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Bioefficacy of botanical based seed treatment against root-knot nematode, *Meloidogyne incognita* infesting chickpea (*Cicer arietinum* L.)

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Abstract
Root-knot nematode, *Meloidogyne incognita* is considered to be the most important nematode of pulse crops including chickpea. Farmers experience chronic losses by root-knot nematode because of it's wide distribution and high frequency in all agro-climatic zones of India. Looking to it's economic importance, several pesticides have been tried for the management of nematode, but due to environmental pollution, health hazards, high cost and lack of easy availability, their adoption at farmer's level has been limited. Therefore, attempts were made to determine alternative methods which may be effective, economical and eco-friendly for the management of root-knot nematode, *M. incognita* on chickpea. Experimental findings exhibited that the seed treatment with Periwinkle leaves powder at 10% w/w was found best followed by Parthenium leaves powder at 10% and Water hyacinth leaves powder at 10% w/w in improving plant growth of chickpea and reduced reproduction of root-knot nematode, *M. incognita*.

Keywords: Chickpea, root-knot nematode, periwinkle, parthenium, water hyacinth

1. Introduction
Chickpea is a cool season legume crop and is grown in several countries worldwide as a food source. Chickpea (*Cicer arietinum* L.) is among the most widely consumed legumes in the world, particularly in tropical and subtropical areas (Chhangani) [1]. Seed is the main edible part of the plant and is a rich source of protein, carbohydrates and minerals especially for the vegetarian population. As in case of other legume crops, chickpea fix atmospheric nitrogen through its symbiotic association with *Rhizobium spp*. thus helping in enhancing the soil quality for subsequent cereal crop cultivation. Chickpea is basically grown in the dried region of India. The major chickpea producing States of India includes Rajasthan, Madhya Pradesh, Maharashtra, Uttar Pradesh, Andhra Pradesh and Karnataka. Two types of chickpeas are recognized, the white-seeded "Kabuli" and the brown coloured "Desi" types. Chickpea is a good source of carbohydrates and protein and protein quality is considered to be better than other pulses. Chickpea is rich in nutritionally important unsaturated fatty acids such as linoleic and oleic acids. β-Sitosterol, campesterol and stigmasterol are important sterols present in chickpea oil. Ca, Mg, P and especially K are also present in chickpea seeds. Mature chickpeas are cooked to prepare various delectable dishes in number of social functions. Root knot nematodes are prevailent in 90% of agricultural crops and considered to be the major problem. Root-knot nematodes are a major threat in the production of various crops, and widely distributed in all over the world. In India, Root-knot nematode was first reported by (Barber) [2] on tea roots from Devala territory of Kerala. (Bhattiand Jain) [3] Reported yield losses to the extent of 90%, 46.2% and 23% in okra, tomato and brinjal by root-knot nematode, *Meloidogyne incognita* under field conditions in Haryana. (Sharma and Baheti) [4] Reported losses to the tune of 46.0, 46.7, 47.8 and 55.4% on pea, okra, tomato and bottle gourd, respectively by root-knot nematode, *M. incognita* and *M. javanica* under light soil of Rajasthan. (Ali) [5] reported that root-knot nematode; *Meloidogyne incognita* is responsible to cause 25.6% losses on chickpea. The aim of the study is to find the best suitable treatment of botanical based seed treatment against root-knot nematode, *M. incognita* which could be used as an alternative to synthetic pesticides in future.

2. Materials and methods
A pot experiment was carried out to test the efficacy of plant leaves powder *viz*., Periwinkle (*Catharanthus roseus)*, congress grass (*Parthenium hysterophorus) and* Water hyacinth

(Eichhornia crassipes) for the management of root-knot nematode, *Meloidogyne incognita* on chickpea (cv. GNG-1581) at Department of Nematology, Rajasthan College of Agriculture, MPUAT, Udaipur. Plant leaves powder was used at 2.5, 5 and 10% (w/w) as seed dressing treatment. A treated check (Neem leaves powder10% w/w) was taken along with untreated check for comparison.

2.1 Maintenance of pure culturing of *M. incognita*

Egg masses of *M. incognita* was collected from brinjal roots and freshly hatched second stage juveniles were inoculated on 15-20 days old brinjal seedlings already growing and maintained in 15 cm sized earthen clay pots filled with steam sterilized soil to provide adequate pure population of *M. incognita* to carry out various experiments.

2.2 Methodology

Weighed quantity of seeds were taken in a beaker, added few drops of gum and stirred with the help of glass rod and there after required quantity of plant leaves powder were added to it and mix thoroughly to provide uniform smooth coating of leaves powder over seeds. The chalk powder was used as drying agent. The experiment was laid out in completely randomized design and all the treatments were replicated five times. The soil samples were collected before sowing to determine initial inoculum level. After 10 days of sowing, one healthy plant in each pot was maintained and watered regularly as and when required. Observations on plant growth parameters *viz.,* shoot length (cm), shoot weight (g), root length (cm), root weight (g) and No. of nodules per plant as well as nematode reproduction parameters *i.e.* number of galls per plant, number of egg masses per plant, number of eggs & larvae per egg mass and final nematode population per 100cc soil were taken 60 days after sowing. For studying the nematode infection, the roots were stained with 0.1% acid fuchsin lacto-phenol at 80ºC for 2-3 minute (McBeth,Taylor and Smith) [6].

3. Results and Discussion

3.1 Efficacy of plant leaves powder as seed treatment against root-knot nematode, *Meloidogyne incognita* infecting chickpea

An experiment was conducted to study the effect of botanicals as seed treatment on plant growth characters and reproduction of *M. incognita* on chickpea. Under this trial, plant leaves powder (Periwinkle, Parthenium and Water hyacinth) were used at 2.5%, 5% and 10% w/w as seed treatment. A treated check (Neem leaves powder 10% w/w) and untreated check was also maintained to compare the experimental findings. Observations on plant growth characters (shoot length, root length, shoot weight, root weight and nodules per plant) and nematode reproduction (galls per plant, egg masses per plant, eggs& larvae per egg mass, final nematode population per 100cc soil) were recorded and analyzed.

The result of experiment showed that the seed treatment of Periwinkle leaves powder at 10% significantly reduced the number of galls /plant, number of eggmasses/ plant, number of eggs & larvae /egg mass and final nematode population/100cc soil and considerably increased the shoot length, shoot weight, root length, root weight and number of nodules per plant as compared to control. Among all botanicals Periwinkle leaves powder was better as compared to Parthenium and Water hyacinth against root knot nematode, *M. incognita* on chickpea, recorded observations are presented in Table 1 and illustrated through Figure 1-2.

A. Plant Growth Parameters

Data presented in Table-1 and Fig. 1 revealed that the seed treatment of Periwinkle leaves powder at 10% significantly increased shoot length (73.17%), shoot weight (56.07%), root length (53.55%), root weight (84.21%) and number of nodules per plant (22.22%) as compared to control. Among all the treatments, maximum shoot length (82.11%), shoot weight (73.26%), root length (60.16%), root weight (108.42%) and number of nodules per plant (29.16%) were observed with Neem leaves powder at 10% w/w which was maintained as standard check and it differed significantly from rest of the treatments.

B. Nematode Parameters

Data presented in Table-1and Fig. 2 revealed that the seed treatment of Periwinkle leaves powder at 10% significantly reduced the number of galls per plant (48.42%), number of eggmasses/ plant (47.05%), number of eggs & larvae /egg mass (43.05%) and final nematode population/ 100cc soil (66.08%) as compared to control. However, Neem leaves powder was found superior in terms of reducing infection as compared to other treatment. On the whole, Periwinkle leaves powder at 10% (w/w) as seed treatment proved to be most effective in reducing the infection of root-knot nematode, *M. incognita* and to boost up plant growth characters of chickpea.The present findings are in the line with the findings of (Verma and Khan) [7] who found length of roots and shoot were highest with the application of Neem leaves (66.5 and 59.5 cm). (Wondimeneh) [8] Studied the nematicidal potential of baker tree (*Milletia ferruginea*), bitter leaf (*Vernonia amygodalina*), parthenium (*Parthenium hysterophorus*), lantana (*Lantana camara*), Mexican marigold (*Tagetes minuta*), Mexican tea (*Chenopodium ambrosioides)*, neem (*Azadirachta indica*). Application of botanicals was found to reduce the formation of galls, number of eggs/egg-mass and final nematode population density in the soil and increased plant height of tomato. (Mehta, Baheti, Rathore and Nama) [9] Reported maximum increase in plant growth character of maize when Neem (*Azadirachta indica*) leaves powder applied at 4 g/plant followed by aak (*Calotropis procera*) and Water hyacinth (*Eichhornia crassipes*) leaves powder at 4 g/ plant. Maximum reduction in maize cyst nematode, *H. zeae* population.

Result of present investigation were also found similar with (Hoque, Aslam, Howlader and Mamun)[10] who studied the performance of some indigenous plant cakes against plant parasitic nematodes in tea. Indigenous crude plant cakes of Marigold, *Tagetes sp*. (Leaves, flowers and stems), Karanj, *Pongamia pinnata* (leaves and fruits), Chirota, *Swertia chirayaita* (leaves and stems), Neem, *Azadirachta indica* (leaves) and Mahagoni, *Swietenia mahogany* (seeds) were tested. Marigold plant cake showed the highest (78.80%) mortality of nematodes in the treated soil followed by Mahogani (77.08%) and Neem (75.40%). Present study were also similar with found (Farma, Refaei, Khalil, Marwa)[11] who conducted the green house experiment to evaluate the nematicidal activity of certain alkaloid plants namely periwinkle (*Catharanthus roseus)*, datura (*Datura stramonium*), lupin (*Lupinus albus*), pomegranate (*Punica granatus*) and fenugreek (*Trigonella foenum*) against root knot nematode, *M. incognita* infectind cucumber (*Cucumis sativus*). Dried powdered parts of such plants were screened at three rates (1,3 and 5g/plants). Dried leaf powder of *C. roseus* (62.5%) as well as dried seed powder of *L.albus* (52.8%) and *T. foenum* (43.2%) induced remarkable improvement in total

plant fresh weight of cucumber at the rate of 5g/plant. By all treatments of alkaloid plants root knot nematode population whether in soil and roots, root galling and number of egg masses were significantly suppressed. Dried leaf powder of *C. roseus* at three tested rates (70.1, 71.6 and 72.6%) performed the best and suppressed total nematode population of *M. incognita.*

Table 1: Efficacy of plant leaves powder as seed treatment against root-knot nematode, *Meloidogyne incognita* on chickpea

Treatments	Shoot* length (cm)	Shoot* weight (g)	Root* length (cm)	Root* weight (g)	No. of* nodules/ plant	No. of** galls / plant	No. of** egg masses/ plant	No. of** eggs and larvae/ egg mass	Final** nematode population /100cc soil
T_1 -Periwinkle leaves powder 2.5% w/w	28.02 (27.19)	13.11 (13.80)	14.09 (19.40)	4.43 (16.57)	30.20 (4.86)	30.20 (20.52)	28.40 (16.47)	184.00 (14.81)	300.00 (46.73)
T_2- Periwinkle leaves powder 5% w/w	33.10 (50.24)	14.05 (21.96)	16.22 (37.45)	5.89 (55.00)	32.80 (13.88)	26.40 (30.52)	23.60 (30.58)	150.20 (30.46)	243.00 (56.85)
T_3 - Periwinkle leaves powder 10% w/w	38.15 (73.17)	17.98 (56.07)	18.12 (53.55)	7.00 (84.21)	35.20 (22.22)	19.60 (48.42)	18.00 (47.05)	123.00 (43.05)	191.00 (66.08)
T_4 -Parthenium leaves powder 2.5% w/w	27.00 (22.56)	12.76 (10.76)	13.67 (15.84)	4.21 (10.78)	29.60 (2.77)	32.20 (15.26)	30.00 (11.76)	193.80 (10.27)	320.40 (43.11)
T_5-Parthenium leaves powder 5% w/w	31.17 (41.48)	13.74 (19.27)	15.88 (34.57)	5.48 (44.21)	32.40 (12.50)	27.80 (26.84)	25.80 (24.11)	163.40 (24.35)	256.60 (54.43)
T_6 -Parthenium leaves powder 10% w/w	36.02 (63.50)	17.00 (47.56)	17.02 (44.23)	6.85 (80.26)	34.80 (20.83)	21.00 (44.73)	20.40 (40.00)	132.00 (38.88)	203.00 (63.95)
T_7 -Water hyacinth leaves powder 2.5% w/w	25.18 (14.29)	12.54 (8.85)	12.11 (2.62)	4.02 (5.78)	29.20 (1.38)	34.60 (8.94)	30.40 (10.58)	202.60 (6.20)	360.80 (35.93)
T_8 -Water hyacinthleaves powder 5% w/w	29.98 (36.08)	13.25 (15.01)	15.45 (30.93)	5.23 (37.63)	31.00 (7.63)	28.00 (26.31)	26.20 (22.94)	173.00 (19.90)	288.00 (44.86)
T_9 - Water hyacinth leaves powder 10%w/w	33.89 (53.83)	15.10 (31.07)	16.50 (39.83)	6.46 (70.00)	33.20 (15.27)	23.40 (38.42)	21.60 (36.47)	138.00 (36.11)	222.40 (60.51)
T_{10}-Neem leaves powder 10% w/w	40.12 (82.11)	19.96 (73.26)	18.90 (60.16)	7.92 (108.42)	37.20 (29.16)	16.20 (57.36)	15.00 (55.88)	120.20 (44.35)	186.00 (66.97)
T_{11}-Untreated check	22.03	11.52	11.80	3.80	28.80	38.00	34.00	216.00	563.20
SEm±	0.481	0.240	0.276	0.093	0.495	0.467	0.409	2.699	4.603
CD at 5%	1.372	0.684	0.788	0.267	1.411	1.332	1.166	7.693	13.121

Note: Data are average value of five replications
Initial inoculum level: 250 larvae/100 cc soil
Data in parantheses are per cent increase*/decrease** over check

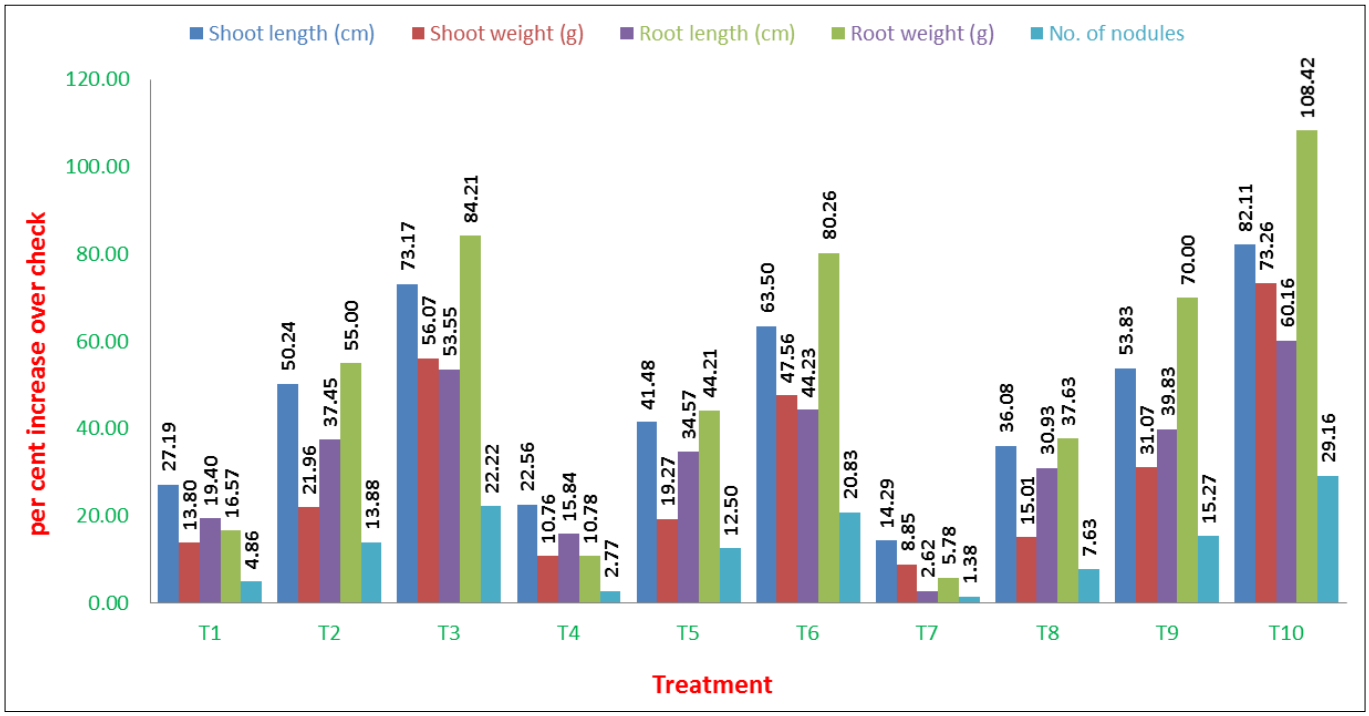

Fig 1: Efficacy of plant leaves powder as seed treatment on plant growth of chickpea infested with root-knot nematode, *Meloidogyne incognita*

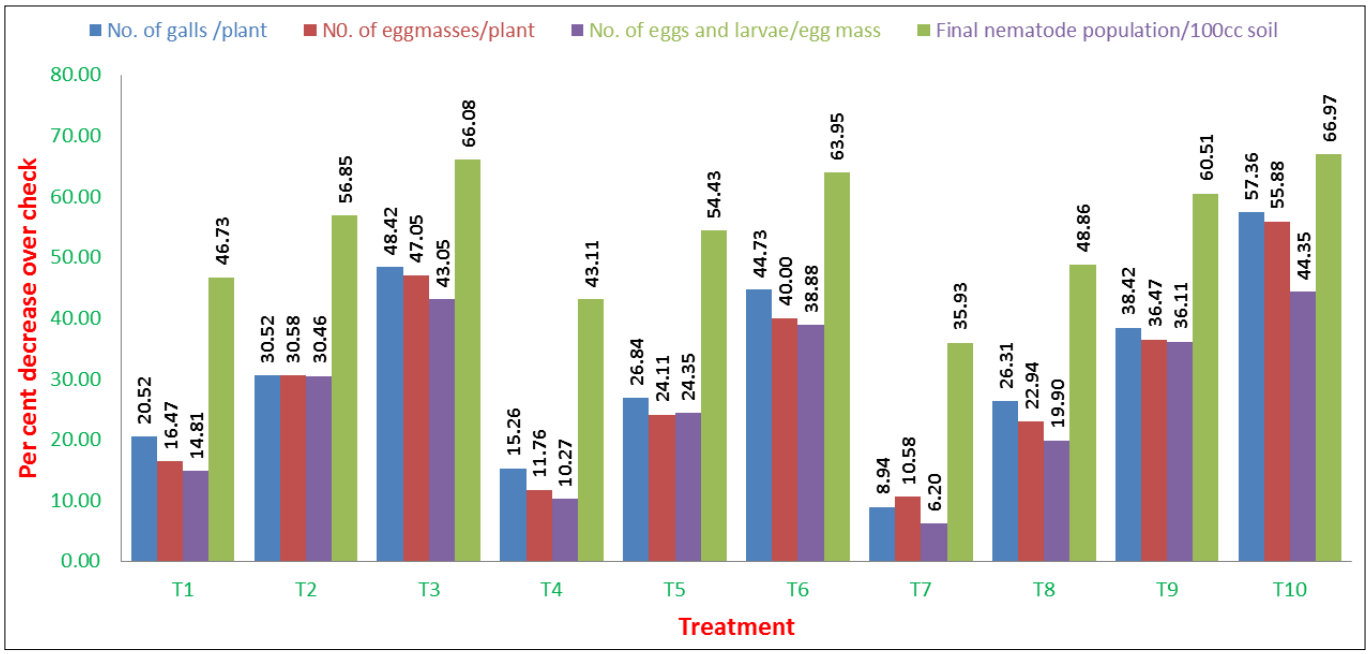

Fig 2: Efficacy of plant leaves powder as seed treatment on reproduction of root-knot nematode, *Meloidogyne incognita* on chickpea

4. Conclusion

The present investigation reveals that there is a potential scope for the utilization of different plant product for nematode control. However further research should be carried out to testing the different botanicals under different conditions for managing the plant parasitic nematodes.

5. References

1. Chhangani G, Vyas A, Mahla MK, Tali MK. Impact of farmscaping on the bioecology of gram pod borer. Journal of Entomological Research. 2018; 42:495-498.
2. Barber CA. A tea ell worm disease in South India. Department of land Record, Madras Agricultural Branch, II Bull. No. 1901; 45:227-234.
3. Bhatti DS, Jain RK. Estimation of losses in okra, tomato and brinjal yield due to *Meloidogyne incognita*. Indian Journal of Nematology. 1977; 7:37-41.
4. Sharma GL, Baheti BL. Loss estimates due to root-knot nematode in pea, okra, tomato and bottle gourd crops in Rajasthan, India. Current Nematology. 1992; 3:187-188.
5. Ali SS. Estimation of avoidable yield losses in certain rabi pulse crops due to the root-knot nematode, *Meloidogyne javanica*. Trends in Biosciences. 2009; 2:48-49.
6. McBeth CW, Taylor AL, Smith AL. Note on staining nematodes in root tissues. Proceeding of Helminthological Society of Washington. 1941; 8:26.
7. Verma AC, Khan MN. Potentiality of botanicals for managing *Meloidogyne incognita* in *Ocimum canum*. Annals of Plant Protection Sciences. 2004; 12:464-65.
8. Wondimeneh TH. Root-knot nematode (*Meloidogyne incognita*) management using botanicals in tomato (*Lycopersicon esculentum*). Academia Journal of Agricultural Research. 2013; 1:009-016.
9. Mehta SK, Baheti BL, Rathore BS, Nama CP. An effective tool for the management of maize cyst nematode, *Heterodera zeae* on maize (*Zea mays* L.). Journal of Biopesticides. 2015; 8:62-67.
10. Hoque A, Aslam A, Howlader, Mamun M. Performance of some plant cakes against plant parasitic nematodes in tea. Journal of Entomology and Zoology Studies. 2017; 5:1428-1432.
11. Fatma AM, Refaei AR, Khalil AE, Marwa M. Potential use of botanical rich in alkaloids for controlling *Meloidogyne incognita* and *R*otylenchulus reniformis infecting Cucurbits. Egyptian Journal of Agronematology. 2016; 15:29-43.