



Protocols for managing invasive insects and microbes

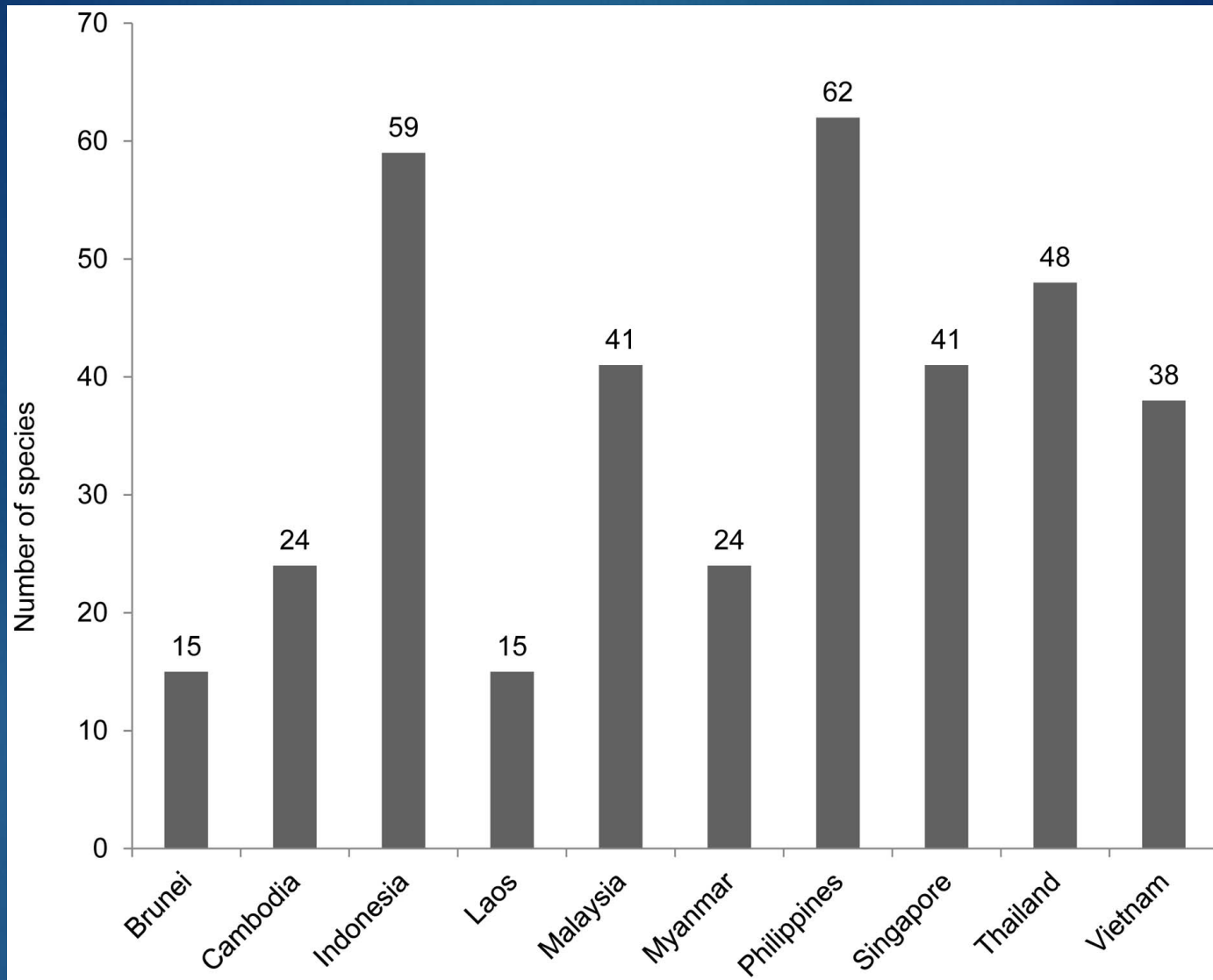
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Damage costs by non-indigenous species to Southeast Asian countries (\$ million).

Country	Crop pest	Pesticide	Golden Apple Snail	White Spot Synd Virus	H5N1	SARS
Brunei	1			<1		
Cambodia	384			<1	5	
Indonesia	7,462			127	261	
Lao PDR	208				5	
Malaysia	1,731	1,481		23		64
Myanmar	2,279	120		16		
Philippines	2,418		1,398	34		45
Singapore	0.5			<1		184
Thailand	3,927	1,941	11	161	50	
Vietnam	3,190		64	139	49	

Source: Nghiem *et al.* (2013) Economic and Environmental Impacts of Harmful Non-Indigenous Species in Southeast Asia. PLoS ONE 8(8): e71255.
doi:10.1371/journal.pone.0071255



Number of reported environmental invasive species in Southeast Asian countries.

Source: Nghiem *et al.* (2013) Economic and Environmental Impacts of Harmful Non-Indigenous Species in Southeast Asia. PLoS ONE 8(8): e71255. doi:10.1371/journal.pone.0071255

Invasive insects and microbes

- ▶ Information for Asia-Pacific hard to find
- ▶ 17 plant invasive pathogens listed in the USDA National Invasive Species Information Centre
- ▶ Pathogens relevant to Asia-Pacific:
 - ▶ Citrus greening – *Liberibacter asiaticus*
 - ▶ Southern bacterial wilt – *Ralstonia solanacearum*
 - ▶ Guava rust – *Puccinia psidii*

Invasive insects

- ▶ Coconut hispine beetle – *Brontispa longissima*
- ▶ Asian citrus psyllid – *Diaphorina citri* (citrus greening)
- ▶ Blue gum chalcid – *Leptocybe invasa*
- ▶ Chinese Rose Beetle – *Adoretus sinicus*
- ▶ Erythrina gall wasp – *Quadrastrictus erythrinae*
- ▶ Eucalypt gall wasp – *Ophelimus maskelli*
- ▶ Leucaena psyllid – *Heteropsylla cubana*
- ▶ Melon fruit fly – *Bactrocera cucurbitae*
- ▶ Queensland fruit fly – *Bactrocera tyroni*
- ▶ Whitefly – *Aleurodiscus dispersus*
- ▶ Yellow crazy ant – *Anoplolepis gracilipes*
- ▶

Some useful links:

- ▶ CABI Invasive species compendium
<http://www.cabi.org/isc/>
- ▶ INVASIVES Newsletter of the Asia-Pacific forest invasive species network
<http://www.fao.org/asiapacific/resources/newsletter/invasives/en/>
- ▶ Invasive species in Australia
<http://www.environment.gov.au/biodiversity/invasive-species/publications/factsheet-invasive-species-australia>
- ▶ US Forest Service Invasive Species Program
<https://www.fs.fed.us/invasivespecies/>
- ▶ USDA National Invasive Species Information Center
<https://www.invasivespeciesinfo.gov/index.shtml>

Success stories – Very few!!!

- ▶ Coconut hispine beetle – *Brontispa longissima*?
 - ▶ Biological control using parasitoids, predators, *Metarrhizium anisopliae*
 - ▶ Quarantine and phytosanitary measures
 - ▶ Surveillance
 - ▶ Chemical control
 - ▶ <http://www.fao.org/publications/card/en/c/c4b725b7-f6a6-5565-bd8f-c097fe4b9b90/>
 - ▶ <http://www.fao.org/docrep/010/ag117e/AG117E00.htm>
- ▶ Coconut cadang-cadang disease???

Research and management of IAS in the Asia-Pacific region

- ▶ Limited research e.g. *Brontispa longissima*, yellow crazy ant.....
- ▶ Management on-going as part of quarantine measures, prevention, eradication, and general pest and disease management and control efforts

Points for consideration/key issues for developing protocols

- ▶ Research and management efforts on IAS in the region
- ▶ IAS do not recognise political boundaries!
- ▶ Expanding host ranges and their impact on different countries
- ▶ Interaction between invasive plants and soil microbes
- ▶ Mycorrhizas and N-fixers – facilitate plant invasion

Outputs of workshop

- ▶ Prepare a consolidated list of case studies and **management protocols**
- ▶ Gaps in information
- ▶ Capacity building necessary to implement protocols developed