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Supplemental Figure 1. *Oryctes rhinoceros*: male (*left*), female (*right*).

Supplemental Figure 2. *Oryctes rhinoceros.* Immature stages: upper, from left, egg, first-instar larvae, second-instar larvae, third-instar larva; lower, from left, prepupa, pupa.

Supplemental Figure 3. Felled coconut pole with *Oryctes rhinoceros* larvae and adults, Nacula, Fiji.

Supplemental Figure 4. Coconut palms killed and reduced to poles due to repeated heavy attacks by *Oryctes rhinoceros*, Drauniivi, Fiji. Breeding is now taking place in the tops.

Supplemental Figure 5. Potential new *Oryctes rhinoceros* breeding sites in coconut trunks felled by a hurricane, Savusavu, Fiji.

Supplemental Figure 6. Heart of coconut palm cut open to show *Oryctes rhinoceros* adult in feeding hole, with chewed fiber pushed out behind (RW Paine).

Supplemental Figure 7. Coconut palm damaged by *Oryctes rhinoceros* near Togowere, Viti Levu, Fiji. It would be scored as damaged in a Rapid Damage Survey, and the number of fronds damaged would be counted for a Detailed Damage Survey.

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Supplemental Figure 8. *Scapanes australis grossepunctatus*: male (*left*), female (*right*).

Supplemental Figure 9. Young oil palm attacked by *Scapanes australis grossepunctatus*, Mosa, New Britain, Papua New Guinea---note damage to central spear leaves.

Supplemental Figure 10. Young coconut palm attacked by *Scapanes australis salomonensis*, Munda, New Georgia, Solomon Islands—note crumpled, stunted central fronds.

Supplemental Figure 11. Young coconut palm attacked by *Scapanes australis salomonensis*, Munda, New Georgia, Solomon Islands—note damage to central spear and fronds.

Supplemental Figure 12. Damage by *Oryctes rhinoceros* to coconut palms before OrNV establishment, Rakiraki area, Fiji. Note many V-cut fronds.

Supplemental Figure 13. Same location as Supplemental Figure 12, after establishment of OrNV---note improvement and reduction of damage to the palms.

Supplemental Table 1. Breeding sites of palm dynastids

Species	Distribution	Breeding site (References)	Notes	Endemic pathogens present in the localities indicated below
Oryctes rhinoceros	From Réunion and Mauritius in West Indian Ocean, eastward to Fiji and Tonga in South Pacific Ocean (excluding Australia)	**Coconut palms**		**Bacteria**
		Dead standing poles (33, 61)	General---all locations	*Acinetobacter calcoaceticus* from manure heaps in Madurai, India, caused 56% mortality when fed to larvae (19).
		Stumps (33, 61)	General	*Bacillus* spp. caused up to 21% larval mortality in Malaysia (32, 41).
		Decaying trunks (33, 61)	General	*Pseudomonas alcaligenes* caused 20–30% mortality in Kerala, India (10).
		Detritus in crowns of live palms (53)	Guam (similar habit to *O. elegans* and *O. agamemnon* in date palms). Discovered in 2007, the eradication effort since 2008 is aided by detection of acoustic stridulatory signals from larvae and adults in poles and crowns (25).	**Fungi**
				Metarhizium anisopliae incidence is usually low.
				India: Andhra Pradesh, 0.7% of larvae affected (50); South Andaman Islands 1.7–7.8% (39); Kerala, 3% (11).
				Indonesia: 6.5% of breeding sites were infected in South Sulawesi, and 10.8% were infected in North Sulawesi. (60).
				Maldives: 1.3–2.8% (60) of breeding sites were infected.
		Vermicomposting sites (7)		Malaysia: Up to 2% of L3, but in one situation 12% of pupae were affected (32), while in the Philippines 4.3% of trunks were on the ground and 6% of dead poles were infected (58).
			India: These are heaps of coconut fronds and cattle dung slurry being converted into compost by earthworms (*Eudrilus* sp.).	***Oryctes Nudivirus* (OrNV)**
				OrNV was discovered in adults in Kerala (57) and caused 2--8% larval mortality in Andhra Pradesh (50) and 5% in Kerala (11), where it may be a biotic stress factor (10) as 52% of larvae infected with it in the laboratory subsequently died from *P. alcaligenes*, so this bacterium may potentially undermine OrNV by killing off larvae and reducing OrNV propagation (10, 11).
		Coir waste (9)	India	Luzon, Philippines: Coconut poles were the preferred breeding site but had significant OrNV incidence and optimized transmission, so up to 5 poles per hectare helped limit beetle damage (17, 58). For other localities where it is endemic, see the text for details.
		Oil palms		
		Poisoned standing old poles (45)	Malaysia	
		Shredded old trunks (33, 35, 36, 45)	Malaysia: This replaced burning. The pulverized chipped material is spread in a thin layer, or in windrows, between rows of replants, and may be 80% decomposed by 56 weeks (35).	
		Fronds (33)		
		Empty fruit bunch refuse (30, 54)	Malaysia	
		Other types of decaying wood, rubber, and jungle stumps (30)	Malaysia	
		Compost, cattle dung heaps (22, 61)	General, also China and Oman	
		Sawdust, megass (= bagasse) heaps (61)	General, also Hainan Island, China	

Oryctes monoceros	Seychelles East and West Africa	**Coconut trunks** (23) (52)	Well protected from predators. Nigeria: Egg, larval, and pupal stages lasted 11, 76, and 16 days, respectively	OrNV was introduced on some islands of the Seychelles and in Tanzania (see text).
Oryctes agamemnon	North Africa and Middle East	**Date palms** Dead respiratory roots around the base of trunks (48) Dead dry bark, frond petioles, and offshoots (3, 21, 48)	Tunisia: This damage often causes the palm to fall over. Egg stage lasted 14 days, L1 33 days; L2 30–64 days; L3 55–118 days; pupa 24 days (21, 47). Tunisia, Saudi Arabia, and Oman	--
Oryctes elegans	Middle East, Iran	**Date palms** At junction of dead and living tissue in crowns (42) In debris in bases of lower fronds and in tunnels in dead fronds (20)	Iran Iraq (12–13 larvae per tree)	--
Scapanes australis australis	Papua New Guinea mainland Kar Kar Island	Under decaying logs (5) In rotten coconut stumps and leaf mounds of nesting wildfowl (4)	At soil level with fecal pellets Wildfowl is *Megapodius freycinet*	--
Scapanes australis grossepunctatus	Papua New Guinea New Britain (Gazelle Peninsula)	Often in rotting *Gliricidia sepium* cocoa shade tree stumps and roots (4,8) Rotting cocoa pod heaps (4, 5, 8) Under bush wood (4,8) Coconut stumps (rarely) (4,8)	It has been shifting over past decades from forest breeding to these introduced tree breeding sites, thus threatening coconut replanting.	--

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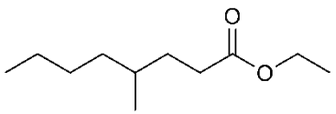
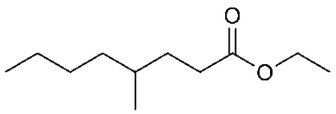
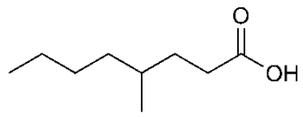
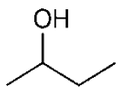
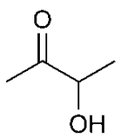
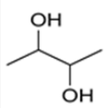
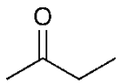
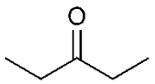
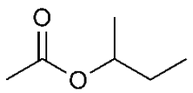
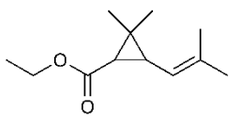
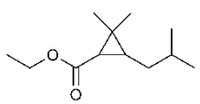
Supplemental Table 2. Pheromones, also attractants, of palm dynastid beetles.

Species	Male aggregation pheromone (key component)	Other components	References	Sex and reproductive state of beetles caught in traps using pheromone	Notes on trials of pheromone traps
Oryctes rhinoceros	Ethyl 4-methyloctanoate (E 4-MO) 	Ethyl 4-methylheptanoate + 4-methyloctanoic acid	14, 29	Indonesia: 81% females, one-half having developed ovaries but empty bursa copulatrix, suggesting they were seeking a mate or oviposition site occupied by males (29) Malaysia: Average catch 60% females, of which 92% were gravid, with 16 eggs per female (31) and deemed to be looking for breeding sites (32) India: 68% females of 12,700 beetles trapped in coconut plantations, of which 54% were virgin and 34% gravid (16)	In Malaysia, in 1- to 3-year-old oil palm plantations a trap density of 1 per 2 ha caught most beetles per trap (6). Double vane traps were the most efficient type (6, 34) and best positioned 3 m above ground, 1-2 m above the young canopy, releasing about 9 mg pheromone day^{-1}. They gave good reduction in damage where catches were less than 10 beetles $trap^{-1}$ $week^{-1}$(6). A synergist is freshly rotting empty oil palm fruit bunches, where available, which increased catch by four times that of pheromone alone, thus reducing dose and cost (49), but its weight can destabilize the elevated trap and so may be omitted (34).
Oryctes monoceros	Ethyl 4-methyloctanoate (E 4-MO) 	4-Methyloctanoic acid (elicited no response in antennae of either sex, and if added to traps in Ivory Coast reduced catch) (1)	13	43% females, of which 96% were mated and gravid (Ivory Coast) (2)	In the Ivory Coast trial 1.2--2.5 traps ha^{-1} in a 19 ha coconut plot inside a 4,000 ha oil palm plantation reduced damage from 4% palms killed in 2001 to 0.2% in 2003, then nil in 2004 using routine trapping (1.7 traps ha^{-1}), which caught over 3,300 beetles in 9 months (1). The synergist was freshly rotting empty oil palm fruit bunches or rotting coconut palm trunk pieces, but cost increased due to labor needed to add this (1, 2)
Oryctes elegans	4-Methyloctanoic acid  A method for commercial synthesis is given in Reference 51.	E4-MO + four other minor components	42	55% females	In Iran, the pheromone alone is barely attractive but far more effective with the synergist, odor from 1 kg per bucket trap of fresh crushed date palm tissue was renewed weekly, but obtaining a supply of this may be a problem. The traps were positioned 3–5 m aboveground just below the date palm crowns and caught 4,000 beetles over 2 years at an average rate of 6.3 beetles $trap^{-1}$ $week^{-1}$, with maximum catch occurring mid-July to mid-August (42). A later study (27) found no difference in catch whether traps were at ground level or 1.5 or 4 m above it, so ground level placement was more convenient.

Scapanes australis grossepunctatus	Traps baited with males only or 84:12:4 (w/w) mixture of 2-butanol (component 1)  3-Hydroxy-2-butanone (= acetoin) (component 2)  2,3-Butanediol (component 3)  	--	18 43, 44	Male:female ratio: 2:3 (43)	With coconut palm seedlings or sugar cane In New Britain, in a 40 ha cocoa and young coconut plantation, 14 traps baited with a male or, later, with dispensers containing a 90:5 mix of components 1 and 2 plus sugar cane caught over 2,100 beetles. The catch gradually fell over 125 weeks, indicating a reduction in the surrounding population (43), an encouraging result, but efficacy could be affected by the same factors that affect *O. rhinoceros* trapping. Attacked palms are susceptible to secondary lethal invasion by the palm weevil *Rhynchophorus bilineatus*, but after several years palms will have grown past the age group which *S. australis* attacks.

Strategus aloeus	95.5:4.0:0.5 (w/w) mixture of 2-butanone,  3-Pentanone,  Sec-butyl acetate 	--	44	--	--
Earlier synthetic attractants (for comparison with pheromone)					
Oryctes rhinoceros	Ethyl chrysanthemumate (EC, rhinolure) 	--	References to discovering authors given in Reference 5	Apparently attractive to adults seeking breeding sites	Superseded by E 4-MO
Oryctes rhinoceros	Ethyl dihydrochrysanthemumate (chrislure) 	--	References to discovering authors given in Reference 5	Applied to coconut wood cap traps, caught beetles in male:female ratio 1:3.4, and females were mated and had mean of 26 large eggs (5)	Superseded by rhinolure

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Supplemental Table 3. Effects of release or re-release of *Oryctes* Nudivirus (OrNV) since 1980

Release into countries where it is not endemic								**Re-release into countries where it is not endemic**			
	Against *Oryctes rhinoceros*					**Against *Oryctes monoceros***		**Against *Oryctes rhinoceros***			
Country where released	Andaman Islands (South and Little Andamans)	Minicoy Island (India)	Maldives Islands	Oman (Sultanate)	Papua New Guinea (East New Britain, New Ireland, Manus Island)	Seychelles Archipelago	Tanzania	Andaman Islands - South	Andaman Islands - Little	Samoa	Tonga
References	15	28	59, 60	22	12	24	40, 46	37	38	26	56
Source of isolate released	KI	KI	5 isolates	Institute of Virology, United Kingdom	Samoa (originally Malaysia)	Philippines and Praslin Island	Samoa/Philippines	KI (crude virus prepared from larval midguts)	KI (crude virus prepared from larval midguts)	Samoa (originally Malaysia)	Samoa (originally Malaysia)
When released	1987	1983--1984	1984--1985	1989	1978--1979	1981–1983 on 2 islands, 1973 on Praslin Island	1983--1987	2001--2002	2002--2003	Starting 1975	1970
Number of adults released	50--86 at 4 locations	165	40–51 per island (59)	900	920 East New Britain, 247 New Ireland, 250 Manus Island	131–278 at each of 3 sites	Nearly 2,000 over 2 sites	800 over 5 locations totaling 53 ha	Over 3 locations	30–400 per release per site at 6 sites; total released at each site 495–1690	No further release from 1970 up to 1978 resurvey
% of adults later found infected (i.e., post-OrNV release)	60% after 3 months	50% of those trapped after 2.5 years	22% from EC traps, 43% from breeding sites	41% after 2 months	11.5% females, 24% males, from EC traps	30–35% (EC-trapped), 76% on Praslin	60% (field and EC-trapped) after 1.5 years at 1 site, 40% after 1 year at another (40) Later (46) 35% from breeding sites, 25% from traps (30% overall)	21% at start to 66% at end (in larvae 11% at start, 38% at end)	Rose from 18% at start in pheromone-trapped adults to 68% after 3 years (3.6-fold increase)	From 30–50% at start to 20–30% at end at 2 sites, 10% at 1 site, all from EC traps, 65% at end from crowns	In 1978, 94% from crowns, 77% from breeding sites (about 86% overall)
Damage reduction	90% by 43 months	From 45--60% fronds damaged at start, to 3--20% after 3.5 years	1,814 cuts to fronds ha^{-1} before; 403 cuts ha^{-1} after	85% fronds and 83% palms damaged before release; 4% and 3.5%, respectively, damaged after 6 years	--	--	From 44–50% palms with central crown damage to 20% after 1.5 years at 1 site, and from 75% to 63% at another; control sites stayed the same (40)	From 64% fronds damaged at start to 2% 4 years later, and central spear (spindle) damage fell from 52% to 0.5%	55% of fronds and 44% of spindles damaged at start, fell to 0.4% and 0.1%, respectively, after 3 years	Drop in central frond damage from 70% to 30% at 1 site, and from 80% to 70% at another	From 10% of palms with central crown damage in 1971 to 4% in 1978

Adult population reduction	80% after 18 months and 96% after 55 months at one location	30% of central spears damaged at start, fell to 8% after 9 months	Average number of attacks ha^{-1}: 37.5 before and 9.5 after (with X2B isolate)	--	--	30% population fall assessed by palm damage. Proportion of males EC-trapped fell, as noted for *O. rhinoceros* in Samoa (26)	Sex ratio of EC-trapped adults stayed around 1:1 (i.e., no drop-off in males) (46)	--	--	EC-trapped males had higher OrNV incidence. Catch of males fell to 17–27% but remained at 42–45% in crowns	--
Breeding site occupancy and/or OrNV incidence	--	--	--	--	--	0–23% of larvae infected, with much variation between sites	Infected larvae not found, and in the laboratory larvae showed low susceptibility (40) as in the Ivory Coast (5)	Fell from 95% occupancy to 8%	Fell from 85% occupancy to 5%	--	9% occupancy where breeding sites were abundant, 31% where sites were fewer, and 15% had infected larvae or adults
Rate of spread	1 km $month^{-1}$	--	Crossed sea 1.5 km to a nonrelease island	--	1 km $month^{-1}$	1.5 km $month^{-1}$ from time of release, and 4 km $month^{-1}$ once epizootic starts	--	--	--	--	2.3 km $month^{-1}$ (55)

Abbreviations: EC, ethyl chrysanthemumate; KI, Kerala isolate; OrNV, *Oryctes Nudivirus*

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