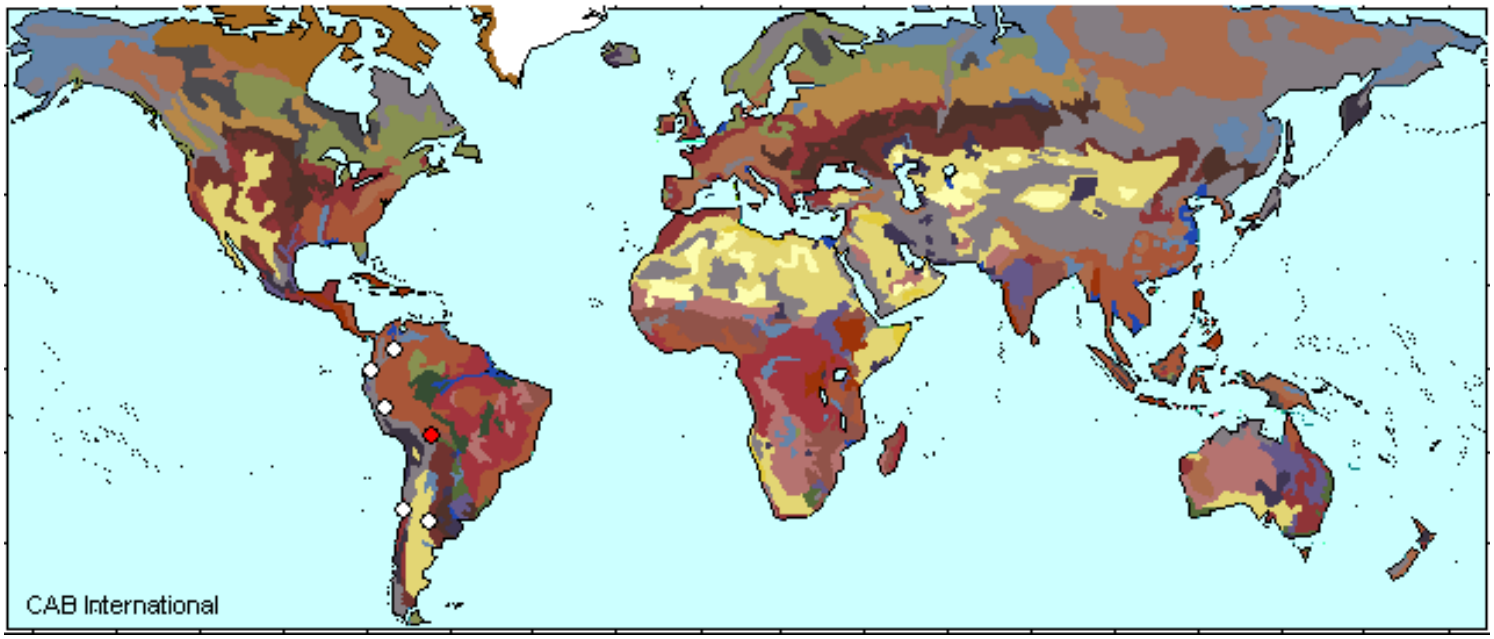
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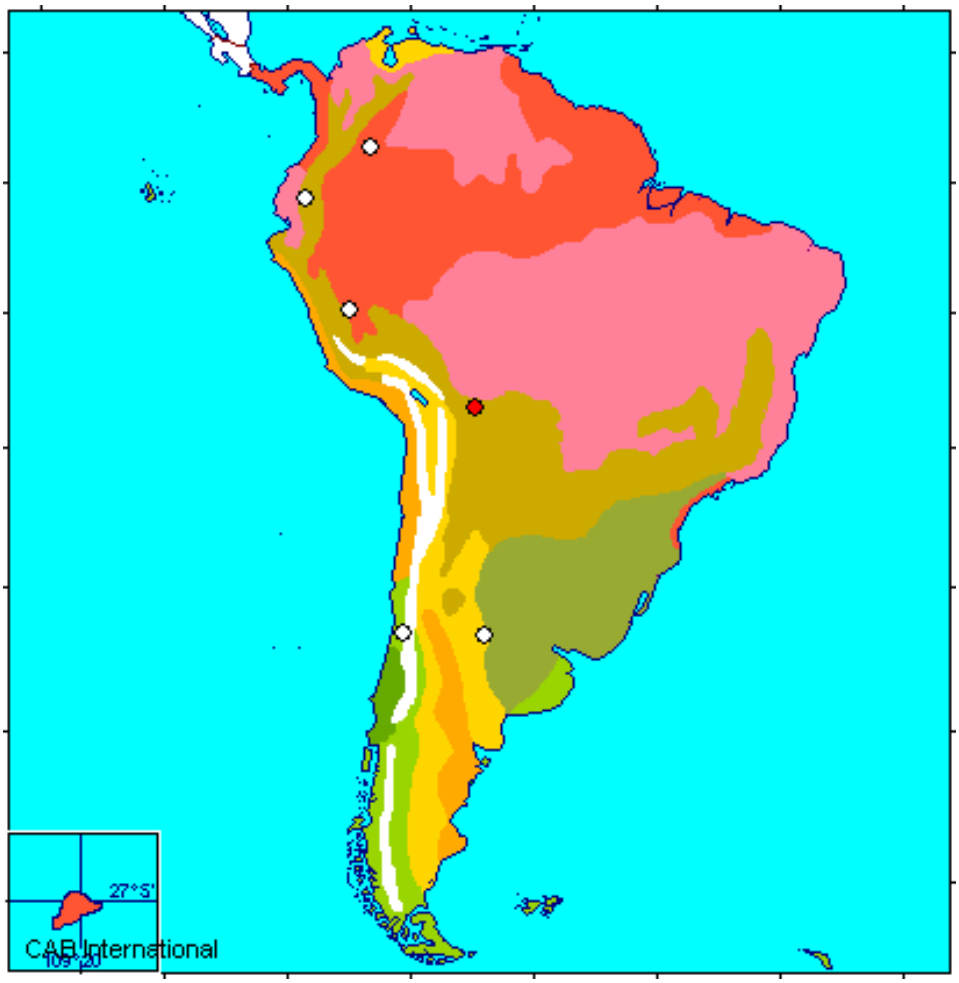
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109°20
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Last modified: 05/04/2004

Scientific name:
Eurysacca quinoae Povolný, 1997

Common name:
quinoa moth

Taxonomic position:
- Lepidoptera: Gelechiidae

Insect pest attacking:
- quinoa

Click the Picture or Map for further information

Selected sections for: *Eurysacca quinoae* (quinoa moth)

Preferred Scientific Name

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Adult moths emerge from pupae in the soil, although they can also be found in the inflorescence. Shortly after emergence the moths mate and the females lay regular batches of up to 30 or 40 eggs, mainly on the undersides of leaves or on the inflorescence. The eggs normally hatch in 9-10 days and the larvae immediately start to feed on the leaves.

Development and Survival

The effect of temperature on development has been described in an unpublished thesis by Flavio (1997) and further data on the development time is presented by Franco and Ochoa (1996) and in an unpublished thesis by Quispe (1978). Phenological data shows that the development time for this species, from egg to adult, ranges from 47 to 88 days in the field, depending on temperature. In a study by Flavio (1997), the development time was found to be either 28 days (24°C) or 56 days (5-22°C).

It is not known whether either species enters diapause; they may be facultative Rasmussen et al., 2001a, 2003).

Fecundity

The maximum number of eggs per female is about 300 (Flavio, 1997). Mean batch size is 30-40 eggs (Mujica, 1993). The effect of temperature on fecundity has not been described.

Phenology

Two to three moth generations are found during the quinoa field season in Peru from November to May, depending on the climatic conditions (Zanabria and Banegas, 1997; Mujica et al., 1998). The number of generations per year is not known, nor is it clear whether the second and third generation overlap. Mujica et al. (1998) indicated that the first generation is found from November to December, while second and third generations are found from March to May/June in the Altiplano of Peru.

Symptoms Text

The larvae of E. quinoae and E. melanocampta are first found between the apical leaves of late emerging plants, though not usually on early emerging plants. The damage here is mainly on the panicle. More damage is seen as the plant grows due to the large number of larvae per plant. The larvae rasp or chew the foliage with a preference for the inflorescence and immature grains (Mujica et al., 1998; Rasmussen et al., 2003).

Symptoms by affected plant part

- Fruits/pods: internal feeding; external feeding.
- Growing points: external feeding.
- Inflorescence: internal feeding; external feeding.
- Leaves: external feeding; abnormal forms; internal feeding.
- Stems: external feeding.
- Whole plant: external feeding.

Notes on Natural Enemies

Total parasitism of Eurysacca in quinoa fields ranges from 15 to 45% throughout Peru (Delgado, 1989; Zanabria and Banegas, 1997; Rasmussen et al., 2001a). Povolny and Valencia (1986) recorded up to 60% parasitism of E. melanocampta collected from potato in Colombia.

Rasmussen et al. (2001a) investigated the parasitoid complex of E. quinoae in Peru. They found that an undescribed species of Phytomyptera was the dominant species. Less important parasitoids were Copidosoma gelechiae, Diadegma sp. and a new species of an undescribed genus of Ichneumonidae. Significant differences were found between the parasitoid complex in the inter-Andean valleys and in the Altiplano. Whilst Phytomyptera was the most common parasitoid in the inter-Andean valley, the undescribed Ichneumonidae was the most common species in the Altiplano (Rasmussen et al., 2001a). The same parasitoid complex was later found to control E. melanocampta in the inter-Andean valleys (C Rasmussen, CIP, Peru, personal communication, 2000).

Predators may also be important natural enemies of Eurysacca. They include members from Coleoptera (Carabidae, Cicindelidae and Coccinellidae), Hymenoptera (Sphecidae) and Neuroptera (Hemerobius tolimensis; Hemerobiidae) (Zanabria and Mujica, 1977; Rasmussen et al., 2003).

Experiments from Peru and Bolivia showed that the granulosis virus could reduce the numbers of E. melanocampta by up to 50% (Calderón et al., 1996; Zanabria and Banegas, 1997).

Control

- Introduction
- Cultural Control
- Host-Plant Resistance
- Biological Control
- Chemical Control

Introduction

The timing of chemical and biological control is essential for the control of E. quinoae and E. melanocampta; however, little work has been done on the development of monitoring methods. Pheromones for attracting the adults have not been developed for either of the two species of Eurysacca. In a revision of previous studies, Rasmussen et al. (2003) found that the economic threshold level was from 3 to 15 larvae per plant in the Altiplano area of Peru.

Cultural Control

E. melanocampta has been found to carry-over out of the cropping season on volunteer quinoa plants, and their presence should be controlled (Rasmussen et al., 2001). Crop rotation and intercropping has also been recommended to break the continuity of the food chain for the pests in Peru and Bolivia (Mujica, 1993; Tapia, 1997; Zanabria and Banegas, 1997).

Host-Plant Resistance

Field observations indicate that white and sweet quinoa cultivars, with low saponin content, are more susceptible to pest attacks than bitter ones, and that cultivars with lax inflorescences show partial resistance to the Eurysacca moths (Mujica et al., 1998).

Biological Control

E. melanocampta and E. quinoae have a wide range of natural enemies, but their role in suppressing the population density is variable and unclear. However, natural enemies may play an important role in population regulation, and measures that preserve and encourage the build-up of natural enemies should be integrated into pest management programmes and production practices. None of the natural enemies have been used commercially or studied in detail. E. melanocampta larvae can be controlled by a baculovirus (Calderón et al., 1996; Zanabria and Banegas, 1997).

Chemical Control

The majority of the crop production in Bolivia and the Altiplano of Peru is organic. However, insecticides are often applied in the inter-Andean valleys of Peru. The insecticides currently in use are pyrethroids (Zanabria and Banegas, 1997). Formulations of natural plant extracts have not been tested thoroughly, though the use of antifeedants such as Minthostachys (Laminaceae) shows some control of the pests (Saravia, 1998).

Means of Movement and Dispersal

Plant parts liable to carry the pest in trade/transport
- Fruits (inc. Pods): Eggs, Larvae, Pupae; borne internally; borne externally; visible to naked eye.
- Flowers/Inflorescences/Cones/Calyx: Eggs, Larvae, Pupae, Adults; borne internally; borne externally; visible to naked eye.
- Leaves: Eggs, Larvae, Pupae; borne internally; borne externally; visible to naked eye.

Plant parts not known to carry the pest in trade/transport
- Bulbs/Tubers/Corms/Rhizomes
- Seedlings/Micropropagated Plants
- Roots
- Stems (above Ground)/Shoots/Trunks/Branches
- True Seeds (inc. Grain).

Impact

Both species of Eurysacca are considered very severe pests of quinoa in the main producing countries, Bolivia and Peru. Eurysacca is probably responsible for yield losses of 15-18% rising to 50% or more in dry years in Peru, and even more in Bolivia (Mujica, 1993; Rasmussen et al., 2003). Reports from adjacent countries where quinoa is grown show that there is less susceptibility of the crop to Eurysacca, this is probably due to the less intensive production of quinoa (Rasmussen et al., 2003).

Detection and Inspection Methods

Crop scouting should be carried out on a number of plants per field at least weekly after plant emergence. The nocturnal or crepuscular adults may be detected with light traps.

Eggs are mostly found on the undersides of the leaves or in the inflorescence and may be very hard to see. Feeding perforations from the first-instar larvae are best noticed early in the season, when the larvae mine fresh leaves. Later in the season larvae are easily detected inside the inflorescence and may drop off the plant if shaken lightly. They may also be present feeding on the leaves. To accurately identify the Eurysacca species, larvae and/or pupae should be retrieved and adult moths reared for identification.

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Title: Larva

Caption: Fifth-instar larva of E. quinoae.

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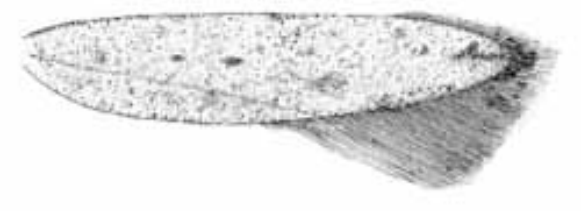

Title: Anterior wing

Caption: Anterior wing of E. quinoae; note light perspective.

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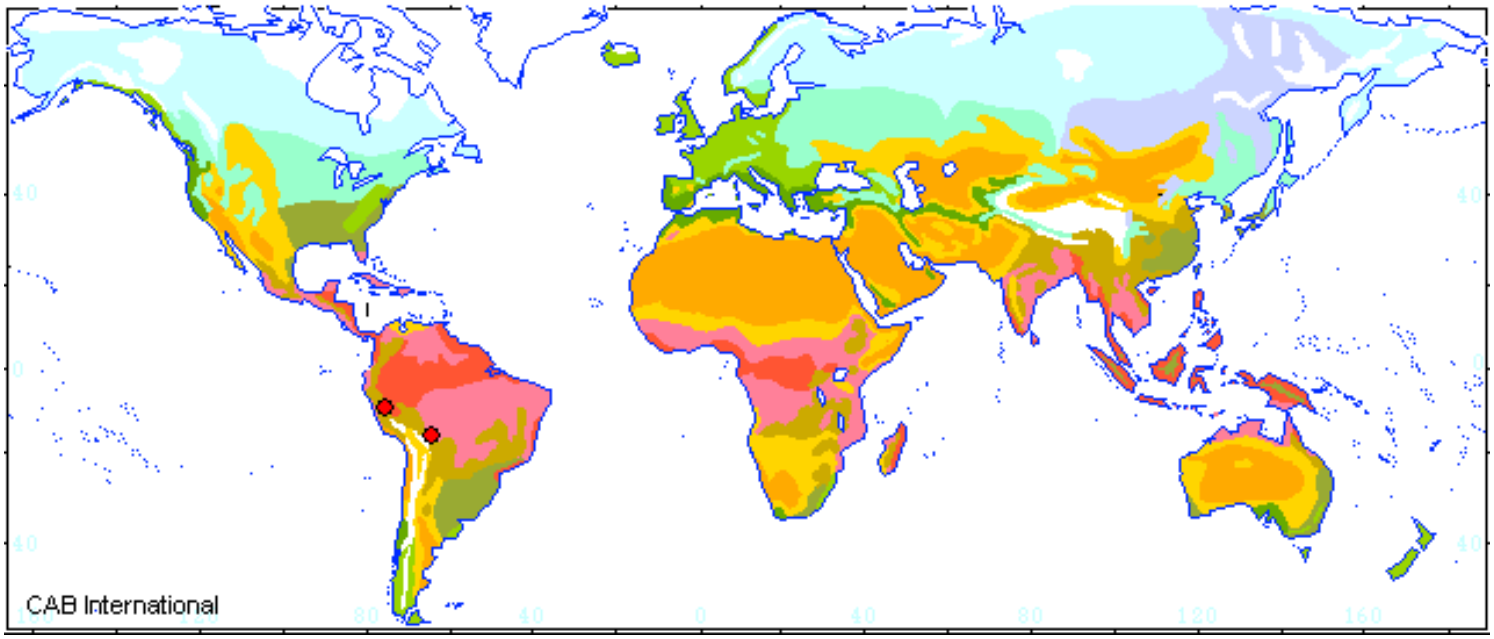
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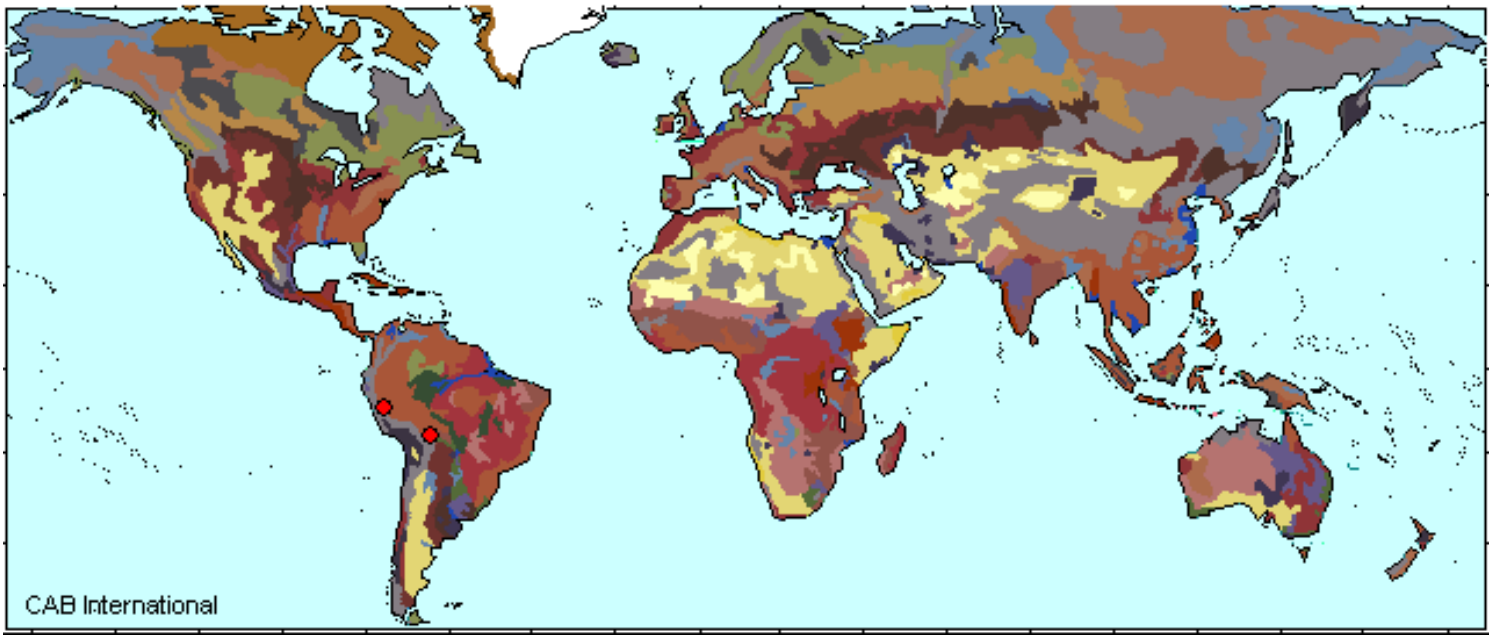
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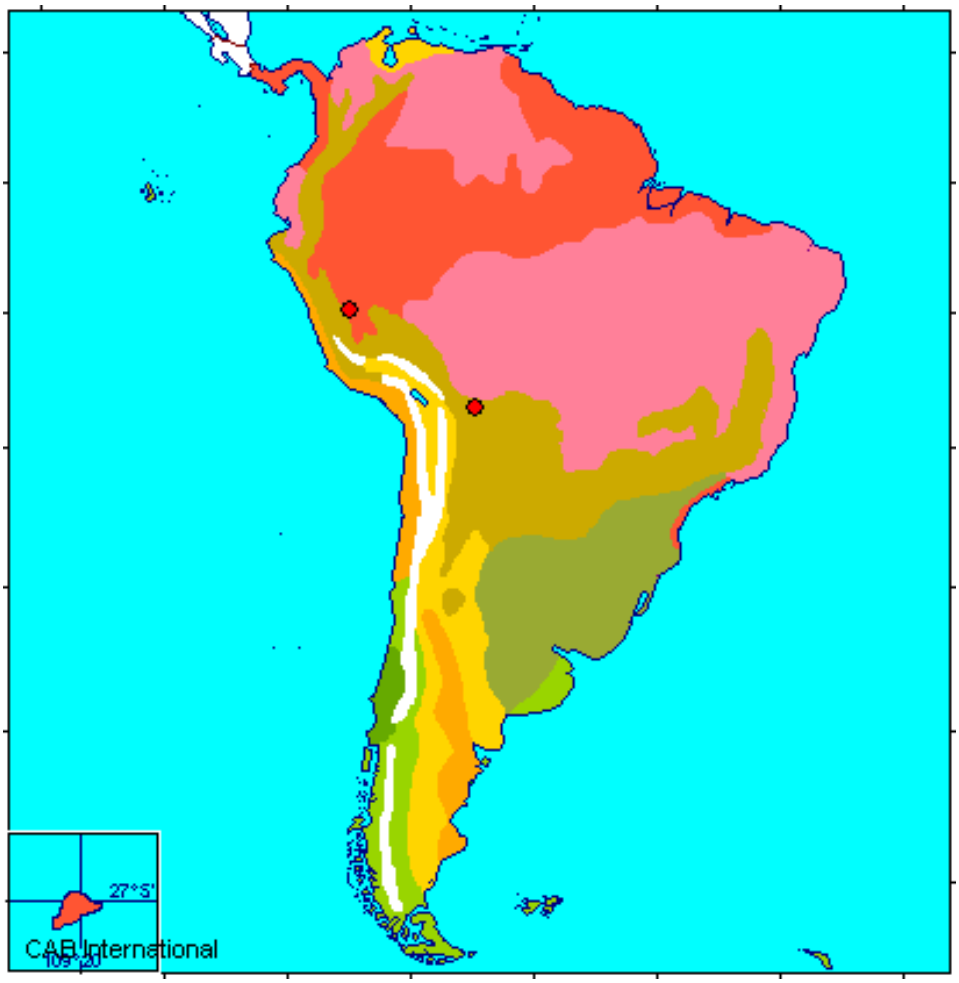
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