

Integration and Synthesis Summary for Plants, Pacific Islands
Flowering Plants Assessment Group 6 – Monocots dependent on biotic pollination vectors and able to use self-fertilization and/or asexual reproduction at least partially to maintain populations over time

The tables below contain summaries of the information and data we used to determine the ranking (high, medium, low) for vulnerability, risk and usage indicators. Information in most of the columns was used directly in the ranking determination (green fill). Where indicated, information in other columns was not used directly in the ranking calculation, but provided additional information about the species that fed into one of the ranking metrics or was used to make the draft determination when relevant. The summary for this assessment group also includes new conservation measures¹ that have been incorporated into the Action since the draft biological opinion was released. The measures and our related assumptions are incorporated into our analysis (immediately above Table 3), and also factor into the rationales for our conclusions for each species, as described below.

All species in this assessment groups are monocots, a class of angiosperm flowering plant defined by having only one cotyledon (embryonic seed leaves). There are a large variety of monocot species, typical monocot plants include grasses, lilies and palms. The monocots in this assessment group utilize biotic vectors to accomplish pollination, such as insects, birds and mammals. All plants in this group can rely on self-fertilization or asexual (vegetative) reproduction at least partially in order to maintain their populations over time. Seed dispersal for the species in this group is achieved by biotic (dispersal by animals) and/or abiotic (dispersal by wind, water or gravity) means.

Table 1: Summarizing Data and Information for Vulnerability Ranking

Data Sources: Status of the Species (SOS) accounts updated as of November 2019 (Appendix C); NA=Not Applicable; GU=Guam; CNMI=Commonwealth of Northern Marianas Islands

Scientific Name	Common Name	Location	Status	Population Level Trends	Species Level Trends	Number of Populations	Distribution	Number of Individuals	Pesticides Listed as a Threat	Pollinator Loss Listed as a Threat	Vulnerability Ranking
<i>Bulbophyllum guamense</i>	Cebello halumtano	GU, CNMI	Threatened	Not Available	Guam: declining (USFWS, 2015)	12 (USFWS, 2015)	It is known from widely distributed occurrences on the southern Mariana Islands of Guam and Rota (Ames 1914, p. 13; Raulerson and Rinehart 1992, p. 90; Costion and Lorence 2012, pp. 54, 66; Global Biodiversity Information Facility (GBIF) 2012a—Online Herbarium Database; Zarones et al. 2015c, in litt.) (USFWS, 2015).	Guam: < 250; Rota: 261+	No Mention	No Mention	High
<i>Dendrobium guamense</i>	No common name	GU, CNMI	Threatened	50% decline in range (USFWS, 2015)	Number of known individuals increasing (USFWS, 2015)	21 (USFWS, 2015)	It occurs on Guam, Rota, and Tinian, and was recently recorded for the first time on Aguiguan (Ames 1914, p. 14; Raulerson and Rinehart 1992, p. 98; Quinata 1994, in litt.; Raulerson 2006, in litt.; Costion and Lorence 2012, p. 66; Zarones et al. 2015a, in litt.; Zarones et al. 2015c, in litt.). Raulerson (2006, in litt.) cites <i>D. guamense</i> as also occurring on Agrihan, however, a voucher record or survey report to support this location could not be found (USFWS, 2015).	~1,250 - 35,000 (USFWS, 2015)	No Mention	No Mention	High

*Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Table 2: Summarizing Data and Information for Risk Ranking

Data Sources: SOS accounts (Appendix C); NA=Not Applicable; GU=Guam; CNMI=Commonwealth of Northern Marianas Islands

Risk to Individuals and Pollinators if exposed: The individual plants in this assessment group are not expected to experience effects to growth or survival from exposure to malathion. Mortality is expected for insect pollinators and seed dispersers exposed to malathion on use sites, via spray drift, and from mosquito control applications. Because terrestrial invertebrates exhibit a range of sensitivities to malathion, insect abundance is expected to be reduced where exposure

¹ Additional information on these new conservation measures can be found in the Description of the Action section of this biological opinion.

occurs, but not completely eliminated. However, some species are likely to incur greater levels of mortality than others based on their sensitivity. As plants often have unknown or specific pollinators and seed dispersers for which toxicity data is unavailable, we assume insects that pollinate or disperse the seeds of listed plants are sensitive to malathion, and that exposure will cause mortality. In field studies, reductions of common insect species following pesticide exposure are often temporary with recovery over a short period of time. However, since listed plants may be reliant on insect pollinators or seed dispersers that are limited in range or abundance, these insect species may be less likely to recover following pesticide exposure. Some bird pollinators and seed dispersers exposed to malathion on use sites may experience mortality or sublethal effects, depending on the site of exposure and size of the bird. Smaller birds exposed on use sites with higher allowable use rates (e.g., developed, open space developed, orchards and vineyards) have a greater chance of being affected. Exposure to spray drift is not expected to result in effects to bird seed dispersers. No effects (mortality or sublethal effects) are expected for mammalian pollinators or seed dispersers from malathion exposure either on use sites or from spray drift.

Scientific Name	Common Name	Direct effects expected (yes or no, reduction in dry weight when exposed in use areas that may have effects)	Effects to Pollinators	Method of Reproduction (risk modifier)	Seed Dispersal Vector (risk modifier)	Obligate or Specific Pollinator (risk modifier)	Pollination Vector*	% Range Overlap with Federal Lands	Risk Ranking
<i>Bulbophyllum guamense</i>	Cebello halumtano	No	High	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No Mention	Insect	0	Medium
Dendrobium guamense	No common name	No	High	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No Mention	Insect	0	Medium

*Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Cumulative Effects and Environmental Baseline: Please refer to the Status of the Species accounts (Appendix C) and overarching Environmental Baseline and Cumulative Effects sections of this Opinion.

Additional Conservation Measures:

Additional information on these new conservation measures can be found in the *Description of the Action* section and Appendix A-2 of this biological opinion, and further information on the anticipated impacts of each measure in the *Effects of the Action* section.

General Conservation Measures

Several additional conservation measures have been recently provided by EPA and will be implemented as part of the Action. These measures will apply to all species in this assessment group with corresponding use type overlap and usage (i.e., mosquito adulticide, agricultural and residential uses). All measures are anticipated to limit the exposure of pollinators and seed dispersers to malathion in the described use area where it occurs in or around the range of the species, thus further reducing the risk of reproductive effects to the species. We summarize the new measures and our related assumptions below.

Bloom restrictions: New restrictions on orchards and vineyards, pasture, and other crops UDLs will prohibit application of malathion within three days prior to bloom, during bloom, and until petal fall is complete on certain crops. This measure is anticipated to limit the exposure of pollinators/seed dispersers to malathion in this use area where it occurs in or around the range of the species, reducing the risk of impacts to reproduction.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit lower the maximum allowable number of applications (previously ranging from 3-13 applications per year, depending on the specific crop) to 2-4 per year, as described in the Description of the Action of this Opinion. This is anticipated to reduce the amount of malathion used and decrease exposure to the species and its pollinators/seed dispersers, thus decreasing the risk of impacts to reproduction and direct impacts to the plant itself.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are anticipated to significantly reduce exposure to species and their pollinators/seed dispersers that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application. We anticipate this measure will further reduce exposure to biotic pollinators and seed dispersers, thus decreasing the risk of impacts to reproduction and sub-lethal impacts to the plant itself.

Table 3: Summary of Conclusions

Number	Scientific Name	Common Name	Location	Vulnerability Ranking	Risk Ranking	Potential Exposure Ranking	Species Conclusion (J, NJ)*
1	<i>Bulbophyllum guamense</i>	Cebello halumtano	GU, CNMI	High	Medium	Low	NJ
2	<i>Dendrobium guamense</i>	No common name	GU, CNMI	High	Medium	Low	NJ

*J = Jeopardy; NJ = No Jeopardy

Rationale for Species Conclusions

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service’s biological opinion that the registration of malathion, as proposed is not likely to jeopardize the continued existence of the plant species in this assessment group.

For these species, we anticipate their high vulnerabilities and variable levels of risk to individuals or species is offset by low levels of usage of malathion, as described below. As discussed in the Approach to the Analysis of the Pacific and Caribbean Island Species, there is a high degree of uncertainty for quantitative usage data for the Pacific Islands. For species with a portion of their range on Federal lands, we did not quantitatively evaluate use or usage on in these areas, but we assume only low levels of usage, per the rationale described in the Biological Opinion. For the non-Federal lands portion of the species ranges, we have limited information on past malathion usage in the Pacific Islands, and thus our estimation of usage and exposure on non-Federal lands contains a large degree of uncertainty. Briefly, we anticipate that usage in non-agricultural areas will be low (up to 5% of overlap in any given area). We anticipate that the available agricultural usage data, which is from a single year and does not distinguish between use categories, likely provides an upper bound of malathion usage for our analysis, particularly as it includes all insecticides. This usage is also anticipated to be low (~5% of agricultural lands treated across the islands as an upper bound for malathion for the Pacific Islands), though we cannot predict the degree of usage in proximity to particular species’ ranges. However, given that 95% of agricultural fields are not anticipated to be treated with insecticides, we assume a low probability that any individual plant will be in proximity to agricultural usage of malathion.

Bulbophyllum guamense and *Dendrobium guamense* have high vulnerabilities based on their endangered status and restricted distributions as shown above. *Bulbophyllum guamense* is an epiphytic orchid known from widely distributed occurrences on the southern Mariana Islands of Guam and Rota, in the forest ecosystem, though most occurrences are on the island of Rota (Final Listing Rule, 2015). *Dendrobium guamense* is also an epiphytic orchid known from the forest ecosystem on Guam, Rota, Saipan (historically), and Tinian. It was also recently recorded for the first time on Aguiguan (Final Listing Rule, 2015).

Specific species of pollinators are unknown for both plants, but suspected to be insects based on known pollinators of other orchid species. Mortality is expected for insect pollinators and seed dispersers exposed to malathion on use sites or via spray drift. We anticipate adverse effects to these species due to the reduction in pollinating insects and seed dispersers.

Given that these species can rely on a variety of seed dispersal vectors, including abiotic vectors, and in light of the additional conservation measures, we do not anticipate effects to insect or avian seed dispersers for these species would result in species-level reproductive effects.

We anticipate these species will have a low level of exposure to malathion given they occur in forests where we anticipate less exposure, as malathion is not registered for use in forests and due to the blocking effects of vegetation on spray drift in the forest. In addition, there is a low probability that the species range will overlap with or occur in proximity to a malathion agricultural use site on the Pacific islands, as described above, so it is unlikely malathion usage will occur in or near these species’ ranges. However, we anticipate the conservation measures described above will further reduce the risk of exposure of both pollinators and seed dispersers in the portion of the range where we anticipate malathion to be applied. For example, residential uses of malathion are now limited to two applications per year (reduced from as many as necessary) and to spot treatments only, reducing the application footprint and likelihood of spray drift within developed and open space developed areas. The reduced application footprint and likelihood of spray drift are a result of the allowable application methods for spot treatment (such as the use of hand-pump sprayers, which are not capable of producing broadcast use) and low amounts of chemical used.

We do not anticipate that the use of this pesticide is likely to have species-level effects due to these species existence in habitat areas where they do not have a high potential for malathion exposure, their low likelihood of being in proximity to a malathion usage area, their reliance on abiotic seed dispersal vectors. The implementation of the conservation measures will further reduce the likelihood of exposure of these plants and their pollinators and seed dispersers. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of *Bulbophyllum guamense* and *Dendrobium guamense* in the wild.