W3186 and S1066
Annual Meeting
Davis CA
10-11 November 2016

Remember to send minutes to Ron (r-lacewell@tamu.edu)

Present: Noah Adamo, Edward Caswell-Chen, Senyu Chen, Jon Eisenback, Travis Faske, Cynthia Gleason, Saad Hafez, Russ Ingham, Chuck Johnson, Vince Klink, Ron Lacewell, Gary Lawrence, Kathy Lawrence, Haddish Melakeberhan, Henry Nguyen Tom Powers, Phil Roberts, Bob Robbins, Dave Thompson, Brent Sipes, Steve Thomas

Guests: Valerie Williamson, Howard Ferris

Welcome

W3186 and S1066 participant introduced themselves.

Steve Nadler welcomed the group. Nematology at UCD - 20 yrs ago was very vibrant. Retirements have not been replaced. The budget at UCD declined for many years, increasing only recently. The new dean is receptive to nematology so a plant nematologist is being hired and a soil ecologist is in the pipeline.

Administrative Advisers

Ron Lacewell: S1066 started 1 Oct 2015. The annual report needs to be filed in 60 days. Rick Davis is secretary. One regional group met in Washington DC using a workshop format and invited DC project leaders to work on NSF or NIFFA grants. The group may want to think about doing this in 2018 (IPM, precision ag, loss of chemicals as topics).

Dave Thompson: W3186 renews in 2018 and may want to discuss renewal at business meeting. We should think about nominating W3186 for a western award. We need to think about impact - NIFA is talking about capacity building (like this meeting) and their impact. Meeting in Washington DC might be a good idea even in terms of marketing the project/group.

Reports

VA: RK1 and RK2 in Tobacco: project starting; mixed reports on resistance level, some reports RK2 is a quantitative trait, RK2 mechanism not clear and will be investigated, variation within a cultivar really speaks to the need for isogenic lines; Very good discussion and ideas shared; Tobacco acreage world-wide is relatively stable. China and India are large producers. Lots of good work being conducted in this crop.

VA: A first report of *Meloidogyne mali* in America from NY was made. Mm has a wide host range including ferns but not grasses, was originally described in Japan, and a few years ago appeared in Europe on elm. First in the Netherlands then Italy, places associated with elm breeding, so maybe Mm was imported into Netherlands along with root stock from Japan.

VA: Nematodes on rice and vegetables in Cambodia were few on vegetables grown using plastic mulch. There were no organisms associated with these vegetables perhaps because the soil had lots of chemigation. Some *Rotylenchulus* was found in vegetables not grown with plastic mulch - lots of rootknot and lance nematodes were also found. In rice, lots of *Hirschmanniella* was found and maybe caused 20-30% yield loss.

MN: Winter oil seed cover crops pennycress and camelina oil seed crops are being tested and SCN reproduction is good on pennycress. SCN reproduction on resistance soybean increasing since 1997 on PI 88788, PI 209332, and PI 548316. SCN reproduction on PI 567516C is low and it is a new source of resistance for many SCN type. PI 567516C appears to be a different gene. QTL shows it to be a novel R gene on chromosome 10. Also QTLs on chromosome 8 and 18 are not rhg or Rhg. Breeding trials suggest that it might be a good source of resistance. Fungal communities in soybean were studied for biological control in a site established in 1982 using metabarcoding. Differences between corn and soybean and among rotations is evident.

MO: New resistance sources for SCN in the PI collection are being evaluated along with assays for rootknot and reniform nematode resistance. Used rhg1 and Rhg4 to group soybean based on copy number and presence of the genes. A medium copy number is like Peking, a high copy number is like PI 88788. A third group with low copy number and no Rhg4 is the source for new SCN resistance genes. Copy number is related to resistance level. PI 567516C has no rhg1 or Rhg4 but has a major QTL on chromosome 10. PI 567305 has a QTL on chromosome 8 and 18. Both PI have resistance to SCN, rootknot, and reniform. This is a method to deal with loss of resistance in the field to SCN. Currently using a KASP genotyping assay to verify the data. The project is collaborating with MN and AR.

AL: Mi found in cotton, Ma in peanut but not many other species. Plant health improvement with growth regulators (hormones), starter fertilizers and nematicides; prescription combinations (nematicides and starter fertilizers) might be best but do not add too much; Tumeric lines are all susceptible to rootknot nematode; *Caternaria* fungus found in rootknot, reniform, and cyst greenhouse cultures - able to culture on beef extract agar; fungi seem to infect stressed nematodes rather than vibrant nematodes; cotton yield loss to reniform was 36-57%; Velum did well in controlling reniform damage, on cotton velum not as effective in controlling damage but very cultivar dependent; earthworms will pass viable nematodes

MS: Defense against soil borne pathogens gene discovery is the thrust now. SCN infection linked to specific cell types, interest is in those genes that are expressed in and define the resistant cell, a-SNAP is involved which a secretion gene, looking at 200 genes and level of resistance, looking at gene families now and other families

AR: Rooknot nematode on soybean has become #1 problem, Mi is the common species, moved from cotton monoculture and the use of soybean Group 3 and 4, most cultivars do not have Mi resistance (89% are susceptible) or even frogeye leaf spot resistance, Telone II availability is limited for soybean growers, ILeVo good, Votivo not bad, Luna (Velum) not having an effect, Roundup Ready plants not being used so frequently (lots of roundup resistant pigweed), Liberty Linked is the popular herbicide transgenic now but there is movement to dicamba resistance.

AR: 142 soybean cultivars screened - 5 with resistance to reniform nematode, 216 breeder lines - 22 resistance to reniform nematode, 21 PI with 14 very resistant, doing similar resistant screening since 1994 - 215 PI evaluated and will conduct a meta-analysis; *Meloidogyne hispanica* identified in 2 sites in agricultural fields, Meloidogyne incognita is the most common species. Have also found *Meloidogyne arenaria, hapla, haplanaria, marylandi*, and *partityla. Meloidogyne partityla* also reproduces on nutall oak and overcup oak.

VA: Host resistance to rootknot is need in tobacco now (growers use rotation and resistance for *Globodera*) and some lines have resistance (RK2). Brazil and China breeders working to incorporate rootknot resistance into cultivars; Luna, Telone II, AITC (costly), and Magestene (as organic alternative) all showed some nematode control; Nimitz performs sporadically so placement is critical for efficacy.

MI: *Meloidogyne hapla* and lesion nematodes are common in vegetable fields, plant-parasitic nematodes are most common in agricultural soils. Cover crops for nematode management are desired and being investigated. Nematodes may not be biggest factor in vegetable yield loss.

OR: Nothing to say about *Globodera ellingtoniae*; *Meloidogyne chiwoodi* (Mc) on potato can start out low but still reach high levels, threshold is less than 0.4 nematodes/250 cc soul, Vydate no longer available which increases demand for Telone which is in limited supply, metam sodium has environmental concerns, so growers want and need biological controls, Sudangrass Sordan 79 does not allow Mc reproduction, incorporating biomass reduces Mc with a high rate of Sordan 79 the best in reducing Mc. In greenhouse trial simulating applying biological control products early in the season (Bio Blend, Hyper Galaxy, MeloCon) provide some reduction in J2 in soil and in eggs on roots, Meloon was the best in reducing egg populations, results are encouraging.

HI: Mint is evaluated as a living mulch for vegetable production, mint is not a host to rootknot or reniform nematodes, the mint did not adversely affect yield of eggplant and added 17% profit; Entomopathogenic nematodes are more common in Hawaii than thought, *Oschious* is the most common genus.

ID: In potato found *Ditylenchus medicargis*, a new record for the US; mint survey shows lesion, northern rootknot, pin, and other nematodes, stand loss caused by lesion and verticillium is severe, plants unable to recover after cutting, tested products do not provide control, furrow irrigation exacerbates nematode problems (especially pin nematode); tolerant beet cultivars in conjunction with low levels of Telone II look promising, green manure crops can increase yield; Vapam + vydate or + movento or the new chemistries provide alternatives to address the limited supply of Telone II, BioAct active ingredient is paceilomyces, adding Adsorb or similar products with metam sodium increases its efficacy.

NM: *Ditylenchus* species genetic variation (18S ITS I & II and 24S) through direct sequencing, some deep sequencing of nematode samples spiked with rootknot and stem nematodes but has required some bioinformatics to analyze; *D. dipsaci* was found in NM for first time never previously found in alfalfa even; Xeriscape plants susceptible to *M. incognita* being tested in a high foot traffic microplot test (residents can see the experiment and signs are posted to explain to

public); Avid and Nimitz on turf for ring looks very good, now looking for something to manage lesion nematode control; Nimitz for control lesion in pinto beans and for Mi in vineyard grapes.

WA: Effectors and phytohormones, nematode secretions and Jasmonic acid; Interested in Mh265 specific to nematodes and Mi131 has homology to actin-binding protein, Mh265 looks to be involved in basal defense response by plants, Mi131 profiling domain but why secrete something that binds to actin? Sequesters actin and therefore interferes with cytoskeleton which might be responsible for lack of cytokinesis in giant cells; Mc RMc1(blb) gene to be used to study virulence and avirulence in *M. chitwoodi.*

CA - Riverside: Carrots, resistance and *Meloidogyne*; Range of resistance to Mi in carrots from many sources/backgrounds, Galling is the problem so we want to stop galling on the tap root, 4 major and 1 minor chromosome regions/QTL for Mi resistance, Carrot resistance panel set up and tested across rootknot species (11 resistance X 49 nematode isolates of Mi, Mj, Ma, Mh) not finding naturally occurring virulence in Mi populations, need to introduce resistance into commercial cultivars, not as much resistance to Mh found in the panel and the panel shows greater variation existing in Mh; 25 Mi virulent on Mi-1 and Cowpea Rk does not appear to be any cross virulence or cross selection from virulence from tomato to carrot or cowpea to carrot; looking to build profiles of virulence in Mi and it seems like there might be a cross virulence selection but virulence on Mi1 seems to have virulence on Rk

NE: Barcoding for *Pratylenchus* and *Aphelenchoides*, navigating database purgatory, east-west transect sample from Kansas to Nebraska and COI gene , first see 6 clades based on COI, also used keys and BLAST, also doing greenhouse reproduction and this shows that all isolates reproduce on corn, soybean, wheat at some level, not everything with COI tree, Blast and keys, sometimes the outputs seem to suggest that there may be errors; *Aphelenchoides besseyi* on rice - data base contains so much stuff called besseyi that is probably not besseyi, very muddled situation in gene database.

CA - Davis: Snails and movement of plant pathogens could be accidental associations, phoresis, dispersal may occur with pathogens, found a variety of nematodes in snails (free living and plant parasitic), the snails are sampling the environment; Active nematodes were recovered up to 168 hours after consumption, these nematodes are infective after passing through the snail digestive track; snails could serve as a bio-sentinel organism.

CA - Davis: Less diversity within asexual *Meloidogyne* species than within one sexual *Meloidogyne* (speakerdeck.com/davelunt); what attacks nematodes to roots - heat stable, hydrophyllic not charged substance, active fraction is about 1000 daltons secondary metabolite; ascaricides can be attractive to males; CRISPR micro-injection into germline in *C. elegans*, looks to be successful in injecting *M. hapla* males.

Joint Business Meeting

Approval of 2015 minutes:

S1066 – approved

W3186 - approved

W3186:

W3186 Host Russ Ingham meeting in Oregon targeting 1-2 November 2017 (Saad Hafez has offered Boise ID as an alternative if needed).

Brent Sipes will serve as Chair 2017, Ed Caswell-Chen will serve as Vice Chair, Cynthia Gleason will serve as Secretary 2017. Reports to B. Sipes by 18 November 2016.

W3186 will rewrite next year. Updating and perhaps minor tweaking of the existing project is probably what is needed. The new project will must be submitted in January 2018. NIFA emphasized broad categories of existing RFPs (will need to adjust based upon new priorities). The group will correspond with suggestions over email. It is important to articulate the success and impacts of the project in the revision. We will need to have a discussion if we want to modify the objectives. Phil Roberts will start a new draft and circulate for input. The project should be formulated as key impact areas and demonstrate multi state impact.

We will think about having a meeting in Washington DC in 2018 or some time thereafter.

S1066:

S1066 Chair Rick Davis will host the 2017 meeting in North Carolina. Don Dickson will serve as Secretary in 2017 going on to chair and host the meeting in 2018. Please have reports to Travis Faske by 18 November 2016.

Meeting Adjourned at 11:45 am 11 November 2016.