Host plant root exudates reduce phytonematode cuticle aging to maintain *Pasteuria* endospore attachment

Sharad Mohan[1], K. Kiran Kumar[2] and Keith G. Davies[3]

[1] ICAR- Indian Agricultural Research Institute, New Delhi-110 012, India [2] ICAR- Central Citrus Research Institute, Nagpur- 440033, Maharashtra, India [3] University of Hertfordshire, Hatfield, UK

Introduction

Pasteuria penetrans and other closely related bacteria are endospore forming obligate hyperparasites with the potential to suppress phytonematodes. Endospores are host specific and initiate infection of phytonematodes by adhering to the nematode cuticle (Fig. 1). Here we test the hypothesis that plant root exudates from different nematode host plants affect endospore adhesion to nematode cuticle.

Materials and Methods

•Endospore attachement bioassays of the homologous hyperparasites (HcPn and MiPp) with different aged J2s (0, 7 and 14 days old) of their host nematodes Pigeon pea cyst nematode (PpCN), *Heterodera cajani* and Root knot nematode (RKN), *Meloidogyne incognita*.

•Treatment of 0, 7 and 14 days old J2s of RKN, and PpCN with cow pea, tomato and potato root exudates for 24 h followed by bioassays of HcPn and MiPp with PpCN and RKN, respectively.

•50 µL stock suspensions of endospores (500 μL^{-1}) with 50 µL of nematodes (4 μL^{-1}).

Results

•As J2s age there is a reduction of endospore adhesion in both *Pasteuria* population MiPp that adhere to *M. incognita* and HcPn that adhere to *H. cajani* nematodes (Fig. 2).

•The profile of compounds produced by different host plants have both similarities and differences between the various host plants of tomato, potato and cowpea (Fig. 3).

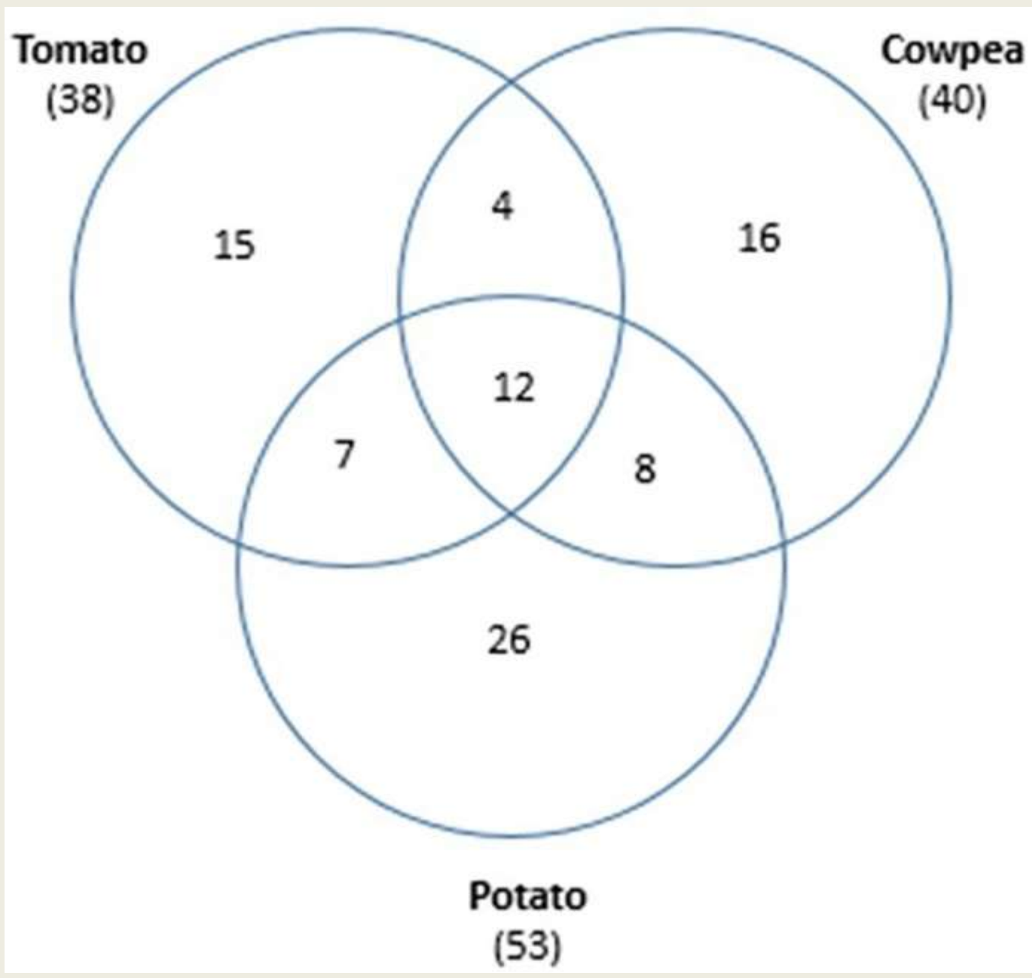
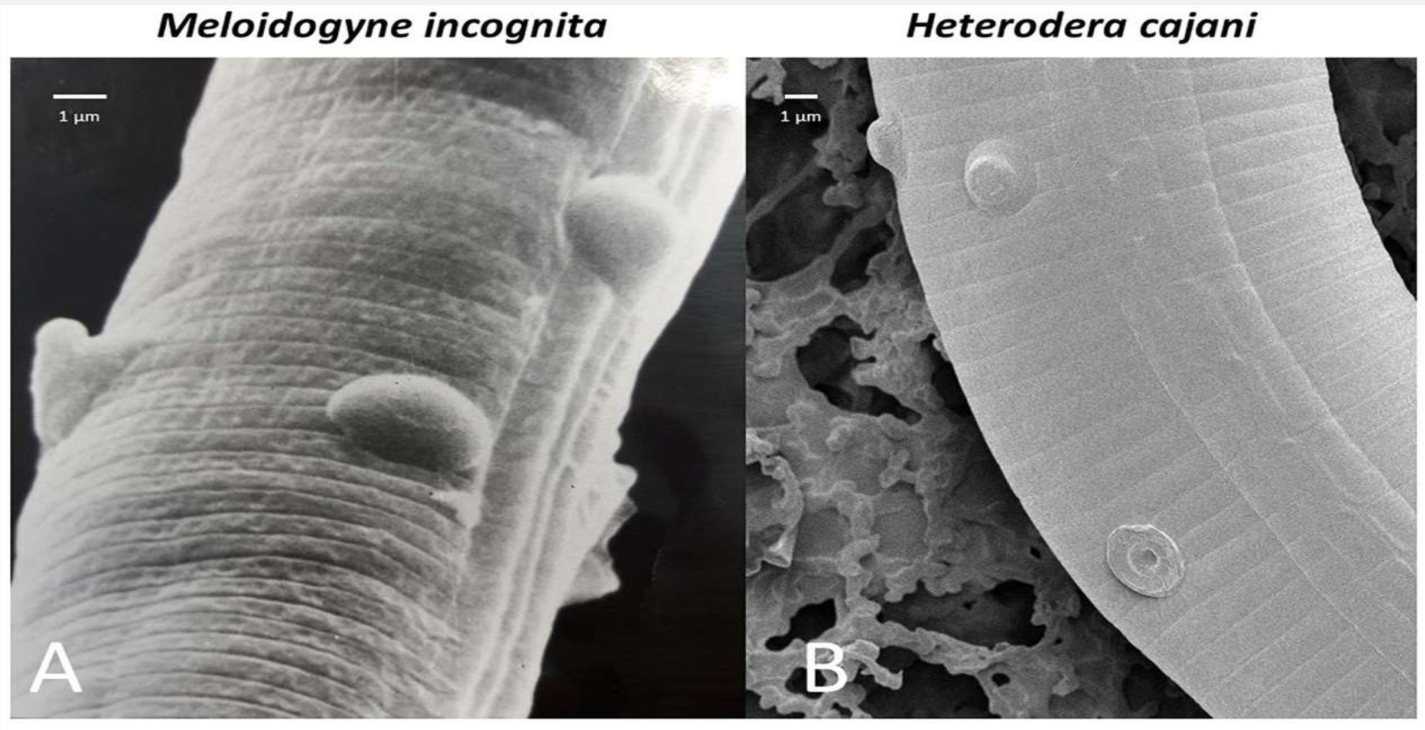


Fig. 3 Venn diagram of the 88 compounds identified by GC/MS contained in root exudates in common from tomato, potato and cowpea

•The exposure of J2s to different plant root exudates affects the adhesion of endospores of the different *Pasteuria* populations to the nematode hosts differently by affecting the aging process of the cuticle (Fig. 4).



C

Crop host status	Root-knot nematode (RKN)	Cyst nematode (HC)
Cowpea	+	++
Tomato	++	-
Potato	+	-

Fig. 1 (A) SEM of J2 *M. incognita* encumbered with endospores of *P. penetrans*; (B) SEM of J2 of *H. cajani* encumbered with endospores of a *Posterior nishizawae*-like species; (C) the crop status as a major host (++), minor host (+), non host (–), to the plant nematodes *H. cajani* and *M. incognita*

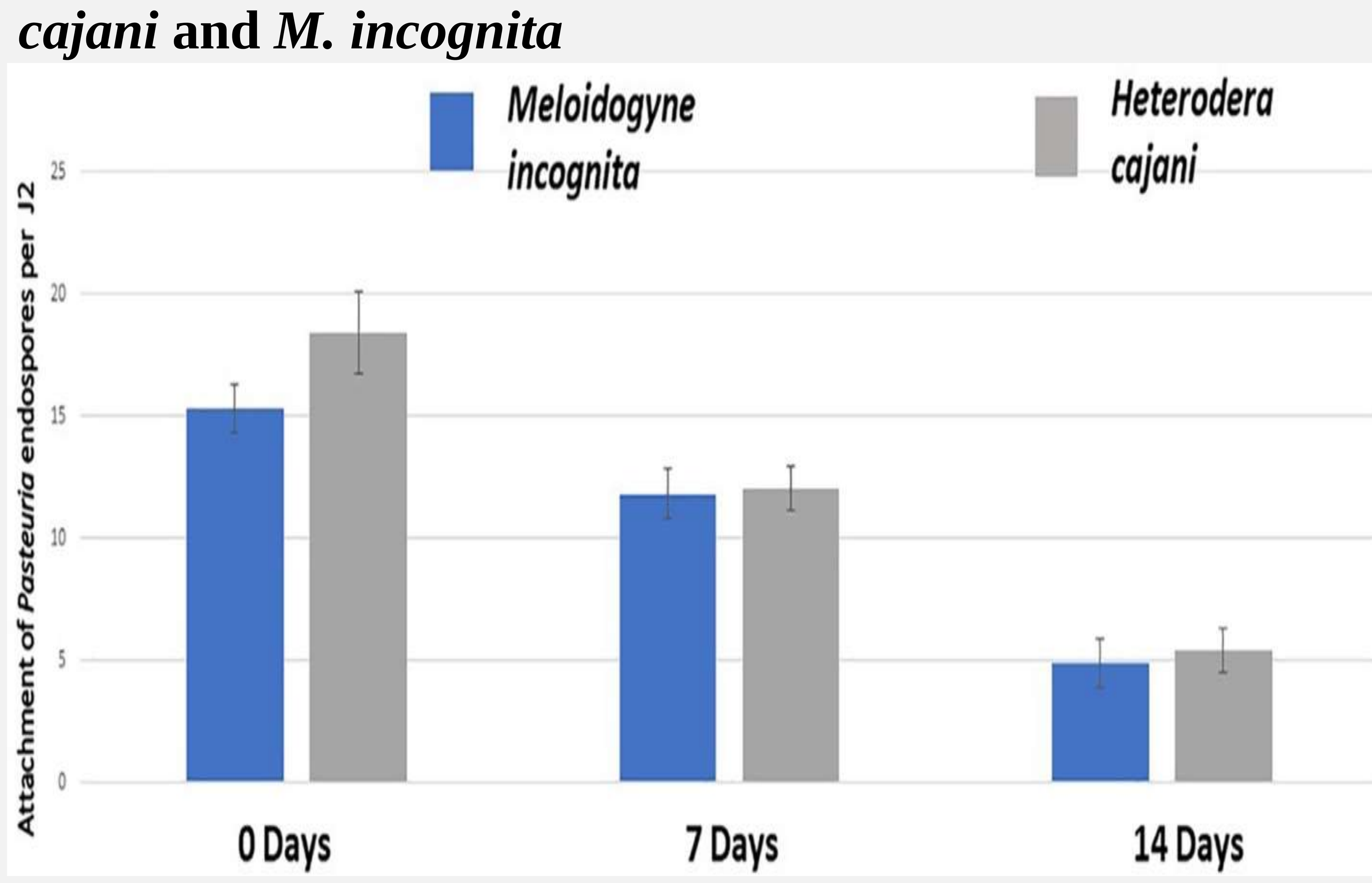


Fig. 2 The mean number of endospores adhering to the cuticle of J2s of *M. incognita* and *H. cajani* at 0, 7, and 14 days following a standardized attachment bioassay (ANOVA *P* = 1.15⁻¹²; bar is ± standard error of the mean)

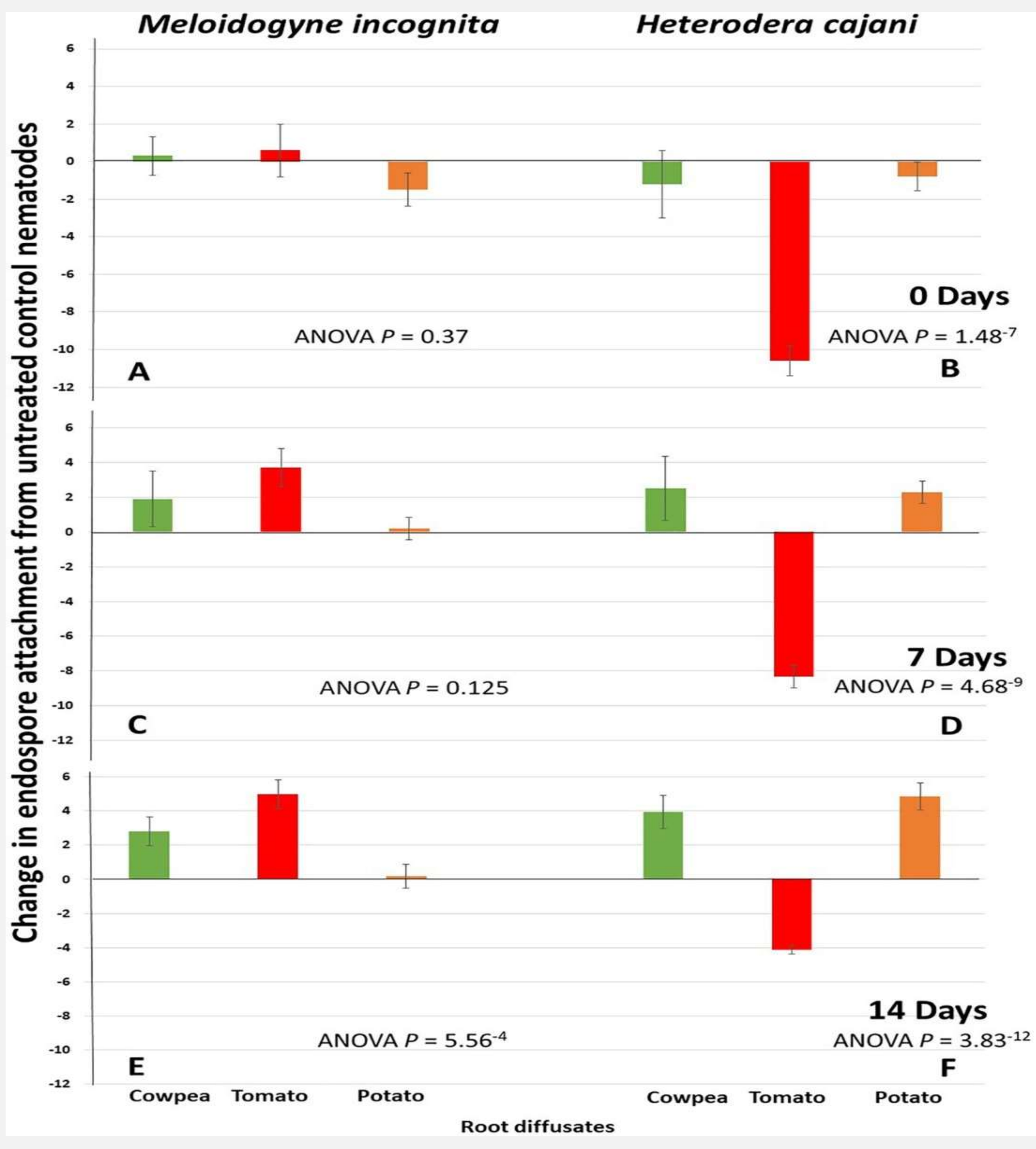


Fig. 4 Mean change of endospore attachment of (to *M. incognita* and *H. cajani* J2s spores $J2^{-1}$) from a water treated controls at 0 (A,B), 7 (C,D), and 14 (E,F) days post hatch following treatment with root diffusates cowpea, tomato, and potato

Conclusion: i) *Pasteuria* endospore adhesion decreased with nematode age, and that infective juveniles pre-treated with homologous host root-exudates increased attachment of endospores to the nematode cuticle, whereas non-host root-exudates did not.

ii) Judicious manipulation of environmental factors produced by the plant root and by careful crop rotation can help in the development of environmentally benign control strategies.

Reference: Mohan S, Kiran Kumar K, Sutar V, Saha S, Rowe J and Davies KG (2020) Plant Root Exudates Recruit Hyperparasitic Bacteria of Phytonematodes by Altered Cuticle Aging: Implications for Biological Control Strategies. Front. Plant Sci. 11:763. doi: 10.3389/fpls.2020.00763