NEMATODE PESTS OF TROPICAL TUBER CROPS

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NEMATODES ON TUBER CROPS

- Neglected pests.
- Losses caused are severe in tuber crops than in other cultivated crops.
- Not only reduce tuber yield but also bring down the quality
- Infested tubers are smaller in size, often malformed
- All these lower the marketability of the tubers.
- Multiply during transport and also during the post-harvest storage.

- As the nematodes continue to multiply even after harvest and during storage, seed materials severely infested rot or dry up by the next planting season.
- They are inadvertently selected out.
- This type of selections helped to eliminate infested material which in turn helped in the evolution of large number of resistant cultivars among tuber crops.
- A large number of resistant tuber crops are already identified in cassava, sweet potato, yams and aroids.

The occurrence of high degree of resistance to nematodes is a unique feature in tuber crops

Cassava

- *Meloidogyne incognita* and *M. javanica* are the most important and widespread among all the nematodes
- Other species of *Meloidogyne* reported on cassava are *M. arenaria* and *M. hapla*.
- Among *Pratylenchus sp - P. brachyurus, P. safaenis* are reported from cassava.
- Other nematodes reported on cassava are *Rotylenchulus reniforms, Helicotylenchus erythrinae, H. dihystera* and *Scutellonema bradys* which are however, of lesser importance to the crop.

Use of resistant varieties most desirable for the management of the root-knot nematode.

Table 1: Reaction of exotic cassava accessions to root-knot nematode, *Meloidogyne incognita*

Germplasm accessions screened	Mean nematode population/g root (range)	Root-knot index
CE 2, 6, 8, 9, 11, 12, 13, 14, 16, 17, 23, 24, 25, 26, 29, 30, 31, 38, 40, 44, 45, 48, 50, 51, 52, 53, 55, 56, 60, 64, 66, 68, 70, 71, 77, 81, 84, 90, 92, 101, 102, 108, 111, 113,124, 126, 130, 170, 184, 197	0	0
CE 15, 22, 36, 39, 47, 58, 65, 74, 78, 86, 94, 117, 169, 178	108.64 (36-260)	0*
CE 1, 5, 7, 34, 35, 42, 46, 54, 63, 67, 69, 73, 76, 82, 83, 88, 95, 96, 98, 100, 104, 105, 106, 112, 114, 119, 129, 131, 158, 171, 176	269.36 (48-920)	1
CE 3, 4, 19, 28, 37, 43, 49, 59, 72, 79, 85, 89, 91, 93, 97, 109, 121, 157	914.83 (149-1340)	2
CE 10, 18, 33, 62, 99	2307.4 (1740-2840)	3
CE 32, 103	2790 (2460-3120)	4

* indicate no visible galls

- The leaf, rind and fleshy tuber extracts of cassava were observed to possess nematicidal properties to the second stage juveniles of *M. incognita.*
- At 1:1 and 1:5 concentrations the extracts were cent per cent lethal at 24 h. exposure.
- Even dilutions of 1:50 and 1:100 were found to be lethal at longer duration
- Fresh cassava leaf and tuber rind incorporated into the soil 15 days prior to sowing of okra @ 50 or 100 g/pot significantly reduced root-knot nematode build up and improved plant growth parameters and pod yield

- Nematicidal and insecticidal properties found in manipueira, a liquid by product of cassava flour production.
- Cassava starch factory effluents were found to have nematicidal properties.
- **Stored effluent was found to be more toxic than fresh effluent.**
- Toxicity of fresh effluent is due to the presence of cyanides whereas in stored effluents the cyanide are reduced considerably.
- Higher toxicity is due to the formation of organic acids such as acetic, lactic, etc.

SWEET POTATO

NEMATODES ON SWEET POTATO

- ***Meloidogyne* spp.**
- ***Rotylenchulus reniformis***
- ***Pratylenchus* spp**
- ***Ditylenchus destructor***
- ***D. dipsaci***

Root-knot Nematode

- *Meloidogyne incognita* is the most important species attacking sweet potato.
- Other species of *Meloidogyne* include *M. javanica, M. hapla* and *M. arenaria.*
- Infestation by *Meloidogyne* spp. causes reduction in yield and quality.
- Severe infestation also produces deep longitudinal cracking on the tuber which affects the marketability.
- Galls produced by the nematodes are very small and hence escape the attention of casual observers

SWEET POTATO INFESTED WITH RKN

Resistance to *M. incognita* and *M. javanica* are reported in sweet potato from various countries and active breeding programmes are being conducted in US, Japan and China.

Released high yielding nematode resistant varieties are:

Satsumahikari
Excel
Yushu 3
Fusabeni Topa 3
Hi-Starch
Red glow
J-red

India

Khajangod, Sree Vardhini, Sree Nandhini

SREE BHADRA

- ✓ Sree Bhadra, a high yielding variety of sweet potato from CTCRI was identified as a resistant trap crop to root knot nematode.
- ✓ When this variety was planted in a root-knot nematode infested field the nematode population declined to below detectible level over single cropping duration of 90-95 days.
- ✓ Subsequent susceptible plants viz coleus and African yam also escaped nematode damage when planted in such fields.

Table 2: Resistant Accessions of Sweet Potato Germplasm

Germplasm accessions screened	Root-knot index	Mean nematode population/g root (range)
S 21, 43, 44, 56, 57, 58, 72 75, 87, 149, 150, 162, 164, 238, 244, 283, 284, 456, 508, 535, 567, 592, 598, 605, 608, 617, 630,634	0	160.56 (19-400)
S 12, 13, 14, 22, 23, 25, 27, 31, 32, 33, 41, 71, 78, 81, 83, 117, 152, 155, 175, 207, 214, 217, 241, 292, 315, 380, 500, 503, 510, 515, 523, 529, 537, 557, 560, 580, 584, 591, 595, 609, 615, 618, 632, 637	1	324.26 (50-800)
S 4, 6, 8, 9, 22, 26, 28, 46, 61, 68, 69, 70, 80, 88, 156, 204, 208, 215, 222, 227, 256, 288, 312, 313, 316, 406, 493, 506, 525, 526, 527, 559, 562, 565, 572, 581, 590, 593, 603, 607, 620, 635, 641, 642	2	595.29 (110-1620)

Rotylenchulus *reniformis*

- Infestation by the nematode may cause cracking of storage roots
- *R. reniformis* reduced the yield from 13.4-60.6 %

Pratylenchus

P.coffeae, P. flakkeniss, P. brachyurus, P. penetrans, P. vulnus and P. zeae.

Yams

Three most important nematode pests of yams

- Root-knot nematode
- Root lesion nematode
- Yam nematode

Root-knot nematode infestation produces deformed tubers with uneven surface, whereas the other two nematode produce typical 'dry rot' of tubers.

Root-knot Nematode

- *Meloidogyne incognita* is the major nematode infesting yams the world over
- In India *D. esculenta*, *D. alata* and *D. rotundata* are found to be highly susceptible to the nematode.
- In *D. alata* infestation lead to wart like projections on tuber surface and reduction in size of tuber
- In cross section of tuber, female with egg masses were found on the peri-pheri.

Root-Knot on Yams

In *D.esculenta* severe infestation resulted in production of small sized tubers in bunches which are unfit for consumption

Dioscorea rotundata

In *D. rotundata* profuse roots were recorded on infested tubers at harvest

High yielding and released varieties from the CTCRI, '**Sree Latha' of *D. esculenta*** and '**Sree Keerthi' of *D. alata*** were found to be highly resistant to the root-knot nematode.

Out of 33 *D. alata* accessions tested against *M. incognita*, 3 were immune (Da 66, 120, 228) Da 199 was highly resistant and a further 9 were resistant.

The Yam Nematode

- *Scutellonema bradys* is one of the most important pests infesting yams.
- This nematode is recorded on yams from India, West Africa, the Caribbean and Brazil.
- The nematode produce 'dry rot' on yams

The Lesion Nematode

- *Pratylenchus coffeae* is recorded from Jamaica , Puerto Rico and British Solomon Islands
- The symptoms are very similar to that of 'dry rot'
- Also recorded from India on *D. alata* and *D. rotundata*

Colocasia and Xanthosoma

Damage on these two crops depended mostly upon the cultivar, growing conditions, nematode population and geographic location

- In Colocasia infected cormels were deformed and smaller in size with branches which affected the marketability of the tubers.
- Roots recorded typical galls.

Infected Tubers of Colocasia

***Xanthosoma* tuber infested with**

R. similis & RKN

R. similis

Amorphophallus

- Tuber damage due to infestation by the root-knot and root lesion nematodes
- Infestation by the RKN produce typical galls on the roots.
- In corms and cormels infestation leads to irregular projections, which are relatively more on the latter.
- Under severe infestation, the tuber tissue gets discoloured and in corms the infested area dries up a situation resembling dry rot of yams
- The root knot nematode multiplies in the tuber after harvest during transport and in store, causing more damage.

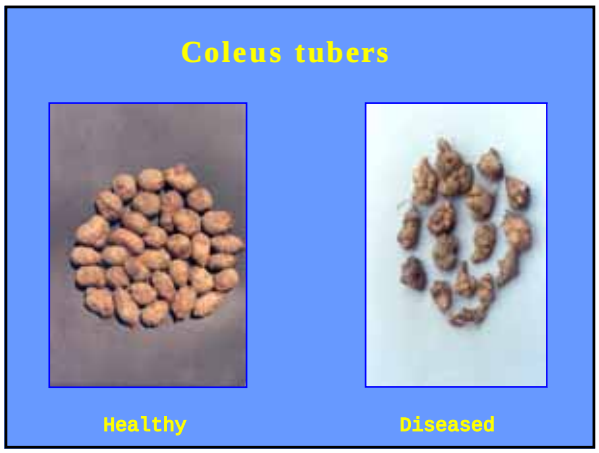
Diseased Tubers of Amorphophallus

- Infestation by lesion nematode change tuber colour to black with cracks on the surface.
- Infestations by both the nematodes were found to be very high in irrigated fields as compared to rain fed tracts.
- No resistance has so far been reported in Amorphophallus to root-knot nematode.
- Farmers in Kerala practice crop rotation. Planting healthy nematode free corms and rotation of the crop with non host crops are the only way to keep the crop free infestation.
- Other nematodes infesting Amorphophallus are *Radopholus similis* and *Radopholoides* sp.

Minor Tuber Crops

- Among the minor tuber crops, coleus (*Solenostemon rotundifolius*) is extensively grown in Kerala as well as Tamil Nadu.
- It is highly susceptible to the root-knot nematode.
- Severe gall formation was recorded in Kerala.
- More pronounced galls appeared in mildly infested tubers under storage whereas heavily infested ones rotted.
- Cultivation of sweet potato variety Sree Bhadra helped to reduce root-knot nematode in infested field and subsequent planting of coleus escaped the nematode damage.

Coleus Roots infested with Meloidogyne incognita


Coleus tubers
Healthy
Diseased


THANK YOU