Digital supplementary material to

WARREN, R.J. II & GILADI, I. 2014: Ant-mediated seed dispersal: A few ant species (Hymenoptera: Formicidae) benefit many plants. – Myrmecological News 20: 129-140.

Appendix S1: Ant species recognized (or proposed) as keystone seed dispersers. Support for keystone recognition is categorized as "overwhelming" (consistently confirmed by many studies at many sites and, usually, by several study groups); "intermediate" (several studies focus on the role of a specific ant species in seed dispersal/removal but more data are needed establishing dispersal effectiveness); and "limited" (keystone disperser role is suggested but limited geographically or only reported in a single study).

Disperser type is defined as "classic" when there is a substantial accumulation of support that an ant species is both the main seed remover of myrmecochorous seed and that the plant benefits from that interaction. Classic disperser ants typically have most traits associated with high quality seed dispersal. Some species appear keystone dispersers based on high removal rates, but the efficiency of the dispersal (i.e., it benefits the plant) is not confirmed ("effective seed removers"). Some authors use the term: "legitimate dispersers" to describe effective seed dispersers that have some traits suggesting a positive effect on seeds, but their status as keystone dispersers remains undetermined.

Ant species	Ecosystem	References	Degree of support	Disperser type	Comments
Aphaenogaster rudis complex	Deciduous forest, Eastern North America	NESS & al. (2009)	Overwhelming	"classic" seed disperser	
Formica polyctanea (FOERSTER, 1850)	Deciduous forest, Eastern Europe	GORB & GORB (1995, 2003)	Overwhelming	"classic" seed disperser	
Rhytidoponera metallica (F. SMITH, 1858)	Sandplain shrubland, Western Australia	GOVE & al. (2007)	Overwhelming	"classic" seed disperser	
Rhytidoponera violacea (FOREL, 1907)	Sandplain shrubland, Western Australia	GOVE & al. (2007), LUBERTAZZI & al. (2010)	Overwhelming	"classic" seed disperser	
Rhytidoponera inornata (CRAWLEY, 1922)	Sandplain shrubland, Western Australia	MAJER & al. (2011)	Overwhelming	"classic" seed disperser	
Anoplolepis custodiens (F. SMITH, 1858)	Fynbos, South-Africa	BOND & SLINGSBY (1983), CHRISTIAN (2001)	Overwhelming	"classic" seed disperser (?)	Many traits fit keystone disperser traits.
Melophorus turneri perthensis (W.M. WHEELER, 1934)	Sandplain shrubland, Western Australia	MAJER & al. (2011)	Intermediate	"classic" seed disperser	
Aphaenogaster longiceps (F. SMITH, 1858)	Open woodland, New-south Wales, Australia	ANDERSEN (1988), HUGHES (1991), HUGHES & WESTOBY (1992)	Intermediate	Effective seed remover	Some traits of classic keystone disperser.
Myrmica rubra (LINNAEUS, 1758)	Deciduous forest, Europe (invasive in NA)	SERVIGNE & DETRAIN (2008)	Intermediate	Legitimate disperser	Some traits of classic keystone disperser.
Pogonomyrmex cunicularius (MAYR, 1887)	Open semi-arid shrubland, Argentina	ARANDA-RICKERT & FRACCHIA (2011, 2012)	Limited	Effective seed remover	Studied over limited geographic extent. Some characters fit "classic" keystone disperser traits.
Formica lugubris (ZETTERSTEDT, 1838)	Temperate mountainous scrubland, North-Western Spain	BOULAY & al. (2006), MANZANEDA & REY (2009)	Limited	Legitimate disperser	Studied over limited geographical extent.
Camponotus vagus (SCOPOLI, 1763)	Temperate mountainous scrubland, North-Western Spain	MANZANEDA & REY (2012)	Limited	Legitimate disperser	Studied over limited geographical extent. High survival of seedlings around nest of this ant species.
Camponotus cruentatus (LATREILLE, 1802)	Mediterranean scrubland and mixed forest, Central-southern Spain	BOULAY & al. (2006), MANZANEDA & REY (2009)	Limited	Legitimate disperser	Studied over limited geographical extent.
Ectatomma brunneum (F. SMITH, 1858)	Tropical Savannah, French Guiana	RENARD & al. (2010)	Limited	Effective seed remover	Studied over limited geographical extent. Some traits that fit keystone disperser.

Pheidole capensis (MAYR, 1862)	Fynbos, South-Africa	BOND & SLINGSBY (1983), CHRISTIAN (2001), BOTES & al. (2006)	Limited	Effective seed remover	
Aphaenogaster senilis (MAYR, 1853)	Mediterranean scrubland, Spain	GOMEZ & ESPADALER (1998), BAS & al. (2009), BARROSO & al. (2013)	Contradictory	Effective seed remover	Remove seeds of both myrmecochores and non-myrmecochores. Some evidence for negative effect on seeds.

References

ANDERSEN, A.N. 1988: Soil of nest-mounds of the seed-dispersing ant, *Aphaenogaster longiceps*, enhanced seedling growth. – Australian Journal of Ecology 13: 469-471.

ARANDA-RICKERT, A. & FRACCHIA, S. 2011: *Pogonomyrmex cunicularius* as the keystone disperser of elaiosome-bearing *Jatropha excisa* seeds in semi-arid Argentina. – Entomologia Experimentalis et Applicata 139: 91-102.

ARANDA-RICKERT, A. & FRACCHIA, S. 2012: Are subordinate ants the best seed dispersers? Linking dominance hierarchies and seed dispersal ability in myrmecochory interactions. – Arthropod-Plant Interactions 6: 297-306.

BARROSO, A., AMOR, F., CERDA, X. & BOULAY, R. 2013: Dispersal of non-myrmecochorous plants by a "keystone disperser" ant in a Mediterranean habitat reveals asymmetric interdependence. – Insectes Sociaux 60: 75-86.

BAS, J.M., OLIVERAS, J. & GOMEZ, C. 2009: Myrmecochory and short-term seed fate in *Rhamnus alaternus*: Ant species and seed characteristics. – Acta Oecologica 35: 380-384.

BOND, W.J. & SLINGSBY, P. 1983: Seed dispersal by ants in shrublands of the Cape province and its evolutionary implications. – South African Journal of Science 79: 231-233.

BOTES, A., MCGEOCH, M.A., ROBERTSON, H.G., VAN NIEKERK, A., DAVIDS, H.P. & CHOWN, S.L. 2006: Ants, altitude and change in the northern Cape Floristic Region. – Journal of Biogeography 33: 71-90.

BOULAY, R., COLL-TOLEDANO, J. & CERDA, X. 2006: Geographic variations in *Helleborus foetidus* elaiosome lipid composition: implications for dispersal by ants. – Chemoecology 16: 1-7.

CHRISTIAN, C.E. 2001: Consequences of biological invasions reveal importance of mutualism for plant communities. – Nature 413: 576-582.

GOMEZ, C. & ESPADALER, X. 1998: *Aphaenogaster senilis* MAYR (Hymenoptera, Formicidae): a possible parasite in the myrmecochory of *Euphorbia characias* (Euphorbiaceae). – Sociobiology 32: 441-450.

GORB, E.V. & GORB, S.N. 2003: Seed dispersal by ants in a deciduous forest ecosystem. 1st edition. – Kluwer Academic Publishers, Dordrecht, The Netherlands, 242 pp.

GORB, S.N. & GORB, E.V. 1995: Removal rates of seeds of five myrmecochorous plants by the ant *Formica polyctena* (Hymenoptera: Formicidae). – Oikos 73: 367-374.

GOVE, A.D., MAJER, J.D. & DUNN, R.R. 2007: A keystone ant species promotes seed dispersal in "diffuse" mutualism. – Oecologia 153: 687-697.

HUGHES, L. 1991: The relocation of ant nest entrances – potential consequences for ant-dispersed seeds. – Australian Journal of Ecology 16: 207-214.

HUGHES, L. & WESTOBY, M. 1992: Effect of diaspore characteristics on removal of seeds adapted for dispersal by ants. – Ecology 73: 1300-1312.

LUBERTAZZI, D., LUBERTAZZI, M.A.A., MCCOY, N., GOVE, A.D., MAJER, J.D. & DUNN, R.R. 2010: The ecology of a keystone seed disperser, the ant *Rhytidoponera violacea*. – Journal of Insect Science 10: 1-15.

MAJER, J.D., GOVE, A.D., SOCHACKI, S., SEARLE, P. & PORTLOCK, C. 2011: A comparison of the autoecology of two seed-taking ant genera, *Rhytidoponera* and *Melophorus*. – Insectes Sociaux 58: 115-125.

MANZANEDA, A.J. & REY, P.J. 2009: Assessing ecological specialization of an ant-seed dispersal mutualism through a wide geographic range. – Ecology 90: 3009-3022.

MANZANEDA, A.J. & REY, P.J. 2012: Geographic and interspecific variation and the nutrient-enrichment hypothesis as an adaptive advantage of myrmecochory. – Ecography 35: 322-332.

NESS, J.H., MORIN, D.F. & GILADI, I. 2009: Uncommon specialization in a mutualism between a temperate herbaceous plant guild and an ant: Are *Aphaenogaster* ants keystone mutualists? – Oikos 12: 1793-1804.

RENARD, D., SCHATZ, B. & MCKEY, D.B. 2010: Ant nest architecture and seed burial depth: implications for seed fate and germination success in a myrmecochorous savanna shrub. – Ecoscience 17: 194-202.

SERVIGNE, P. & DETRAIN, C. 2008: Ant-seed interactions: combined effects of ant and plant species on seed removal patterns. – Insectes Sociaux 55: 220-230.