Taxon: Andrographis paniculata (Burm. f.) Wall. ex Nees **Family:** Acanthaceae

Common Name(s): creat
green chireta

Synonym(s): Justicia paniculata Burm. f.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 26 Feb 2020

WRA Score: 8.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Perennial Herb, Weedy, Medicinal, Shade Tolerant, Self-Compatible

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic	y=1, n=0	y
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation		
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal		
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[No evidence] "A. paniculata is relatively widespread and has a tendency to naturalize in areas where it has been introduced. Locally it is cultivated both for its ornamental and medicinal value. Therefore, the risk of genetic erosion seems rather limited. Selection should be directed to plant material with a higher content of medicinally important constituents. Preliminary results from callus culture techniques show considerable potential for improvement."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	NA

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**High**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 24 Feb 2020]	"Native Asia-Tropical INDIAN SUBCONTINENT: India, Sri Lanka"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed]	

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10-20% of full light."

204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is probably native to India, but has been introduced and cultivated as a medicinal plant in many parts of Asia including Indo-China, China, Thailand, Peninsular Malaysia, Indonesia, the Philippines and Australia. It is now widely naturalized in most of these regions. It has also been introduced, possibly for its ornamental value, in the West Indies and Central America."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is probably native to India, but has been introduced and cultivated as a medicinal plant in many parts of Asia including Indo-China, China, Thailand, Peninsular Malaysia, Indonesia, the Philippines and Australia. It is now widely naturalized in most of these regions. It has also been introduced, possibly for its ornamental value, in the West Indies and Central America."
	Wu, Z. Y., P. H. Raven & D. Y. Hong, (eds). 2011. Flora of China. Vol. 19 (Cucurbitaceae through Valerianaceae, with Annonaceae and Berberidaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Cultivated or naturalized in Anhui, Fujian, Guangdong, Guangxi, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Yunnan, and Zhejiang [native to India and Sri Lanka; cultivated or naturalized in Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam, and Caribbean]."

Qsn #	Question	Answer
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 24 Feb 2020]	"Cultivated Asia-Temperate CHINA: China Asia-Tropical INDIAN SUBCONTINENT: India INDO-CHINA: Cambodia, Laos, Myanmar, Thailand, Vietnam MALESIA: Indonesia, Malaysia, Philippines Australasia AUSTRALIA: Australia Southern America CARIBBEAN: West Indies CENTRAL AMERICA: Central America Naturalized Africa WESTERN INDIAN OCEAN: Mauritius Asia-Temperate CHINA: China (s.) Asia-Tropical INDO-CHINA: Indochina MALESIA: Indonesia, Malaysia Southern America CARIBBEAN: West Indies CENTRAL AMERICA: Central America"

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is probably native to India, but has been introduced and cultivated as a medicinal plant in many parts of Asia including Indo-China, China, Thailand, Peninsular Malaysia, Indonesia, the Philippines and Australia. It is now widely naturalized in most of these regions. It has also been introduced, possibly for its ornamental value, in the West Indies and Central America. "
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 24 Feb 2020]	"Naturalized Africa WESTERN INDIAN OCEAN: Mauritius Asia-Temperate CHINA: China (s.) Asia-Tropical INDO-CHINA: Indochina MALESIA: Indonesia, Malaysia Southern America CARIBBEAN: West Indies CENTRAL AMERICA: Central America"
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence to date

302	Garden/amenity/disturbance weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10-20% of full light. "
	Rahman, A. H. M. M. (2013). A Checklist of Common Angiosperm Weeds of Rajshahi District, Bangladesh. International Journal of Agricultural and Soil Science, 1(1), 1-6	"Table 1. A checklist of common angiosperm weeds of Rajshahi district, Bangladesh" [Includes Andrographis paniculate, but with no impacts specified]
	Zeleke, T., Degu, T., Gudisa, T., & Birhan, M. (2019). Rice Weed Species and Weed Management in Ethiopia. Pp. 147 -160 in Advances in Rice Research and Development in Ethiopia. Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia	"Table 2: Weed species composition and diversity in South Gondar Zone" [Includes Andrographis paniculate. Impacts unspecified]
	Mallick, S. N., Maharana, M. R., & Acharya, B. C. (2015). Weed flora of Rourkela and adjoining areas of Sundargarh district, Odisha, India. Journal of Economic and Taxonomic Botany, 39(1), 131-137	"The present study focuses on the weed diversity of non forest and crop fields of Rourkela and adjoining areas in the district of Sundargarh of Odisha state. A total of 174 weed species under 135 genera belonging to 10 monocot families, 43 dicot families and one pteridophytic family are reported in this investigation." [Andrographis paniculata listed among the weeds in this publication]
	Plants for a Future. (2020). Andrographis paniculata. https://pfaf.org. [Accessed 26 Feb 2020]	"Weed Potential: Yes"... "The plant has escaped from cultivation and become naturalized in many areas of the tropics"
	WRA Specialist. (2020). Personal Communication	Classified as a weed in a number of publications, but with no impacts specified. Grows on roadsides, waste places and other disturbed habitats.

303	Agricultural/forestry/horticultural weed	
	Source(s)	**Notes**
	Zeleke, T., Degu, T., Gudisa, T., & Birhan, M. (2019). Rice Weed Species and Weed Management in Ethiopia. Pp. 147 -160 in Advances in Rice Research and Development in Ethiopia. Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia	"Table 2: Weed species composition and diversity in South Gondar Zone" [Includes Andrographis paniculate. Impacts unspecified]

304	Environmental weed	n
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10-20% of full light."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

Qsn #	Question	Answer
305	**Congeneric weed**	
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Potentially. Andrographis echioides, Andrographis laxiflora, and Andrographis serpyllifolia designated as weeds. Impacts uncorroborated

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, (eds). 2011. Flora of China. Vol. 19 (Cucurbitaceae through Valerianaceae, with Annonaceae and Berberidaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Herbs to 50 cm tall, annual, much branched. Stems 4-angled, glabrous. Petiole 0.3–1 cm; leaf blade ovate-lanceolate, lanceolate, or narrowly elliptic, 1.5–7 × 1–2.5 cm, both surfaces glabrous, abaxially pale green, adaxially green, secondary veins 3–5 on each side of midvein, base attenuate and decurrent onto petiole, margin entire, apex acute to shortly acuminate. Inflorescences terminal, leafy panicles of secund racemes; rachis glabrous to sparsely pubescent; bracts triangular to subulate, 1–1.5 mm; bracteoles linear to subulate, 1–1.5 mm. Pedicel 2–9 mm, sparsely pubescent with gland-tipped and non-glandular trichomes (gland-tipped pubescent). Calyx 2.5–3 mm, outside glabrous or gland-tipped pubescent, lobes subulate. Corolla white, 0.9–1.5 cm, outside gland-tipped pubescent; tube basally funnelform for 4–8 mm; lower lip with purple dots, 5–7 mm, erect, lobes ca. 3 mm; upper lip 5–7 mm, reflexed, 2-lobed, lobes ca. 1 mm. Stamens exserted from corolla tube. Style 6–10 mm, sparsely pilose toward base. Capsule ellipsoid-compressed, 1.5– 2 × 0.3–0.4 cm, glabrous or sparsely pubescent with glandtipped trichomes, ca. 12-seeded. Seeds ca. 2 × 1.5 mm, rugose."

402	Allelopathic	y
	Source(s)	**Notes**
	Zeng, L. J., Liu, Y., Chu, C. L., & He, Y. (2011). Studies on the Allelopathy and GAP Management of Andrographis paniculata (Burm. f.) Nees. Research and Practice on Chinese Medicines, (3), 1	"Objective To investigate allelopathy of Andrographis paniculata (Burm.f.) Nees for its GAP management.Methods With watch glass culture,the inhibitory effects of andrographlide and the rhizosphere extract of Andrographis paniculata on seed germination of the herb itself and Bidens pilosa were conducted,and with HPLC method,the main constituents of the rhizosphere extract were analysed.Results The results showed that both of andrographlide and the rhizosphere extract had significant inhibitory effects on the germinations of Bidens pilosa seeds and itself;the effects strengthened with increasing of their concentrations.Andrographlide is one kind of main constituents in the rhizosphere extract indicated by HPLC analysis.Conclusion In the growth period,Andrographis paniculata release some alleochemicals into the soil,and andrographlide is one of the main allelochemical."
	Suwitchayanon, P., Kunasakdakul, K., & Kato-Noguchi, H. (2017). Screening the allelopathic activity of 14 medicinal plants from Northern Thailand. Environmental Control in Biology, 55(3), 143-145	"Table 1 Effect of 14 medicinal plants on hypocotyl and radicle growth of lettuce seedlings" [Includes Andrographis paniculata]

Qsn #	Question	Answer
	Li, M., Zhou, X. Y., & Lu, Z. H. (2010). Allelopathy of Andrographis paniculata vegetative. Journal of Chinese Medicinal Materials, 33(12), 1829-1833	"Within the testing concentration range, water extracts of Andrographis paniculata on allelopathic effects of cabbage (Brassica chinensis), Radis (Raphanus sativus) and Desmodium styracifolium showed allelopathic effect, and roughly showed inhibitive effect. However, showed different effect in which high concentration inhibited and low concentration promoted to different receptor."

403	Parasitic	n
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A perennial herb 30-100 cm tall; stems distinctly 4-angular, glabrous apart from a few hairs at the nodes." [Acanthaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Yusuf, A. L., Goh, Y. M., Samsudin, A. A., Alimon, A. R., & Sazili, A. Q. (2014). Growth performance, carcass characteristics and meat yield of Boer goats fed diets containing leaves or whole parts of Andrographis paniculata. Asian-Australasian Journal of Animal Sciences, 27(4), 503-510	"The study was conducted to determine the effect of feeding diets containing Andrographis paniculata leaves (APL), whole Andrographis paniculata plant (APWP) and a control without Andrographis paniculata (AP0), on growth performance, carcass characteristics and meat yield of 24 intact Boer bucks. The results obtained indicated that inclusion of Andrographis paniculate significantly improved feed intake, weight gain, feed efficiency and live weight. The ratios of carcass to fat, lean to bone, lean to fat, and composition of meat were also improved. In addition, there were significant differences ($p<0.05$) between the dietary treatments in dressing percentage and chilling loss. Goats fed on AP0 (control) had significantly higher proportions of fat and bone, as well as thicker back fat than the supplemented animals (APL and APWP). Higher gut fill in animals fed Andrographis paniculata suggested slow rate of digestion, which could have improved utilization and absorption of nutrients by the animals. Goats fed Andrographis paniculata also produced higher meat yield and relatively lower fat contents ($p<0.05$)."

405	Toxic to animals	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A leaf infusion administered intraperitoneally in mice, has an LD50at 71.1 mg/10 g body weight (acute toxicity). At a concentration of 1 mg/kg it lowers the body temperature at least 2°C. In guinea-pigs, a leaf infusion of 5%, 10% and 15% at a dose of 8 ml/kg lowers the body temperature by 0.9-1.1°C. The possible testicular toxicity of a dried extract of A. paniculata was investigated in male Sprague Dawley rats. No testicular toxicity was found with the treatments of 20, 200 and 1000 mg/kg during 60 days as evaluated by reproductive organ weight, testicular histology, ultrastructural analysis of leydig cells and testosterone levels after 60 days of treatment. It was concluded that A. paniculata extract did not produce subchronic testicular toxicity in male rats. Finally, A. paniculata extract is reported to have antifeedant and anti-oviposition activity against a number of crop pests like Callosobrunchus chinensis , Darcus dorsalis , Nephotettix cincticeps , Plutella xylostella , Sitophilus oryzae and Spodoptera litura ."
	Yusuf, A. L., Goh, Y. M., Samsudin, A. A., Alimon, A. R., & Sazili, A. Q. (2014). Growth performance, carcass characteristics and meat yield of Boer goats fed diets containing leaves or whole parts of Andrographis paniculata. Asian-Australasian Journal of Animal Sciences, 27(4), 503-510	[No evidence] "The results of this study indicate that the inclusion of Andrographis paniculata in the diet of goats has significantly improved their growth performance and meat yield. Therefore, Andrographis paniculata can potentially be used as a natural promoter in ruminants for better growth performance, carcass characteristics and meat production. Nevertheless, further studies should be carried out to characterize the bioactive compounds in Andrographis paniculata and their individual effects on performances in meat goats with special emphasis on rumen fermentation characteristics and nutrient utilization."

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	Rani, B. J., & Sridhar, V. (2005). Record of arthropod pests on Kalmegh, Andrographis paniculata-an important medicinal plant. Insect Environment, 11(2), 89-91	"Abstract : A field study was undertaken during 2001-02 in Bangalore, Karnataka, India to record various pests and their seasonal incidence on kalmegh, A. paniculata. Seedlings were raised in June and transplanted in July at a spacing of 60×30 cm in 20 beds of 2×2 m2 size. Observations on pest incidence and plant parts attacked were recorded from 5 randomly selected beds (5 plants per bed) at 15 days interval. Brown scale, Parasaissetia nigra, was found to be causing significant damage, as the affected plants exhibited stunted growth and drying, followed by semilooper, Panilla sp. nr. albopunctata, which damaged the plants by feeding on young leaves, flower buds and tender pods resulting in foliage loss. This is thought to be the first record of arthropod pests on kalmegh from India."
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"Sclerotium sp. occasionally causes wilt disease in A. paniculata during the rainy season."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Numerous medicinal uses] "The results of this study indicate that the inclusion of Andrographis paniculata in the diet of goats has significantly improved their growth performance and meat yield. Therefore, Andrographis paniculata can potentially be used as a natural promoter in ruminants for better growth performance, carcass characteristics and meat production. Nevertheless, further studies should be carried out to characterize the bioactive compounds in Andrographis paniculata and their individual effects on performances in meat goats with special emphasis on rumen fermentation characteristics and nutrient utilization."
	Medsafe. (2017). Early Warning System - Alert Communication. Andrographis paniculata – potential risk for allergic reactions. https://www.medsafe.govt.nz/safety/EWS/2017/AndrographisPaniculata.asp. [Accessed 25 Feb 2020]	[Potential allergen if taken internally] "Andrographis paniculata is a herb included in some natural health products. These products are used by consumers who believe they support a healthy immune system, support recovery from the common cold and help with symptoms of the cold. Consumers should be aware of the potential risk for serious allergic reactions with products containing andrographis. "

408	Creates a fire hazard in natural ecosystems	
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Unknown. Could possibly increase fuel load and fire risk if growing in high densities] "A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10-20% of full light. "

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10-20% of full light. "

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Benoy, G. K., Animesh, D. K., Aninda, M., Priyanka, D. K. & Sandip, H. (2012). An Overview on Andrographis paniculata (Burm. F.) Nees. Int. J. Res. Ayur. Phar., 6, 752-760	"The plant grows well in all types of soil which explains its wide distribution. It grows in soil types where almost no other plant can be cultivated, particularly 'serpentine soil', which is relatively high in metals such as aluminum, copper and zinc45. However, soil that is flooded or wet throughout the year may be avoided for its cultivation46."

411	Climbing or smothering growth habit	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A perennial herb 30-100 cm tall; stems distinctly 4-angular, glabrous apart from a few hairs at the nodes."

412	Forms dense thickets	
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Gregarious and weedy] "A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10-20% of full light. "

501	Aquatic	n
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Terrestrial] "A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10 20% of full light. "

502	Grass	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 24 Feb 2020]	Family: Acanthaceae Subfamily: Acanthoideae Tribe: Andrographideae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 24 Feb 2020]	Family: Acanthaceae Subfamily: Acanthoideae Tribe: Andrographideae

Qsn #	Question	Answer
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**
	Source(s)	**Notes**
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Herb, erect, quadrangular or winged, many-branched, rootstock and roots more or less woody"

601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[No evidence] "A. paniculata is relatively widespread and has a tendency to naturalize in areas where it has been introduced. Locally it is cultivated both for its ornamental and medicinal value. Therefore, the risk of genetic erosion seems rather limited. Selection should be directed to plant material with a higher content of medicinally important constituents. Preliminary results from callus culture techniques show considerable potential for improvement."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"Propagation of A. paniculata by seed is possible. Seed should be soaked during 24 hours and dried before being sown. Germination starts after 1 week and the mean germination rate is about 80%."

603	**Hybridizes naturally**	
	Source(s)	**Notes**
	Valdiani, A., Abdul Kadir, M., Said Saad, M., Talei, D., Omidvar, V., & Hua, C. S. (2012). Intraspecific crossability in Andrographis paniculata Nees: a barrier against breeding of the species. The Scientific World Journal 2012: doi:10.1100/2012/297545	[Unknown. Intraspecific hybridization reported] "The present study is the first-ever report on deliberate intraspecific hybridization between Andrographis paniculata accessions in a large scale (over 8000 of crosses) that emphasizes the phenological aspects of this problem."

604	**Self-compatible or apomictic**	**y**
	Source(s)	**Notes**
	Benoy, G. K., Animesh, D. K., Aninda, M., Priyanka, D. K. & Sandip, H. (2012). An Overview on Andrographis paniculata (Burm. F.) Nees. Int. J. Res. Ayur. Phar., 6, 752-760	"A. paniculata is hermaphrodite self compatible and a habitual inbreeder. Both stigma and anthers are in intimate proximity showing synchronization of anther dehiscence and stigma receptivity respectively thereby providing autonomous selfing in the species42."
	Lattoo, S. K., Khan, S., Dhar, A. K., Choudhary, D. K., Gupta, K. K., & Sharma, P. R. (2006). Genetics and mechanism of induced male sterility in Andrographis paniculata (Burm. f.) Nees and its significance. Current Science, 91(4): 515-519	"A. paniculata is hermaphroditic, self-compatible and a habitual inbreeder. Intimate proximity of adpressed stigma with the anthers (Figure 1 b) and synchronization of anther dehiscence and stigma receptivity, provide for obligate autonomous selfing in the species. It exhibits a number of features that are in conformity with its breeding behavior."

Qsn #	Question	Answer
	Sharma, B. K., & Jain, A. K. (2015). Studies on some aspects of reproductive biology of Andrographis paniculata (Acanthaceae). The International Journal of Plant Reproductive Biology 7(2): 153-158	"Chia (2009) studied the reproductive biology of A. paniculata at Malaysia and reported that pollination in this species occur in flower buds before anthesis, known as pre-anthesis cleistogamy. He was of the opinion that this type of mating system greatly promotes autonomous self-pollination."
	Valdiani, A., Abdul Kadir, M., Said Saad, M., Talei, D., Omidvar, V., & Hua, C. S. (2012). Intraspecific crossability in Andrographis paniculata Nees: a barrier against breeding of the species. The Scientific World Journal 2012: doi:10.1100/2012/297545	"Synchronization of anther dehiscence and stigma receptivity in AP along with the flower structure in which intimate proximity of stigma with the two-celled anthers (Figures 1(a) and 1(b)) supports the plant to be a hermaphroditic, self-pollinated, self-compatible, and habitual inbreeder [2]."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Sharma, B. K., & Jain, A. K. (2015). Studies on some aspects of reproductive biology of Andrographis paniculata (Acanthaceae). The International Journal of Plant Reproductive Biology 7(2): 153-158	"Floral visitors were observed on a total of 27 freshly opened flowers between 1 : 30 to 2 : 00 p.m. Results indicated that honey bees (Apis dorsata and A. indica) exhibited highest frequency of visit (7 times) followed by butterflies (Pieris brassicae and Limenistin spp.) with only 6 visits during this duration (Fig. 3). Beetles (Heteroligus spp.) and wasps (Vespa spp.) exhibited least visiting frequency i.e. only 3 times." … "Present study has also shown that Andrographis paniculata produces a large number of flowers which subsequently attract a good number of pollinators resulting in the higher percentage of fruits and seed-set."

606	Reproduction by vegetative fragmentation	
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Can be propagated from cuttings with three nodes. Unknown if able to spread naturally by vegetative means] "Propagation of A. paniculata by seed is possible. Seed should be soaked during 24 hours and dried before being sown. Germination starts after 1 week and the mean germination rate is about 80%. Cuttings consisting of 3 nodes taken from the upper third of 1-year-old plants have given the best results in vegetative propagation, with 80-90% rooting. "

607	Minimum generative time (years)	1
	Source(s)	**Notes**
	Sharma, B. K., & Jain, A. K. (2015). Studies on some aspects of reproductive biology of Andrographis paniculata (Acanthaceae). The International Journal of Plant Reproductive Biology 7(2): 153-158	"Andrographis paniculate (Burm.f.) Nees. is an erect annual plant belongs to the family Acanthaceae and commonly known as King of Bitters in English and Kalmegh in Hindi."
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Perennial or annual] "A perennial herb 30-100 cm tall; stems distinctly 4-angular, glabrous apart from a few hairs at the nodes."… "In Vietnam, where the crop is grown as an annual, the leaves are hand picked before flowering and roots are harvested when leaves start discolouring or wilting. "

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	

Qsn #	Question	Answer
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Possibly. Thrives in heavily trafficked and disturbed areas] "A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields"

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"A. paniculata is probably native to India, but has been introduced and cultivated as a medicinal plant in many parts of Asia including Indo-China, China, Thailand, Peninsular Malaysia, Indonesia, the Philippines and Australia. It is now widely naturalized in most of these regions. It has also been introduced, possibly for its ornamental value, in the West Indies and Central America. "

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans"
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Weedy, but not associated with agricultural crops] "A. paniculata is locally common and often gregarious. It exhibits weedy characteristics and occurs from sea-level up to 1600 m altitude in village groves, roadsides, waste places, open sandy locations and fields, but also in monsoon and teak forest receiving only 10-20% of full light. "

704	Propagules adapted to wind dispersal	
	Source(s)	**Notes**
	BiologyDiscussion. (2020). Dispersal of Fruits and Seeds | Essay | Angiosperms | Botany. http://www.biologydiscussion.com. [Accessed 25 Feb 2020]	"The mature fruits of Andrographis paniculata, Ruellia tuberosa (Fig. 2.181 A) of Acanthaceae, when in contact with moisture, suddenly burst with an explo-sive sound and the seeds are dispersed in the nearby regions. Sometimes the seeds are provided with curved hooks, the jaculators — these help in their dispersal. " [Explosive dehiscence disperses seeds. Wind may increase distance and influence direction of dispersed seeds]
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	[Hooks aid in dehiscence] "Fruit an erect, loculicidal, narrowly ellipsoidal, glandular hairy capsule, 14-20 mm × 3-3.5 mm, many-seeded. Seeds held up on well-developed hooks (retinaculae), almost rectangular, rugosely furrowed, with 2 deep furrows. "

705	Propagules water dispersed	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Occurrence along river banks suggests water may facilitate dispersal] "South Asia, India. Herb, erect, quadrangular or winged, many-branched, rootstock and roots more or less woody, lax racemes or axillary or terminal panicles, whitish flowers spotted with rose-purple, corolla 2-lipped, oblong capsule acute at ends, seeds rugosely furrowed, river banks"

706	Propagules bird dispersed	n
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"Fruit an erect, loculicidal, narrowly ellipsoidal, glandular hairy capsule, 14-20 mm × 3-3.5 mm, many-seeded. Seeds held up on well-developed hooks (retinaculae), almost rectangular, rugosely furrowed, with 2 deep furrows." [Not fleshy-fruited]
	BiologyDiscussion. (2020). Dispersal of Fruits and Seeds | Essay | Angiosperms | Botany. http://www.biologydiscussion.com. [Accessed]	"The mature fruits of Andrographis paniculata, Ruellia tuberosa (Fig. 2.181 A) of Acanthaceae, when in contact with moisture, suddenly burst with an explo-sive sound and the seeds are dispersed in the nearby regions. Sometimes the seeds are provided with curved hooks, the jaculators — these help in their dispersal. " [Explosive dehiscence disperses seeds]

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	BiologyDiscussion. (2020). Dispersal of Fruits and Seeds | Essay | Angiosperms | Botany. http://www.biologydiscussion.com. [Accessed 26 Feb 2020]	"The mature fruits of Andrographis paniculata, Ruellia tuberosa (Fig. 2.181 A) of Acanthaceae, when in contact with moisture, suddenly burst with an explo-sive sound and the seeds are dispersed in the nearby regions. Sometimes the seeds are provided with curved hooks, the jaculators — these help in their dispersal. " ["Hooks" aid in dispersal. Explosive dehiscence disperses seeds]

708	Propagules survive passage through the gut	n
	Source(s)	**Notes**
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"Fruit an erect, loculicidal, narrowly ellipsoidal, glandular hairy capsule, 14-20 mm × 3-3.5 mm, many-seeded. Seeds held up on well-developed hooks (retinaculae), almost rectangular, rugosely furrowed, with 2 deep furrows." [Fruit unlikely to be consumed. Seeds dispersed by explosive dehiscence]
	BiologyDiscussion. (2020). Dispersal of Fruits and Seeds | Essay | Angiosperms | Botany. http://www.biologydiscussion.com. [Accessed 26 Feb 2020]	"The mature fruits of Andrographis paniculata, Ruellia tuberosa (Fig. 2.181 A) of Acanthaceae, when in contact with moisture, suddenly burst with an explo-sive sound and the seeds are dispersed in the nearby regions. Sometimes the seeds are provided with curved hooks, the jaculators — these help in their dispersal. " [Explosive dehiscence disperses seeds]

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**

Qsn #	Question	Answer
	de Padua, L.S., Bunyapraphatsara, N. & Lemmens, R.H.M.J. (Eds.). 1999. Plant Resources of South-East Asia. No 12(1). Medicinal and Poisonous Plants 1. Backhuys Publishers, Leiden, The Netherlands	"Fruit an erect, loculicidal, narrowly ellipsoidal, glandular hairy capsule, 14-20 mm × 3-3.5 mm, many-seeded." … "A. paniculata is locally common and often gregarious." [Seed densities unknown]

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	Wong, K. J., Abdullah, T. L., Hassan, S. A., & Puteh, A. (2015). Seed dormancy and germination pattern of Andrographis paniculata at different maturity stages. Seed Science and Technology, 43(2), 324-330	[Seeds exhibit dormancy. Longevity in soil seed bank unknown] "Andrographis paniculata, from the Acanthaceae family, is commonly known as hempedu bumi or 'King of Bitters' and is propagated through seeds. However, dormancy and poor germination hamper cultivation of this species. Thus, an experiment was carried out to determine the effects of seed maturity stage, storage duration and sandpaper scarification on germination of A. paniculata seeds. After scarification, 83 and 96% germination was achieved for grey-purple and grey-brown capsule seeds, respectively, as compared with non-scarified seeds which recorded < 30% germination. Both storage duration and maturity stage affected germination. Seeds from grey-brown capsules stored for nine months reached 50% germination one day earlier than unstored seeds; for seeds from grey-purple capsules, germination was two days earlier. The best germination results were achieved for seeds from grey-brown capsules stored for nine months and scarified using sandpaper."

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability, and elevation range exceeds 1000 m, demonstrating environmental versatility
• Thrives in tropical climates
• Naturalized in a number of locations (but no evidence in the Hawaiian Islands to date)
• A weed of roadside, waste places, fields and potentially of agriculture
• Allelopathic
• May be allergenic to some people
• Shade-tolerant
• Tolerates many soil types
• Reproduces by seeds
• Self-compatible
• Perennial, but able to reach maturity in one growing season
• Seeds dispersed by explosive dehiscence

Low Risk Traits
• Despite naturalization and weediness, valued for medicinal properties
• Unarmed (no spines, thorns or burrs)
• Provides fodder for goats and possibly other livestock