This text is an integral part of the *EPPO Study on bark and ambrosia beetles associated with imported non-coniferous wood* and should be read in conjunction with the study

Pest information sheet
Ambrosia beetle

MEGAPLATYPUS MUTATUS (COLEOPTERA: PLATYPODINAE)

taladrillo grande de los forestales, barreno de los forestales y frutales (Spanish)

EPPO Lists: Megaplatypus mutatus was added to the EPPO A2 List of pests recommended for regulation in 2007. It is currently not regulated by EPPO countries (EPPO Global Database; EPPO, 2018). This pest information sheet uses information from the EPPO PRA and data sheet (EPPO, 2007, 2009) as well as from the literature published since.

PEST OVERVIEW

Taxonomy

Megaplatypus mutatus (Chapuis), Synonyms: *Platypus sulcatus* Chapuis, *Platypus plicatus* Brèthes, *Platypus mutatus* Chapuis (EPPO, 2009).

Associated fungi

Raffaelea santoroi (non-pathogenic) was the only known symbiont until recently (EPPO, 2009). In a recent study (Ceriani-Nakamurakare *et al.*, 2016a), 19 fungi were recovered in galleries of *M. mutatus* and 12 in adults and larvae. Most strains belonged to *Fusarium solani,* and other species included *Raffaelea arxii*, three *Raffaelea* sp., and *Graphium basitruncatum*; *R. santoroi* was not recovered, which suggests an occasional association. The authors concluded that especially *Fusarium*, *Raffaelea* and *Graphium* may have a role in the association with *M. mutatus*, and that the interaction with *F. solani* species complex is particularly relevant due to its potential role as a plant pathogen. No information was found on the pathogenicity of the other fungi associated with *M. mutatus*.

Morphology and biology (from EPPO, 2009 and EPPO PRA, 2007, both citing other sources)
Adults measure ca. 7-9 mm long, and are relatively large for ambrosia beetles. The morphology of the life stages of *M. mutatus* is described in detail in EPPO (2009). *M. mutatus* has one generation per year in South America and in Italy. It overwinters mainly as mature larvae or immature adults. Occasionally a few adults emerge before winter but, if a second generation is started, it is interrupted by cold. Adults appear in the field in late spring-early summer. Males start emerging a few days before females, and fly to tree trunks over 15 cm in diameter, in which they bore a radial gallery directed towards the centre of the trunk, and attract females by releasing a specific pheromone. After emergence, the adult has to find a new host within a maximum of 5 days. After mating, the two adults bore new galleries inside the trunk, in which the female lays 100–200 eggs over a period of 2–3 months. The first and second instar larvae of *M. mutatus* are mycetophagous, later they become xylophagous. The larvae generally reach maturity in the 5 months before the cold season or in early spring. They pupate in spring. The mean diameter of galleries of *M. mutatus* is 4.5 mm, but the diameter of larvae is 2.5 mm. The pest is known to have a very low rate of success in penetrating and reproducing in a tree (EPPO PRA, 2007). On certain hosts (such as cherry, apricot), there may be a large number of entry holes but galleries remain superficial and are blocked by the sap produced by the plant in reaction to the attack, and the pest does not complete its development (Griffo *et al.*, 2012; SFR Campania, 2015).

Spread biology

Adults fly, generally within a range of 50-100 m from the emergence hole. The adult is not a very good flyer, and is not likely to spread more than 100 m (EPPO, 2009, giving sources).

Nature of the damage

M. platypus is a primary pest and attacks only live standing trees. It does not attack declining trees or cut wood, and will only be present in them as a result of earlier primary attack. *M. mutatus* tunnels in the xylem, which weakens the trees, reducing yield (in wood volume) and causing breakage by wind, and even killing trees which are highly stressed. A major damage is loss of wood quality and value due to the presence of galleries and their dark fungal discoloration. Fruit trees are weakened by the galleries, produce less fruit, and become liable to breakage by wind (EPPO, 2009).

Detection and identification

- *Symptoms.* The main sign of infestation is the presence of holes 3 mm wide, exuding dust, sap and frass in early summer (EPPO, 2009; Alfaro *et al.*, 2007). The galleries are lined with the black fungal mycelium (EPPO, 2009). Nursery practices are considered sufficient to detect an infestation as evidenced by the production of sawdust (inspection of the trunks) (EPPO PRA, 2007).
- *Trapping*. The sex pheromones of *M. mutatus* males have been identified (EPPO, 2009 citing others) and work carried out in their use (e.g. Funes *et al.*, 2009). Pheromone traps were used for monitoring in Campania (Gonzalez-Audino *et al.*, 2013).
- *Identification.* The morphology of life stages is described in EPPO (2009, citing sources).

Distribution (see Table 1)

M. mutatus is native to South America. It was first found in Italy in 2000 in Campania, and was still restricted to that area in 2006 (EPPO PRA, 2007), and was found in Southern Lazio in 2016 (Regione Lazio, 2017).

Host plants (see Table 2)

M. mutatus is highly polyphagous, with known hosts belonging to over 35 non-coniferous and 2 coniferous genera. In South America and Italy, *Populus* are the main hosts. In Italy, it was recorded in Campania on: poplar, oak, pear, eucalyptus, peach, apricot, apple, cherry, mulberry, *Robinia* as well as some new host genera (*Corylus*, *Castanea* and *Juglans*), and was observed to complete its development only on some of these species (in 2007: poplar, hazelnut and apple) (SFR Campania, 2015). It is not clear if all hosts in Table 2 are breeding hosts.

Known impacts and control in current distribution

In South America, some poplar producers have lost their high quality wood market and have been obliged to diversify their activity to maintain their income, or else have lost income because of trading a lower quality product (EPPO, 2009). In Argentina, *M. mutatus* is a serious problem in commercial plantations of a number of broadleaf tree species, but is especially damaging to poplars (*Populus deltoides*) because it reduces wood quality and makes it unsuitable for certain uses (Alfaro *et al.*, 2007). On average 4 to 40% of trees are attacked in infested areas (EPPO PRA, 2007). *M. mutatus* has threatened an area of protected trees (*Salix*) in Argentina (EPPO PRA, 2007) (no details were found on possible damage in that area). On *Casuarina cunninghamiana* (an exotic tree commonly used in windbreaks) in Argentina, damage has worsened since the first symptoms were observed in 2007, with complete loss of windbreaks in some cases. In a survey in farms of Entre Rios and Corrientes Provinces, the loss of windbreaks reached 5-90% (Ramos *et al.*, 2015). In the same area, concerns were raised about possible attacks on *Eucalyptus* (the most important forest tree of that area), because of damage reported on *E. camaldulensis* in Uruguay with multiple internal galleries causing breakage (Ramos *et al.*, 2015).

In Italy, *M. mutatus* has caused damage to poplar (reduction of wood quality) and to fruit and nut crops (*Malus, Corylus*) (EPPO, 2009). Walnut and poplar plantations grown for timber production have sustained the greatest economic damage according to Alfaro *et al.* (2007). Severe infestations were noticed in the province of Caserta, mainly on *Corylus avellana*, but also on *Prunus cerasus*, *Pyrus communis* and *Malus domestica* (EPPO, 2004). On plum and kaki (persimmon), the percentage of plants attacked can reach 30% in some cases (Griffo *et al.*, 2012).

Control: In Argentina, early detection and destruction of infested trees is used, as well as injecting insecticides into the galleries or spraying trunks during peak adult emergence in spring (EPPO PRA, 2007). Pheromone-baited traps have been investigated on hazelnut and poplar for mating disruption; although labor intensive, they allow to reduce damage (Funes *et al.*, 2011; Ceriani-Nakamurakare *et al.*, 2016b) and in Italy, the number of active galleries was reduced by 65% on poplar and 56% on hazelnut (Griffo *et al.*, 2012).

POTENTIAL RISKS FOR THE EPPO REGION

Pathways

Entry

The introduction of *M. mutatus* into Italy might be linked to a single trial shipment of poplar round wood with bark from Argentina in 1998. No record of interceptions was found in the literature. The main pathways of entry, as defined in the EPPO PRA (2007), are: plants for planting of host plants with trunks of more than 15 cm diameter; round wood of host plants of more than 15 cm diameter; sawn wood and wood packaging material. The risk of sawn wood was perceived to be lower than round wood because the survival of larvae will be lower as humidity declines. It was noted that wood processing will destroy the pest (poplar wood is mostly processed for pulp, paper, cardboard and plywood production). Debarking will not eliminate the possibility of association of the pest with wood commodities. The host genera mostly traded as wood according to the EPPO PRA (2007) were *Acer, Eucalyptus, Pinus, Platanus, Populus, Quercus, Ulmus, Juglans, Balfourodendron, Cedrela, Castanea*. The likelihood of entry of the pest was overall considered to be low in the EPPO PRA, because at that time few commodities were imported from areas where the pest occurs (the current situation has not been investigated here).

A number of pathways were not mentioned in the EPPO PRA, and are mentioned here for consistency with other pest information sheets in this study. The likelihood of entry on wood chips, hogwood and processing wood residues would be lower than on round wood, as individuals would have to survive processing and transport, and transfer to a suitable host is less likely. Bark on its own is an unlikely pathway (life stages are associated with the xylem). Finally, cut branches are an unlikely pathway unless of a large diameter. This may be the case for the coniferous hosts (as Christmas trees), though there is no information that these are traded; such material is normally used indoors, and the pest is unlikely to be able to transfer to a suitable host.

Summary of pathways:

- *wood (round or sawn, with or without bark, incl. firewood) of hosts of more than 15 cm diameter*
- *wood packaging material if not treated according to ISPM 15*
- *plants for planting (except seeds) of hosts (with trunks of more than 15 cm diameter)*
- *wood chips, hogwood, processing wood residues (except sawdust and shavings)*
- *cut branches (Christmas trees) of coniferous hosts?*

Spread (following introduction, i.e. within EPPO region)

Spread within Italy following the first finding in 2000 has been limited, in the sense that the pest is reported only from two adjacent areas. From 2000 to 2007, the area of distribution of *M. mutatus* increased from 130 km^2 to 587 km^2 (Allegro and Griffo, 2008). Between 2008 and 2012, the infestation's boundary had extended on average by 5 km per year (Griffo *et al.*, 2012). These rates of spread are higher than natural spread reflected under *Spread biology*. It is not known if the potential for natural spread is higher than previously reported, or if human-assisted pathways have played a role in the local spread in Italy (however, the pest has not been reported elsewhere in Italy, which could show more importance of human-assisted pathways). In 2016, *M. mutatus* was found in Southern Lazio, which is the region adjacent to Campania (Regione Lazio, 2017). Natural spread towards the rest of the EPPO region is expected to be slow, as the current distribution in Italy is far from any borders. Human-assisted pathways, especially the transport of poplar wood, may lead to multiple introductions from which local spread could occur, especially if it reaches areas of poplar plantations for wood production.

Establishment

Areas with suitable climates and host plants are available in the EPPO region, therefore establishment is possible. The availability of host plants will not restrict establishment: known hosts are widespread in the EPPO region, and *M. mutatus* is known to have attacked new hosts in South America and in Italy. The major host *Populus* is widely present in the EPPO region, in the wild, in plantations for wood production or other purposes, and as ornamentals. *M. mutatus* is already established in Italy (Campania, Lazio). Using a CLIMEX study (which had a high uncertainty), the EPPO PRA (2007) defined that the coasts of the following countries had a largely similar climate to Campania: Albania, Algeria, Croatia, France, Greece, Portugal, Spain and Turkey. It concluded that the whole Mediterranean coasts and Portugal were at risk (incl. Israel and North African countries). Considering that *M. mutatus* may have a slightly lower degree day per generation requirement than expected, this area could possibly be extended to Northern Italy, Austria, Azerbaijan, Bulgaria, Georgia, Hungary, Moldova, Republic of Macedonia, Romania, Russia, Slovakia, Slovenia, Ukraine

(EPPO PRA, 2007). A wider establishment than originally assessed may also be expected as in Argentina it has extended its range into temperate regions (Neuquén in Patagonia, ca. 39°S) (Alfaro *et al.*, 2007).

Potential impact (including consideration of host plants)
M. mutatus may cause damage to a wide variety of trees which are present in the wild in the EPPO region or planted as forest trees, fruit trees, street trees, ornamentals and other purposes. One major impact would be loss of yield and quality of poplar wood, if it was introduced in areas where these trees are widely planted (e.g. Northern Italy). The limited natural spread may limit impact and allow for containment (if measures are applied). The potential impact was estimated to be high in the EPPO PRA (2007).

Table 1. Distribution

	Reference	**Comments**
EPPO region		
Italy	EPPO Global Database	First record in 2000 (province of Caserta, Campania). Still restricted to this area in 2006 (EPPO PRA, 2007). Found in Southern Lazio in 2016 (Regione Lazio, 2017).
South America		
Argentina	EPPO Global Database	
Bolivia	EPPO Global Database	
Brazil (Bahia, Espirito Santo, Parana, Rio de Janeiro, Rio Grande do Sul, Santa Catarina)	EPPO Global Database	
French Guiana	EPPO Global Database	
Paraguay	EPPO Global Database	
Peru	EPPO Global Database	
Uruguay	EPPO Global Database	
Venezuela	EPPO Global Database	
Absent, unreliable records: Colombia, Costa Rica	EPPO Global Database	

Table 2. Host plants (It is not clear if all hosts below are breeding hosts).

Family	**Genus/Species**	**Reference**
Altingiaceae	*Liquidambar styraciflua*	Giménez and Etiennot, 2003
Calophyllaceae	*Calophyllum*	Alfaro *et al.*, 2007
Calophyllaceae	*C. brasiliense*	Giménez and Etiennot, 2003
Casuarinaceae	*Casuarina*	Alfaro *et al.*, 2007
Casuarinaceae	*C. cunninghamiana*	Giménez and Etiennot, 2003
Casuarinaceae	*C. verticillata = C. stricta*	CPHST, 2016 citing others
Corylaceae	*Corylus avellana*	Allegro and Griffo, 2008
Cupressaceae	*Taxodium distichum*	Giménez and Etiennot, 2003
Ebenaceae	*Diospyros kaki*	Griffo *et al.*, 2012
Euphorbiaceae	*Sebastiania klotzschiana=S. commersoniana*	Giménez and Etiennot, 2003

Family	Genus/Species	Reference
Fabaceae	*Acacia*	Giménez and Etiennot, 2003
Fabaceae	*A. mearnsii*	Vinha Zanubcio *et al.*, 2010
Fabaceae	*Caesalpinia echinata*	Vinha Zanubcio *et al.*, 2010
Fabaceae	*Erythrina*	Alfaro *et al.*, 2007
Fabaceae	*E. crista-galli*	Giménez and Etiennot, 2003
Fabaceae	*Robinia pseudoacacia*	Giménez and Etiennot, 2003
Fagaceae	*Castanea sativa*	Allegro and Griffo, 2008
Fagaceae	*Quercus*	Giménez and Etiennot, 2003
Fagaceae	*Q. palustris*	Giménez and Etiennot, 2003
Fagaceae	*Q. robur*	Giménez and Etiennot, 2003
Fagaceae	*Q. rubra var. ambigua=Q. borealis*	Giménez and Etiennot, 2003
Juglandaceae	*Juglans regia*	Allegro and Griffo, 2008
Lamiaceae	*Vitex megapotamica*	Giménez and Etiennot, 2003
Lauraceae	*Laurus nobilis*	Giménez and Etiennot, 2003
Lauraceae	*Persea*	Alfaro *et al.*, 2007
Lauraceae	*P. americana*	EPPO GD
Magnoliaceae	*Magnolia grandiflora*	Giménez and Etiennot, 2003
Malvaceae	*Luehea divaricata*	Giménez and Etiennot, 2003
Malvaceae	*Tilia moltkei*	Giménez and Etiennot, 2003
Meliaceae	*Cedrela*	Alfaro *et al.*, 2007
Meliaceae	*C. tubiflora*	Giménez and Etiennot, 2003
Meliaceae	*Melia azedarach*	Giménez and Etiennot, 2003
Myrtaceae	*Angophora euryphylla*	Giménez and Etiennot, 2003
Myrtaceae	*Eucalyptus*	Giménez and Etiennot, 2003
Myrtaceae	*E. camaldulensis*	Giménez and Etiennot, 2003
Myrtaceae	*E. dunnii*	Giménez and Etiennot, 2003
Myrtaceae	*E. robusta*	Giménez and Etiennot, 2003
Myrtaceae	*E. tereticornis*	Giménez, 2009, citing others
Myrtaceae	*E. urophylla* × *E. camaldulensis*	Vinha Zanubcio *et al.*, 2010
Myrtaceae	*E. urophylla* × *E. grandis*	Vinha Zanubcio *et al.*, 2010
Oleaceae	*Fraxinus*	Giménez and Etiennot, 2003
Oleaceae	*F. excelsior*	Giménez and Etiennot, 2003
Oleaceae	*Ligustrum lucidum*	Giménez and Etiennot, 2003
Pinaceae	*Pinus*	Giménez and Etiennot, 2003
Platanaceae	*Platanus x acerifolia*	Giménez and Etiennot, 2003
Proteaceae	*Grevillea*	Alfaro *et al.*, 2007
Proteaceae	*G. robusta*	Giménez and Etiennot, 2003
Rosaceae	*Malus domestica*	EPPO, 2004 citing source
Rosaceae	*Malus sylvestris*	Giménez and Etiennot, 2003
Rosaceae	*Prunus armeniaca*	Allegro and Griffo, 2008
Rosaceae	*Prunus avium*	Allegro and Griffo, 2008
Rosaceae	*Prunus cerasus*	EPPO, 2004 citing source
Rosaceae	*Prunus pensylvanica*	EPPO GD

Family	**Genus/Species**	**Reference**
Rosaceae	*Prunus persica*	Giménez and Etiennot, 2003
Rosaceae	*Pyrus communis*	Giménez and Etiennot, 2003
Rutaceae	*Balfourodendron*	Alfaro *et al.*, 2007
Rutaceae	*B. riedelianum*	Giménez and Etiennot, 2003
Rutaceae	*Citrus*	Giménez and Etiennot, 2003
Salicaceae	*Populus*	Giménez and Etiennot, 2003
Salicaceae	*P. alba*	Giménez and Etiennot, 2003
Salicaceae	*P. deltoides*	Giménez and Etiennot, 2003
Salicaceae	*P. x canadensis*	Allegro and Griffo, 2008
Salicaceae	*P. x euroamericana*	Giménez and Etiennot, 2003
Salicaceae	*Salix alba*	Giménez and Etiennot, 2003
Salicaceae	*Salix babylonica*	Giménez and Etiennot, 2003
Salicaceae	*Salix nigra*	Giménez and Etiennot, 2003
Sapindaceae	*Acer*	EPPO, 2009
Sapindaceae	*A. negundo*	Giménez and Etiennot, 2003
Simaroubaceae	*Ailanthus*	EPPO, 2009
Simaroubaceae	*A. altissima*	Giménez and Etiennot, 2003
Ulmaceae	*Ulmus*	Giménez and Etiennot, 2003
Ulmaceae	*U. pumila*	Giménez and Etiennot, 2003

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