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Meghimatium striatum

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Summary

Datasheet Type(s)

Invasive Species

Summary of Invasiveness

Meghimatium striatum is a slug with a yellowish body colour usually with two to five regular brown to dark longitudinal bands. It is originally reported from Java, but it is widespread throughout East Asia, found in the tropical montane forests. It is introduced in the Hawaiian Islands, probably accidentally. It is considered to affect the survival rates of some endangered plant species in upland forest in the Hawaiian Islands.

Pictures

Picture	Title	Caption	Copyright
	Adult	Meghimatium striatum; Adult. South of Jakarta, Indonesia. December 2013.	©Jason Alexander/via iNaturalist - CC BY-NC 4.0
	Adult	Meghimatium striatum; Adult. South of Jakarta, Indonesia. December 2013.	©Jason Alexander/via iNaturalist - CC BY-NC 4.0
	Adult	Meghimatium striatum; Adult. South of Jakarta, Indonesia. December 2013.	©Jason Alexander/via iNaturalist - CC BY-NC 4.0

Identity

Preferred Scientific Name

Meghimatium striatum van Hasselt, 1823

Other Scientific Names

Philomycus australis Bergh, 1870

Philomycus striatus van Hasselt, 1823

Notes on Taxonomy and Nomenclature

Meghimatium striatum van Hasselt, 1823 is a species type of the genus *Meghimatium* which belongs to the Family Philomycidae. *Meghimatium* has been considered a subgenus of *Philomycus* by some authors, but it is now generally considered a genus on its own (Cowie, 1997; MolluscaBase, 2023). *Meghimatium* species are mainly classified based on pigmentation and genitalia (Wiktor et al., 2000). Different collections of M. striatum cluster together, forming a monophyletic group, clearly distinct from other *Meghimatium* species (Schilthuizen and Liew, 2008).

Description

Meghimatium striatum has a yellowish body colour, usually with five regular longitudinal bands from purplish-brown to black in colour; sometimes the outermost two are one line of dots and in other cases they have disappeared completely. The upper tentacles are dark. The body length is up to 45 mm and the body width up to 7 mm (Schilthuizen and Liew, 2008; Tsai and Wu, 2008).

Meghimatium striatum possesses a distinctly long vagina (Tsai and Wu, 2008): additional illustrations of the genitalia are in Gomes et al. (2011).

Distribution

Meghimatium striatum is widespread throughout East Asia. It is originally reported from Java (Tsai and Wu, 2008; Nurinsiyah et al., 2020), and has also been reported from Japan, the Malaysian state of Sabah (northern Borneo), Indonesia, Sumatra (Schilthuizen and Liew, 2008), Sulawesi Island (MolluscaBase, 2023) and southeast China (Wiktor et al., 2000). It was recorded as an introduced species in 1846 in the Hawaiian Islands, where it is now an established slug species (Cowie, 1997).

History of Introduction and Spread

Meghimatium striatum was previously recorded only from the Hawaiian Islands of Kauai and O'ahu, where it has been present since, at least, 1846 (Cowie, 1997). In 1999, it was recorded on the Island of Hawai'i (Cowie, 2000). This species is probably more widespread in the Hawaiian Islands than these records indicate (Cowie, 2000).

Introductions

Introduced to	Introduced from	Year	Reason	Introduced by	Established in wild through natural reproduction	Established in wild through continuous restocking	References	Notes
Hawaii		1846					Cowie (1997)	

Risk of Introduction

Meghimatium species have been intercepted in the USA from China and Taiwan on *Bougainvillea* sp., bonsai, orchids and especially on mushrooms (Gomes et al., 2011). Slugs such as *Deroceras laeve*, *Meghimatium striatum* and *Veronicella cubensis*, have all been found or intercepted in California in the last few years (WIPMC, 2019).

Means of Movement and Dispersal

Vector Transmission (biotic)

Meghimatium striatum has not been documented as a vector of disease, but *M. bilineatum* has been reported as a vector of the ratlungworm (Molet, 2014).

Accidental Introduction

Meghimatium striatum was probably an accidental introduction in Hawaii (Cowie, 1998). In general, land-mollusc species have dispersed outwards from their native area through human-mediated transport (Barker, 1982). Being phytophagous, they are more likely to arrive on plants and food, possibly through agricultural products, as the case of the introduction of *M. pictum* in Brazil, according to the USDA (Gomes et al., 2011).

Pathway Causes

Pathway cause	Notes	Long distance	Local	References
Crop production	accidentally	Yes	Yes	Cowie (1998)

Pathway Vectors

Pathway vector	Notes	Long distance	Local	References
Plants or parts of plants		Yes		Gomes et al. (2011)

Similarities to Other Species/Conditions

Meghimatium striatum and *M. uniforme* are small species reported from Southeast Asia (Tsai and Wu, 2008) and can be identified by their unique and relatively consistent mantle pigmentations and genitalia (Schilthuizen and Liew, 2008). *M. striatum* possesses a distinctly long vagina, and the penis of *M. uniforme* is almost negligible. The above characteristics of *M. striatum* and *M. uniforme* differ markedly from those of *M. burchi* (Tsai and Wu, 2008). *M. pictum* is similar to *M. striatum*, but the background colour of the body is white (Schilthuizen and Liew, 2008).

Habitat

In its native range, it is found in primary tropical montane forests (Java) (Schilthuizen and Liew, 2008; Nurinsiyah et al., 2020). In its introduced range, it is common in forested habitats (Joe, 2006).

In its native range, it is found at altitudes from 200 to 2400 m (Schilthuizen and Liew, 2008; Nurinsiyah et al., 2020). On Hawai'i Island, it is found from 300 m (Joe, 2006) to 823 m (Cowie, 2000).

Habitat List

Habitat	Presence	Status
Terrestrial|Terrestrial - Natural / Semi-natural|Natural forests	Principal habitat	Natural
Terrestrial|Terrestrial - Natural / Semi-natural|Natural forests	Principal habitat	Harmful (pest or invasive)

Biology and Ecology

Genetics

Meghimatium striatum has a sequence of cytochrome oxidase subunit I (COI) gene, partial cds; mitochondrial; 16S and 28S ribosomal RNA gene, partial sequence; mitochondrial (Sayers et al., 2020).

Reproductive Biology

Slug species are hermaphroditic and can self-fertilize with a high rate of reproduction. There is a knowledge gap about the reproductive biology for *M. striatum,* but other species of *Meghimatium*, such as *M. bilineatum*, have a high reproductive rate, producing an average of 932 eggs (Jason, 2016). *M. pictum* lays eggs on the ground (Gomes et al., 2011).

Nutrition

Meghimatium striatum is a grazer and detritus feeder (MolluscaBase, 2023).

Climate

Climate type	Status	Description	Remarks
Af - Tropical rainforest climate	Preferred		
Aw - Tropical wet and dry savanna climate		< 60mm precipitation driest month (in winter) and < (100 - [total annual precipitation{mm}/25])	
Cfa - Humid subtropical climate	Preferred		

Latitude/Altitude Ranges

Latitude North (°N)	Latitude South (°S)	Altitude lower (m)	Altitude upper (m)
35	-5	200	2400

Impact Summary

Category	Impact
Biodiversity (generally)	Negative

Economic Impact

In general, slugs have the potential to significantly reduce the value of nursery stock by feeding on plants. Some species become serious agricultural pests (Gomes et al., 2011). *M. striatum* has not been reported as an agricultural pest.

Environmental Impact

Impact on Biodiversity

Meghimatium striatum, along with other non-native slug species in upland forests of the Hawaiian Islands, showed in experimental conditions that they significantly affect the survival of seedlings of some endemic forest plants (Joe and Daehler, 2008). These seedlings include *Schiedea obovata* (Caryophyllaceae) which is declared as critically endangered (Bruegmann and Caraway, 2003a) and *Cyanea superba* (Campanulaceae) which is currently declared extinct in the wild by the IUCN (Bruegmann and Caraway, 2003b).

There is some belief that non-native slugs have impacted natural communities in Hawaii. The abundance of *M. striatum* is low compared with other slug species, e.g. *Limax maximus* or *Deroceras laeve* (Joe, 2006). Specifically, *S. obovata* shows the lowest mean acceptability amongst slug species, including *M. striatum* (Joe, 2006).

In the specific case of *C. superba*, there are other factors that limit successful recruitment such as seed predation by rats (Joe and Daehler, 2008). In addition, where it is present in moist forest habitat, *S. obovata* is threatened by habitat degradation by feral pigs and fire, which has severely fragmented populations, continuing the decline of mature individuals (Bruegmann and Caraway, 2003a)

Threatened Species

Threatened Species	Where Threatened	Mechanism	References	Notes
Cyanea superba	Hawaii Islands (US)	herbivory	Joe and Daehler (2008)	
Schiedea obovata	Hawaii Islands (US)	herbivory	Joe and Daehler (2008)	

Risk and Impact Factors

Invasiveness

Proved invasive outside its native range

Abundant in its native range

Tolerant of shade

Has high reproductive potential

Impact outcomes

Threat to/ loss of endangered species

Impact mechanisms

Herbivory/grazing/browsing

Likelihood of entry/control

Highly likely to be transported internationally accidentally

Prevention and Control

Due to the variable regulations around (de)registration of pesticides, your national list of registered pesticides or relevant authority should be consulted to determine which products are legally allowed for use in your country when considering chemical control. Pesticides should always be used in a lawful manner, consistent with the product's label.

Prevention

SPS Measures

Nematodes and molluscs present in Hawaii and relevant to Oregon ecosystems (USA) are included as Federal quarantined and regulated pathogens (Randall-Schadel and Caton, 2008).

Control

There is no specific control for *M. striatum*. For the sister species, *M. pictum*, two baits have been evaluated experimentally: iron phosphate bait was more effective (70%) than metaldehyde bait (15%) (Baronio et al., 2014).

Monitoring and Surveillance (incl. remote sensing)

Invertebrates are monitored for *M. striatum* along with other slugs (*Deroceras laeve*, *Limax maximus*), and exclosures are maintained for herbivory and seedling recruitment of the endemic plant *Plantago princeps* in Pahole Natural Area Reserve, O'ahu (Hawaiian Islands, USA) (USFWS, 2010).

Links to Websites

Website	URL	Comment
Catalogue of Life	https://www.catalogueoflife.org/data/taxon/9HDZT	
MolluscaBase	https://www.molluscabase.org/aphia.php?p=taxdetails&id=1249787	

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