Contrasting patterns of insect herbivory and predation pressure across a tropical rainfall gradient

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TABLE S1 Tree species sampled in six tropical forest sites. Given are the number of woody species with adult individuals (≥ 1 cm dbh) in 1-ha, and species with juveniles (≥ 30 cm tall, < 1 cm dbh) in 400 1m^2 plots within the 1-ha sites. For each of the 42 focal species we indicate the number of saplings sampled, and the local abundance rank of the species as trees and saplings (in parentheses, first and second number, respectively). Mean (calculated from median sapling individual herbivory), median, minimum and maximum herbivory, i.e. percentage leaf area removed by herbivores, during c. 50 days are presented.

Tree species	**Family**	**Order**	**No. Saplings**	**Mean (%) ± se**	**Median (%)**	**Min (%)**	**Max (%)**
Panama Pacifico							
Brosimum alicastrum Sw.	Moraceae	Rosales	12 (0.76/ 0.87)	0.14 ± 0.46	0	0	1.61
Faramea occidentalis (L.) A.Rich.	Rubiaceae	Gentianales	16 (0.96/ 0.8)	1 ± 1.86	0.03	0	5.69
Gustavia superba (Kunth) O.Berg	Lecythidaceae	Ericales	15 (0.36/ 1)	7.41 ± 21.89	0.68	0	85.53
Herrania purpurea (Pittier) R.E.Schult.	Malvaceae	Malvales	14 (0.2/ 0.07)	0.53 ± 0.88	0.11	0	3.23
Lacistema aggregatum (P.J.Bergius) Rusby	Lacistemataceae	Malpighiales	15 (0.16/ 0.4)	0.18 ± 0.53	0	0	2.07

Protium tenuifolium (Engl.) Engl.	Burseraceae	Sapindales	14 (0.56/ 0.67)	0.22 ± 0.81	0	0	3.02
Rinorea sylvatica (Seem.) Kuntze	Violaceae	Malpighiales	11 (0.16/ 0.73)	1.5 ± 3.07	0.12	0	9.68
Trophis racemosa (L.) Urb.	Moraceae	Rosales	10 (0.32/ 0.93)	7.29 ± 9.49	3.36	0	27.2
Metropolitano							
Alibertia edulis (Rich.) A.Rich ex DC.	Rubiaceae	Gentianales	15 (0.14/ 0.8)	9.9 ± 23.5	0.02	0	72.82
Astronium graveolens Jacq.	Anacardiaceae	Sapindales	10 (0.71/ 0.2)	0.72 ± 1.44	0.03	0	3.66

TABLE S1 continued.

Tree species	**Family**	**Order**	**No. Saplings**	**Mean (%) ± se**	**Median (%)**	**Min (%)**	**Max (%)**
Metropolitano							
Capparis indica (L.) Druce	Capparaceae	Brassicales	4 (0.14/ 0.2)	0.01 ± 0.02	0	0	0.04
Castilla elastica Cerv.	Moraceae	Rosales	18 (1/ 1)	0.15 ± 0.26	0.02	0	0.81
Cojoba rufescens (Benth.) Britton & Rose	Leguminosae	Fabales	15 (0.21/ 0.6)	0.44 ± 0.92	0.07	0	3.41
Lacistema aggregatum (P.J.Bergius) Rusby	Lacistemataceae	Malpighiales	13 (0.14/ 0.67)	0.95 ± 2.16	0.05	0	5.98
Nectandra lineata (Kunth) Rohwer	Lauraceae	Laurales	7 (0.14/ 0.2)	0.23 ± 0.23	0.3	0.01	0.63
Piper reticulatum L.	Piperaceae	Piperales	17 (0.79/ 0.6)	0.30 ± 0.63	0.07	0	2.45
Posoqueria latifolia (Rudge) Schult.	Rubiaceae	Gentianales	16 (0.36/ 0.87)	4.41 ± 16.81	0.15	0	67.45

Charco							
Alseis blackiana Hemsl.	Rubiaceae	Gentianales	15 (0.5/ 0.47)	0.34 ± 0.61	0.05	0	1.99
Faramea occidentalis (L.) A.Rich.	Rubiaceae	Gentianales	12 (0.13/ 0.65)	0.59 ± 0.91	0.04	0	2.34
Guarea guidonia (L.) Sleumer	Meliaceae	Sapindales	13 (0.44/ 0.71)	0.02 ± 0.05	0	0	0.14
Gustavia superba (Kunth) O.Berg	Lecythidaceae	Ericales	11 (1/ 1)	0.24 ± 0.41	0.07	0.01	1.37
Lacistema aggregatum (P.J.Bergius) Rusby	Lacistemataceae	Malpighiales	7 (0.31/ 0.41)	4.0 ± 5.14	2.12	0	12.21
Piper cordulatum C. DC.	Piperaceae	Piperales	16 (0.06/ 0.76)	0.55 ± 1.49	0	0	5.58
Psychotria acuminata Benth.	Rubiaceae	Gentianales	12 (0.06/ 0.06)	0.75 ± 1.2	0.33	0	3.82
Rinorea sylvatica (Seem.) Kuntze	Violaceae	Malpighiales	13 (0.06/ 0.82)	0.19 ± 0.29	0.07	0	1.06
Sorocea affinis Hemsl.	Moraceae	Rosales	12 (0.13/ 0.88)	1.9 ± 3.39	0	0	8.85
Trichilia tuberculata (Triana & Planch.) C.DC.	Meliaceae	Sapindales	4 (0.25/ 0.06)	0.00 ± 0.01	0	0	0.02
Virola sebifera Aubl.	Myristicaceae	Magnoliales	13 (0.31/ 0.71)	1.03 ± 2.93	0.03	0	10.57
Pipeline Road							
Alseis blackiana Hemsl.	Rubiaceae	Gentianales	8 (0.56/ 0.28)	0.7 ± 1.24	0.13	0	3.48
Aulomyrcia zetekiana (Standl.) Amshoff	Myrtaceae	Myrtales	10 (0.2/ 0.11)	0.01 ± 0.02	0	0	0.06
Hirtella triandra Sw.	Chrysobalanaceae	Malpighiales	14 (0.72/ 0.72)	0.53 ± 1.95	0	0	7.29
Lacistema aggregatum (P.J.Bergius) Rusby	Lacistemataceae	Malpighiales	13 (0.24/ 0.44)	0.81 ± 1.89	0.03	0	5.18
Mabea occidentalis Benth.	Euphorbiaceae	Malpighiales	12 (0.04/ 0.11)	0.06 ± 0.13	0	0	0.44

Oxandra longipetala R.E. Fr.	Annonaceae	Magnoliales	14 (1/ 1)	1.44 ± 4.92	0.01	0	18.47
Perebea xanthochyma H.Karst.	Moraceae	Rosales	13 (0.88/ 0.83)	0.32 ± 0.91	0	0	3.26
Rinorea squamata S.F. Blake	Violaceae	Malpighiales	14 (0.92/ 0.94)	0.07 ± 0.09	0.02	0	0.31

TABLE S1 continued.

Tree species	**Family**	**Order**	**No. Saplings**	**Mean (%) ± se**	**Median (%)**	**Min (%)**	**Max (%)**
Pipeline Road							
Sorocea affinis Hemsl.	Moraceae	Rosales	15 (0.68/ 0.89)	1.58 ± 4.1	0	0	15.81
Tapiria guianensis Aubl.	Anacardiaceae	Sapindales	14 (0.32/ 0.78)	2.69 ± 5.56	0.11	0	19.9
Virola sebifera Aubl.	Myristicaceae	Magnoliales	3 (0.52/ 0.17)	0.08 ± 0.08	0.07	0	0.17
Xylopia macrantha Triana & Planch.	Annonaceae	Magnoliales	11 (0.48/ 0.06)	0.01 ± 0.02	0	0	0.08
Santa Rita							
Chrysophyllum hirsutum Cronquist	Sapotaceae	Ericales	3 (0.59/ 0.04)	0 ± 0	0	0	0
Lacistema aggregatum (P.J.Bergius) Rusby	Lacistemataceae	Malpighiales	9 (0.22/ 0.19)	0.02 ± 0.04	0	0	0.13
Myrcia gatunensis Standl.	Myrtaceae	Myrtales	12 (0.76/ 0.89)	0.17 ± 0.54	0	0	1.87
Protium costaricense (Rose) Engl.	Burseraceae	Sapindales	12 (0.05/ 0.04)	0.00 ± 0.01	0	0	0.05
Psychotria capitata Ruiz & Pav.	Rubiaceae	Gentianales	15 (0.85/ 1)	0.54 ± 1.31	0.06	0	4.93

Psychotria erecta (Aubl.) Standl. & Steyerm.	Rubiaceae	Gentianales	10 (0.34/ 0.85)	0.09 ± 0.13	0.03	0	0.41
Psychotria poeppigiana Müll.Arg.	Rubiaceae	Gentianales	6 (0.02/ 0.81)	0.04 ± 0.04	0.03	0	0.11
Tovomita longifolia (Rich.) Hochr.	Clusiaceae	Malpighiales	12 (0.88/ 0.7)	0.03 ± 0.06	0	0	0.18
Xylopia macrantha Triana & Planch.	Annonaceae	Magnoliales	12 (0.05/ 0.07)	0.06 ± 0.21	0	0	0.74
San Lorenzo							
Garcinia madruno (Kunth) Hammel	Clusiaceae	Malpighiales	3 (27/ 1)	0.02 ± 0.02	0.03	0	0.03
Lacistema aggregatum (P.J.Bergius) Rusby	Lacistemataceae	Malpighiales	13 (36/ 7)	0.12 ± 0.20	0.03	0	0.6
Perebea xanthochyma H.Karst.	Moraceae	Rosales	11 (53/ 12)	0.11 ± 0.31	0.01	0	1.06
Protium panamense (Rose) I.M. Johnst.	Burseraceae	Sapindales	17 (56/ 12)	0.08 ± 0.12	0.04	0	0.46
Psychotria elata (Sw.) Hammel	Rubiaceae	Gentianales	5 (19/ 1)	0.51 ± 0.51	0.36	0.02	1.05
Psychotria erecta (Aubl.) Standl. & Steyerm.	Rubiaceae	Gentianales	3 (1/ 1)	0.01 ± 0.01	0.01	0	0.02
Tachigali versicolor Standl. & L.O.Williams	Leguminosae	Fabales	15 (47/ 11)	0.05 ± 0.12	0	0	0.46
Tapiria guianensis Aubl.	Anacardiaceae	Sapindales	12 (55/ 14)	0.15 ± 0.3	0.05	0	1.06
Tovomita longifolia (Rich.) Hochr.	Clusiaceae	Malpighiales	11 (57/ 11)	0.36 ± 0.98	0.03	0	3.31
Vochysia ferruginea Mart.	Vochysiaceae	Myrtales	9 (31/ 6)	0.20 ± 0.31	0.05	0	0.94

TABLE S2 Results for analyses of the effect of abundance on herbivory across all plots based on three different measures of abundance: (A) absolute individual counts in each plot, (B) non-standardized abundance ranks within each plot, and (C) standardized abundance ranks (as presented in the main text). Herbivory was analysed for (1) all species and for (2) *Lacistema aggregatum*. For details see methods. P-values are shown with values in parentheses being z-values for probability of herbivory and rho-values for amount of herbivory. All three measures yield qualitatively the same results, with the trend to increased probability of herbivory with higher adult abundance being non-significant in (B) and (C), and marginally significant in (A).

	(A) Individual counts	**(B) Non-standardized abundance ranks**	**(C) Standardized abundance ranks**
1. All species			
Adults			
Probability of herbivory	**0.048 (1.979)**	0.123 (1.543)	0.123 (1.541)
Amount of herbivory	0.622 (-0.076)	0.742 (-0.05)	0.398 (-0.129)
Saplings			
Probability of herbivory	**0.001 (3.186)**	**< 0.001 (4.488)**	**< 0.001 (3.91)**
Amount of herbivory	0.773 (-0.044)	0.614 (0.078)	0.5 (0.103)
2. *Lacistema aggregatum*			
Adults			
Probability of herbivory	0.374 (0.89)	0.412 (0.821)	0.309 (1.016)
Amount of herbivory	0.214 (-0.206)	0.228 (-0.2)	0.058 (0.31)
Saplings			
Probability of herbivory	**0.027 (2.217)**	**0.009 (2.625)**	**0.004 (2.852)**

Amount of herbivory	0.359 (-0.153)	0.754 (-0.053)	0.369 (-0.148)

TABLE S3 Within forest variation in probability of herbivore attack and amount of herbivory. We tested for interspecific differences in the amount of herbivory with Kruskal-Wallis tests. The effect of adult and sapling abundance rank on probability of herbivore attack and the amount of herbivore damage was analysed with logistic regressions and Spearman rank sum tests, respectively. Abundance ranks are given to all tree species within a 1-ha plot, with a higher rank indicating more individuals per 1-ha site.

	Amount		**Probability**				**Amount**			
Site	$\chi^2_{interspecific}$ **(df)**	$p_{interspecific}$	z_{tree}	p_{tree}	$z_{sapling}$	$p_{sapling}$	ϱ_{tree}	p_{tree}	$\varrho_{sapling}$	$p_{sapling}$
Panama Pacifico	**12.225 (5)**	**0.032**	**-2.295**	**0.022**	-0.792	0.428	0.58	0.886	0.886	0.992
Metropolitano	3.558 (7)	0.829	-0.08	0.936	1.656	0.098	-0.319	0.221	-0.509	0.099
Charco	**24.268 (9)**	**0.004**	**2.212**	**0.027**	-0.057	0.954	-0.444	0.099	-0.03	0.467
Pipeline Road	6.122 (9)	0.728	0.373	0.709	**2.078**	**0.038**	-0.297	0.204	-0.212	0.28
Santa Rita	0.811 (3)	0.847	**2.834**	**0.004**	**4.615**	**< 0.001**	-0.2	0.458	1	1
San Lorenzo	7.198 (7)	0.409	0.185	0.853	-0.258	0.797	-0.381	0.18	-0.627	0.048