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# An assemblage of predatory mites (Phytoseiidae) associated with a potential biocontrol agent (*Cecidophyes rouhollahi*; Eriophyidae) for weed *Galium spurium* (Rubiaceae)

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The weed *Galium aparine* L. (Rubiaceae), commonly known as cleavers or goose grass, is an exotic plant in New Zealand (Webb *et al.* 1988; Reid 1998). Craemer *et al.* (1999) described a new gall mite species, *Cecidophyes rouhollahi* Craemer (Acari: Eriophyidae), from this weed in France. They suggested that this new species might have potential as a biological control agent against *G. spurium* L. in Canada and western US where the weed was becoming more problematic (Malik & Vanden Born 1988; Whitson 1991). This mite species was later shown to result in severe stunting and complete prevention of seed production in a related weed *G. spurium* in greenhouse tests and was approved for field release against this weed in Canada (Sobhian *et al.* 2004). This mite species was recently reported on *G. aparine* from Auckland, New Zealand (Martin 2017). Mites prefer feeding on the young terminal leaves and can induce the leaf edges to roll inwards and curl (Fig. 1A, B, Fig 2B). Martin (2017) noted: "No natural enemies of this species of mite have been recorded, but predatory mites may feed on these mites". We report here on an assemblage of predatory mites (Phytoseiidae) associated with *C. rouhollahi* on *G. aparine* in Auckland.

We observed a large infestation of *G. aparine* by *C. rouhollahi* along a canal in Waiatarua Reserve (Fig. 1A & B) and another one in St Johns, Auckland (Fig. 2). We collected about 100 stems of *G. aparine* from Waiatarua Reserve on 5 December 2017 and all of them were infested with mites. Most upper leaves were rolled or curled. Close examinations of these curled leaves revealed dense coats of hairs and many *C. rouhollahi*, along with some phytoseiid mites hiding between hairs. The eriophyid mites seemed to provide a certain degree of natural control of the weed. It is unknown if the predatory mites will have a negative impact on the weed biocontrol. It is interesting to note that *Galium palustre* L., which was close to *G. aparine* in the same location, was not infested by *C. rouhollahi*.

To extract gall mites, we sampled 20 terminal stems of *G. aparine* (10 cm long) haphazardly and placed each stem individually in a glass bottle (diameter 6 cm, length 10 cm). We filled the bottle with 2 cm of 95% ethanol and shook it 100 times. We then removed the stem and filtered the liquid with mites via a piece of filter paper. Under a dissecting microscope, we counted 3236.7 (1000–6700) eriophyid mites per stem.

To collect the phytoseiid mites, we beat 3 groups of ca 20–30 collected stems each over a black plastic sheet (450 × 600 cm) 30 times and collected 38 (34–43) phytoseiid mites per group of stems. We placed 10 of these predators (adult females, not identified) individually in a modified 0.3-cm diameter Munger cell (see Petal & Zhang 2017a,b for details) each with 15 eriophyid mites on a leaf of *G. aparine* and confirmed predation of 14–15 (average 14.8) eriophyid mites per day. Among the

 

predatory mites collected, we identified five species common in Auckland: *Neoseiulus cucumeris* (Oudemans, 1930); *Amblyseius herbicolus* (Chant, 1959); *Amblydromalus limonicus* (Garman & McGregor, 1956); *Neoseiulella cottieri* (Collyer, 1964); and *Neoseiulella novaezealandiae* (Collyer, 1964). No other phytophagous mites were observed on *G. aparine*. There seemed to be little doubt that the phytoseiids moved from other plants to this weed to take advantage of the super abundance of a new food source. Two of these phytoseiid species are important biocontrol agents and known to feed on eriophyids. *Neoseiulus cucumeris* could develop successfully on tomato russet mite, *Aculops lycopersici* (Massee), but failed to reproduce on this prey (Brodeur *et al.* 1997); whereas *A. limonicus* could feed and reproduce on a diet of this eriophyid mite (Houten *et al.* 2013).


**FIGURE 1.** *Cecidophyes rouhollahi* and *Galium aparine* (St Johns, Auckland, New Zealand). A. Curled terminal leaves and expanded basal leaves of *G. aparine* (close-up view); B. Curled leaves of *G. aparine* in the field; C. Normal leaves of *G. aparine*.

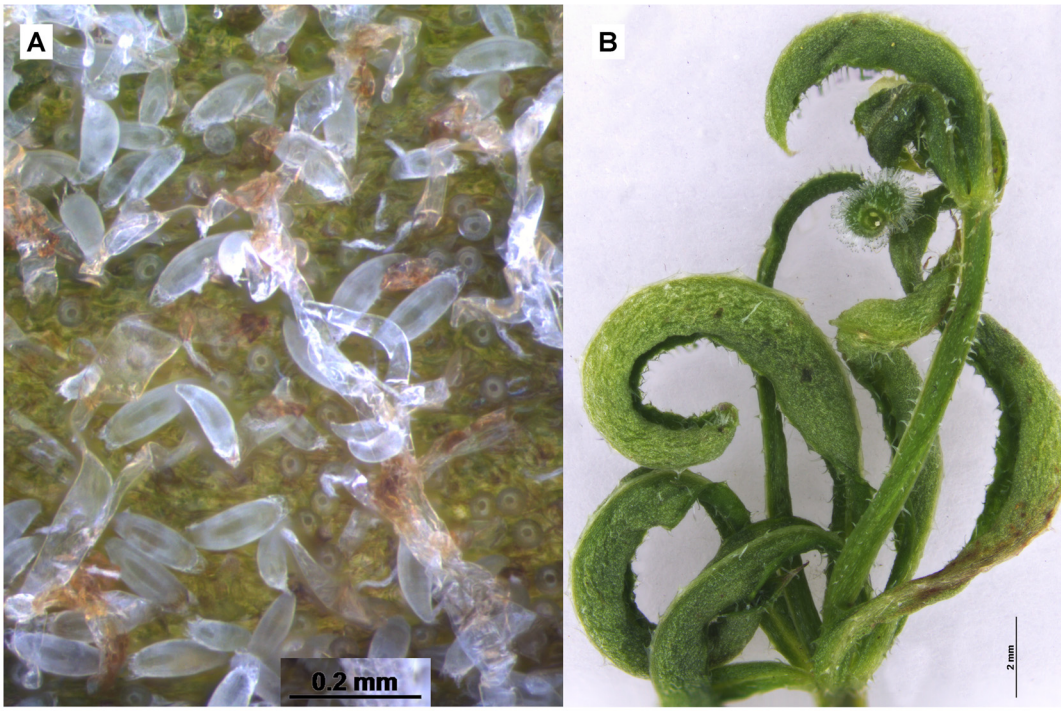


**FIGURE 2.** *Cecidophyes rouhollahi* and *Galium aparine* (St Johns, Auckland, New Zealand). A. *C. rouhollahi* adults and immature stages among leaf hairs (close-up view); B. Close-up view showing curled leaves and dense coat of hairs on them.

The origin of *C. rouhollahi* in Auckland is unknown. As the damage has never been reported in New Zealand before 2017, it is assumed that this must have been a very recent accidental introduction.The mechanism for this fortuitous accidental introduction is unknown and requires further study. Given the host specificity of these mites, they would likely have needed to have been imported on fresh Galium aparine plant material, because these mites will die very soon when removed from their host. Future studies are needed to assess the spread and effects of the gall mites on the weed. It will be also beneficial to examine at an early stage the possible negative effects of predatory mites on natural biocontrol of cleavers as have been reported for other weed biocontrol systems such as gorse biocontrol, which was disrupted by predators (esp. phytoseiid mites and coccinellid beetles) in New Zealand (Palevsky *et al.* 2013).

Material examined and vouchered in New Zealand Arthropod Collection. All specimens collected by Min Ma, Li-Xia Xie and Zhi-Qiang Zhang, 5.XII.2017, from *Galium aparine* L., Waiatarua Reserve, Meadowbank, Auckland: 2♀1♂, *Amblyseius herbicolus*; 6♀1♂1 deutonymph, *Amblydromalus limonicus*; 1♀, *Neoseiulus cucumeris*; 3♀, *Neoseiulella cottieri*; 1♀, *Neoseiulella novaezealandiae*.

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## References


Brodeur, J., Bouchard, A. & Turcotte, G. (1997) Potential of four species of predatory mites as biological control agents of the tomato russet mite, *Aculops lycopersici* (Massee) (Eriophyidae). *The Canadian Entomologist*, 129(1), 1–6. https://doi.org/10.4039/Ent1291-1

Chant, D.A. (1959) Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of thirty-eight new species. *The Canadian Entomologist*, 61(12), 1–166. https://doi.org/10.4039/entm9112fv

Craemer, C., Sobhian, R., McClay, S.R. & Amrine Jr. J.W. (1999) A new species of *Cecidophyes* (Acari: Eriophyidae) from *Galium aparine* (Rubiaceae) with notes on its biology and potential as a biological control agent for *Galium spurium*. *International Journal of Acarology*, 25(4), 255–263. https://doi.org/10.1080/01647959908684162

Collyer, E. (1964) The occurrence of some mites of the family Phytoseiidae in New Zealand, and descriptions of seven new species. *Acarologia*, 6, 632–646.

Garman, P. & McGregor, E.A. (1956) Four new predaceous mites (Acarina: Phytoseiidae). *Southern California Academy of Science Bulletin*, 55, 7–13.

Malik, N. & Vanden Born W.H. (1988) The biology of Canadian weeds: 86. *Galium aparine* L. and *Galium spurium* L. *Canadian Journal of Plant Science*, 68(2), 481–499. https://doi.org/10.4141/cjps88-059

Martin, N.A. (2017) *Galium* gall mite – *Cecidophyes rouhollahi*. Interesting Insects and other Invertebrates. New Zealand Arthropod Factsheet Series Number 112. http://nzacfactsheets.landcareresearch.co.nz/Index.html (accessed 26 Jul 2018).

Oudemans, A.C. (1930) Acarologische Aanteekeningen. CII. *Entomologische Berichten*, 8, 69–74.

Palevsky, E., Gerson, U. & Zhang, Z.-Q. (2013) Can exotic phytoseiids be considered 'benevolent invaders' in perennial cropping systems? *Experimental and Applied Acarology*, 59(1–2), 11–26. http://dx.doi.org/10.1007/s10493-012-9575-4

Patel, K. & Zhang, Z.-Q. (2017a) Functional and numerical responses of *Amblydromalus limonicus* and *Neoseiulus cucumeris* to eggs and first instar nymph of tomato/potato psyllid (*Bactericera cockerelli*). *Systematic and Applied Acarology*, 22, 1476–1488. https://doi.org/10.11158/saa.22.9.12

Patel, K. & Zhang, Z.-Q. (2017b) Prey preference and reproduction of predatory mites, *Amblydromalus limonicus* and *Neoseiulus cucumeris*, on eggs and 1st instar nymphs of the tomato/potato psyllid. *International Journal of Acarology*, 43, 468–474. https://doi.org/10.1080/01647954.2017.1349177

Reid, V.A. (1998) The impact of weeds on threatened plants. Science & Research Internal Report No. 164. Department of Conservation, Wellington, 67 pp.

Sobhian, R., McClay, A., Hasan, S., Peterschmitt, M. & Hughes, R.B. (2004) Safety assessment and potential of *Cecidophyes rouhollahi* (Acari, Eriophyidae) for biological control of *Galium spurium* (Rubiaceae) in North America. *Journal of Applied Entomology*, 128(4), 258–266. https://doi.org/10.1111/j.1439-0418.2004.00818.x

Van Houten, Y.M., Glas, J.J., Hoogerbrugge, H., Rothe, J., Bolckmans, K.J.F., Simoni, S., Arkel, J., Alba, J.M., Kant, M.R. & Sabelis, M.W. (2013) Herbivory-associated degradation of tomato trichomes and its impact on biological control of *Aculops lycopersici*. *Experimental and Applied Acarology*, 60, 127–138. https://doi.org/10.1007/s10493-012-9638-6

Webb, C.J., Sykes, W.R. & Garnock-Jones, P.J. (1988) *Flora of New Zealand. Vol. IV.* Naturalised Pteridophytes, Gymnosperms, Dicotyledons. Botany Division DSIR, Christchurch, Botany Division DSIR, lxviii + 1365 pp, [16] p. of plates.

Whitson, T.D. (1991) *Weeds of the West*. Laramie, W.Y., Western Society of Weed Science, 630 pp.


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