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EFFECT OF INTERCROPPING ON NEMATODES ASSOCIATED WITH GRAPEVINES IN MINIA GOVERNORATE , EGYPT.

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ABSTRACT

Intercropping with maize, sunflower, sesame, soybean, hot pepper and eggplant in a grapevine orchard in Minia Governorate show reducing effect on nematodes associated with grapevine roots.

During 2018, *Meloidogyne* spp. significantly reduced with hot pepper, eggplant and sesame by 87, 85 and 81 %, respectively. Maize and sunflower reduced this nematode by 77 and 51%. Soybean reduced this nematode by 34 %. *Pratylenchus thornei* reduced by sesame, hot pepper, eggplant, maize, soybean and sunflower recording 82, 81, 78, 71, 68 and 54 %, respectively. *Trichodorus* spp. reduced by 80 and 12 % with sesame and sunflower. Spiral nematode reduced by 80% and 11% with hot pepper and maize. *Hoplolaimus* spp. reduced by 79% and 42 % with sesame and maize. Citrus nematode reductions were 3, 4, 24, 2, 20 and 26 % with maize, sunflower, sesame, soybean, eggplant and hot pepper, respectively.

In 2019 *Meloidogyne* spp. reduced with hot pepper, eggplant and sesame plants by 89, 86 and 83 %, respectively. Soybean reduced this nematode by 40 %. *Pratylenchus thornei* reduced by 86, 84, 80, 75, 73 and 58%, with sesame, hot pepper, eggplant, maize, soybean and sunflower respectively. *Trichodorus* spp. reduced by 82 and 15 % with sesame and sunflower. Citrus nematode reduced by 83% and 14% with hot pepper and maize. *Hoplolaimus* spp. reduced by 80% and 46 % with sesame and maize. Reductions in citrus nematodes were 4, 3, 25, 0, 22 and 30 % with maize, sunflower, sesame, soybean, eggplant and hot pepper, respectively.

Key words: Intercrops, Phytonematodes, Root knot Nematode.

INTRODUCTION

Intercropping of yield plants between fruit trees considered approach followed by farmers for gaining more profits. Some of these intercrops may be as antagonists for nematodes but others play a role in enhancing nematodes. Chadfield *et al.* (2022) reported that intercropping reduced damage to focal crops from nematodes by 40% and disease incidence by 55%. Nematode control using intercropping was sufficient to offset reductions in focal crop yield from intercrop presence, making intercropping a viable agricultural tool. They also mentioned that across all intercropping systems the intercrop has a significant impact on outcomes. The objective of this research aiming to test the effect of the different intercrops on grapevine infestation by phyto-nematodes after one week from the harvest of intercrops for choice the best plants that play a role in the integrated nematodes managements**.** Several intercropped plants tested for their effect on nematodes (Mc Donald 1987, Siddiqui and Alam1987, Agu 2008, Berry *et al.* 2009, Dong *et al*.2012, Agarwal *et al* 2013, Kimaru *et al*. 2015 Abd Allah *et al.* 2020 and Manju *et al*. 2021).

MATERIALS AND METHODS

During April of two successes seasons 2018 and 2019, four summer yield crops i.e. maize, sunflower, sesame and soybean also two vegetable crops i. e. hot pepper and eggplant were planted as intercrops in plots one tenth acre in area per each. These plots replicated four times and distributed in complete randomized designs between grapevine orchard located in Samalot district, Minia Governorate. Other unplanted plots served as control treatments. Composed samples (Twenty kilograms soil) were taken from grapevine soil and roots in each plot before intercrops plantation and after one week from the harvest of the intercrops and from control plots (non intercropped) in the same times. Samples were transferred in plastic bags to the laboratory for nematode extraction by combination of Baermann funnels with elutriation and sieving technique (Barker *et al.*, 1985). Nematodes in different species in aliquant sample were counted. The efficiency of the different treatments was estimated using the Henderson &Tilton equation. The significance of the difference between reduction percentages was estimated by Chi square test.

RESULTS AND DISCUSSION

Data explained in table (1) and fig. (1) show the effect of intercropping with different plants belonging different families on phyto-nematodes species associated with grapevine Balady Cv. in Samalot district, Minia Governorate during 2018. Reduction percentages in nematode population after one week from harvest the intercropped plant was estimated following Henderson and Tilton (1955) formula. Root knot nematode reduced with different intercrops especially with hot pepper followed by eggplant then sesame plants recorded reduction percentages of 87, 85 and 81 %, respectively. Murungi et al. (2018) explained that Solanaceae plants may be particularly effective against nematodes because they emit methyl

salicylate that negatively affect nematodes. Furthermore, exposure to methyl salicylate can confer resistance to agricultural pests (Bar-Nun & Mayer, 2008) and its metabolism regulates plant defense signaling and systemic acquired resistance in exposed plants (Chen *et al*.,2019). Alashalaby and Noweer (2003) reported that aqueous sesame extract significantly reduced the total number of root knot nematode juveniles and inhibited egg hatch in peanut roots and soil. (Radwan *et al.* 2009). Found that sesame extract has been found to contain a mixture of unsaponifiable materials such as sesamin, sesamolin, and sesamol which are nematicidal .

Maize and sunflower differed significantly and came in moderate arrangement in their effect on root knot nematode population recording 77 and 51 reduction percentages, respectively. Soybean retarded whereas reduced population of root knot nematodes by 34 %. Lesion nematode *Pratylenchus thornei* reduced in descending order by the intercropping with sesame, hot pepper, eggplant, maize, soybean and sunflower recording reduction percentages of 82, 81, 78, 71, 68 and 54 %, respectively. Stubby nematode *Trichodorus* spp. influenced in differed effects whereas the reduction ranged between 80 to 12 % with the intercropping with sesame and sunflower, respectively. Spiral nematode *Helicotylenchus pseudorabtus* reduced with the tested intercrops in the range of 80% to 11% with hot pepper and maize, respectively. Lance nematodes *Hoplolaimus* spp. moderately affected by the tested intercrops without a huge difference in the reduction that ranged between 79% in the maximum and 42 % reduction percentages in the minimum record with sesame and maize respectively. These results on lance nematode can be attributed to its host range that includes soybean and maize, which attracted this nematode and reduced the infection load on the focal host, the grapevine. Citrus nematode reduction percentages due to intercropping was unobserved that may be attributed to the limited hosts of citrus nematode that attract this nematode so reduce nematode infestation on the host plant (grapevine). The recorded reduction percentages in nematode population in grapevine rhizo-sphere were 3, 4, 24, 2, 20 and 26 % with the following intercrops maize, sunflower, sesame, soybean, eggplant and hot pepper, respectively.

Table (2) and Fig. (2) also show the effect of intercropping with different plants on plant parasitic nematode species associated with grapevine Balady Cv. in Samalot district, Minia Governorate during 2019. Root knot nematodes reduced with hot pepper, eggplant and sesame plants by reduction percentages of 89, 86 and 83 %, respectively. Wuyts *et al*. 2006 explained that methyl salicylate emit by solanaceae plants has been shown to be effective for *Meloidogyne incognita*. Sesame extract has been found to contain a mixture of materials have nematicidal effects (Radwan et al., 2009).also similar report was mentioned by Sikora and Fernandez (2005). Root knot nematode population moderately reduced by Maize and sunflower recording 79 and 56 reduction percentages, respectively. With soybean intercropping, the population of root knot nematodes slightly reduced recording 40 %.

Lesion nematode *Pratylenchus thornei* with the intercropping by sesame, hot pepper, eggplant, maize,

soybean and sunflower reduced in descending order of 86, 84, 80, 75, 73 and 58%, respectively. Reduction in stubby nematode (*Trichodorus* spp.) ranged between 82 to 15 % with sesame and sunflower intercropping, respectively. Spiral nematode *Helicotylenchus pseudorabtus* reduced with the tested intercrops in the range of 83% to 14% with hot pepper and maize, respectively. Lance nematodes *Hoplolaimus* spp. moderately affected by the tested intercrops in the range between 80% in the maximum and 46 % reduction percentages in the minimum record, with sesame and maize respectively. In general all planted crops contribute in different degrees in reducing nematode infestation to the focal plant (grapevine). Parker *et al.* (2016) mentioned that diverse plantings provide many benefits f or agroecosystem health. For example, "t rap crops" that are highly attractive to pe sts can protect nearby plant

Reductions in citrus nematodes were substandard recording 4, 3, 25,0 , 22 and 30 % with maize, sunflower, sesame, soybean, eggplant and hot pepper, respectively. These results indicate the importance of hot pepper, eggplant and sesame in reducing nematode population resultant the effect of their root exudates against nematodes. Other plants haven't any effect because their roots not produced antagonistic nematode substances and non-hosts for citrus nematode.

Table (1) : Reduction percentages in phyto-nematodes after one week from intercrops harvest during 2018 season

Treatments (Plantations)	Reduction percentages in nematode numbers					
	Root-knot nematode *Meloidogyne* spp. Avg. No./ 250g soil	**Lesion nematode *Pratylenchus thornei*.**	**Stubby nematode *Trichodorus* spp.**	**Spiral nematode *Helicotylenchus* pseudorobustus**	**Lance nematodes *Hoplolaimus* spp.**	**Citrus nematode *Tylenchulus semipentrans***
Maize	77 a b	71 ab	28d	11 d	48 c	3 b
Sunflower	51 c	54 c	12e	62 bc	59 b	4 b
Sesame	81 a	82a	80a	78 a	79 a	24 a
Soybean	34 d	68 b	74ab	50c	42 c	2 b
Eggplant	85a	78 a	50 c	70 ab	60 b	20 a
Hot Pepper	87 a	81a	66 b	80 a	72 a	26 a

Reduction percentages followed by the same letters not significantly differed according to Chi square test.

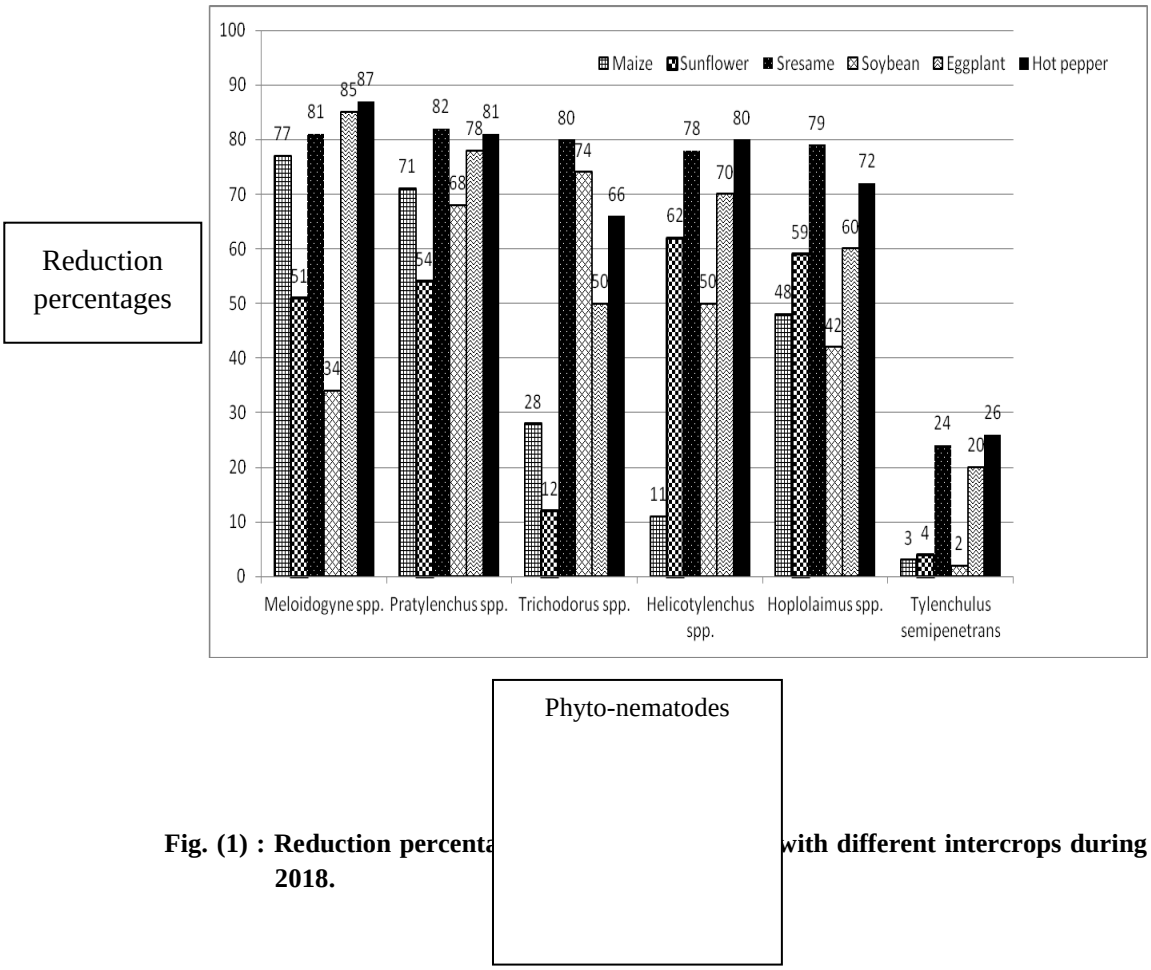

Fig. (1) : Reduction percenta with different intercrops during 2018.

Table (2) : Reduction percentages in phyto-nematodes after one week from intercrops harvest during 2019 season

Treatments (Intercrops)	Reduction percentages in nematode numbers					
	Root-knot nematode *Meloidogyne* spp. Avg. No./ 250g soil	Lesion nematode *Pratylenchus thornei*.	Stubby nematode *Trichodorus* spp.	Spiral nematode *Helicotylenchus* pseudorobustus	Lance nematodes *Hoplolaimus* spp.	Citrus nematode *Tylenchulus semipentrans*
Maize	79a	75 b	32 d	14 e	50 ab	4 b
Sunflower	56 b	58 c	15 e	66 c	60 b	3 b
Sesame	83 a	86a	82 a	80 a b	80 a	25 a
Soybean	40 c	73 b	76 ab	54 d	46 c	0 b
Eggplant	86 a	80 a b	53 c	72 bc	63 b	22 a
Hot Pepper	89 a	84 a	70 b	83a	75a	30 a

Reduction percentages followed by the same letters not significantly differed according to Chi square test.

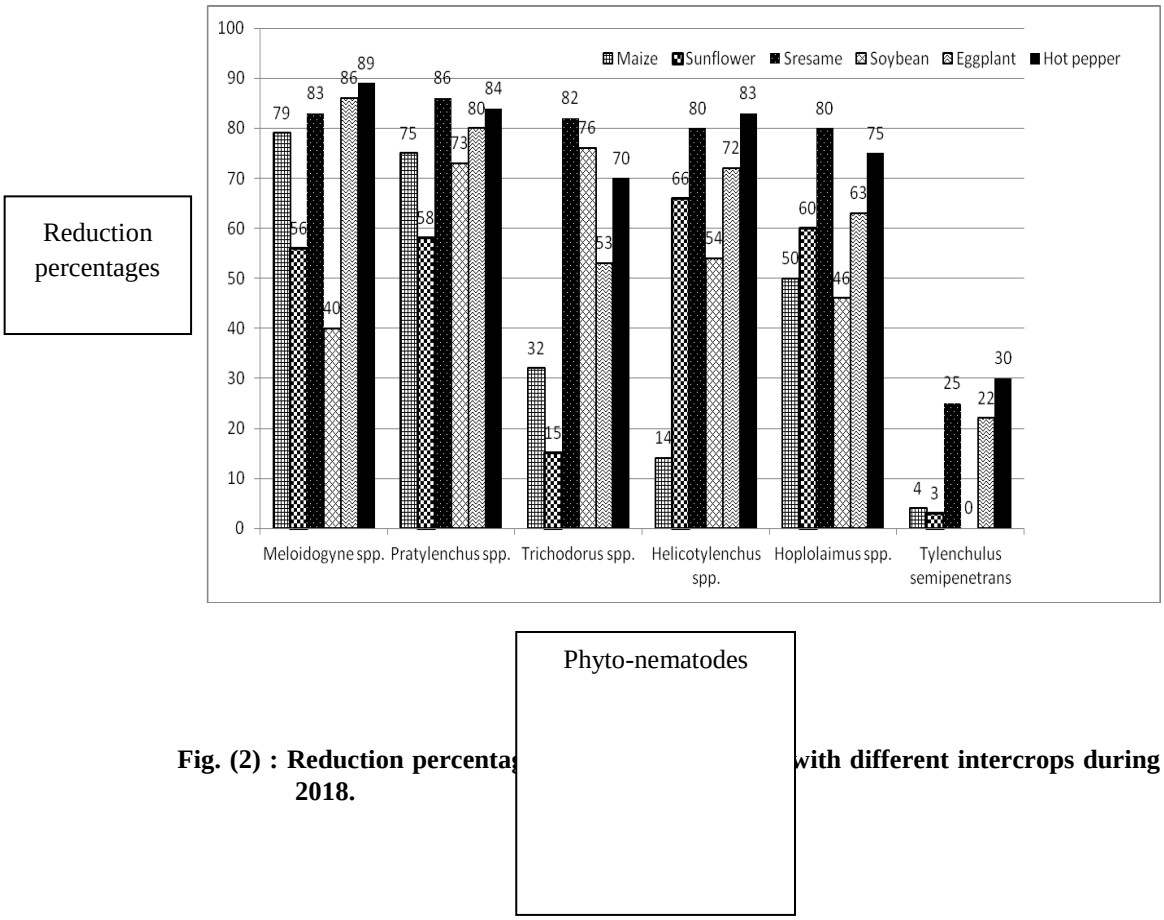

Fig. (2) : Reduction percentag with different intercrops during 2018.

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الملخص العربي

تأثير الزراعة البينية على النيماتودا المصاحبة لكروم العنب فى مركز سمالوط ,محافظة المنيا, مصر

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تم دراسة تأثير الزراعة البينية بأربعة محاصيل حقلية صيفية، وهي الذرة وعباد الشمس والسمسم وفول الصويا، بالإضافة إلى محصولين من الخضروات وهما الفلفل الحار والباذنجان في بستان عنب موجود في منطقة سمالوط بمحافظة المنيا وأظهرت النتائج حدوث خفض للديدان الخيطية المرتبطة بجذور العنب.

خلال عام 2018 انخفض معدل نيماتودا تعقد الجذور في جذور كروم العنب مع تحميل المحاصيل المختلفة خاصة مع الفلفل الحار يليه الباذنجان ثم السمسم وسجلت نسب انخفاض بلغت 87 و85 و81% على التوالي. كان تأثير الذرة وعباد الشمس متوسطاً في خفض أعداد نيماتودا تعقد الجذور حيث بلغت نسبة الانخفاض 77 و51% على التوالي. كان فول الصويا متأخرا في حين انخفض عدد نيماتودا تعقد الجذور بنسبة 34٪.

تم تقليل نيماتودا تقرح الجذور فى منطقة جذور العنب بترتيب تنازلي من خلال الزراعة المتداخلة مع السمسم والفلفل الحار والباذنجان والذرة وفول الصويا وعباد الشمس مسجلة 82، 81، 78، 71، 68 و 54٪ على التوالي. نيماتودا التقصف .*Trichodorus* spp انخفضت في حدود 80 إلى 12% في جذور العنب مع السمسم ودوار الشمس على التوالي. انخفضت نسبة الديدان الخيطية الحلزونية *Helicotylenchus pseudorabtus* في حدود 80% إلى 11% مع الفلفل الحار والذرة، على التوالي. النيماتودا الرمحية .*Hoplolaimus* spp. وتراوحت نسبة إنخفاضها بين 79% و42% في السمسم والذرة على التوالي. كان الانخفاض في نيماتودا الموالح 3، 4، 24، 2، 20 و 26% مع المحاصيل البينية التالية: الذرة، دوار الشمس، السمسم، فول الصويا، الباذنجان والفلفل الحار، على التوالي.

وتشير البيانات التي تم الحصول عليها في عام 2019 إلى أن نيماتودا تعقد الجذور انخفضت مع الزراعة البينية للفلفل الحار والباذنجان والسمسم بنسب انخفاض بلغت 89 و86 و83% على التوالي. تم تقليل هذه الديدان الخيطية عن طريق زراعة الذرة وعباد الشمس مسجلة 79 و 56 نسبة انخفاض على التوالي. ساهمت زراعة فول الصويا في تقليل نيماتودا تعقد الجذور بنسبة 40%.أما بالنسبة لنيماتودا تقرح الجذور *Pratylenchus thornei* مع الزراعة البينية بالسمسم والفلفل الحار والباذنجان والذرة وفول الصويا وعباد الشمس انخفضت بترتيب تنازلي 86، 84، 80، 75، 73 و 58٪ على التوالي. وتراوح الانخفاض في أعداد نيماتودا تقصف الجذور (.*Trichodorus* spp) بين 82 إلى 15% عند زراعة السمسم وعباد الشمس على التوالي. انخفضت نسبة النيماتودا الحلزونية *Helicotylenchus pseudorabtus* مع المحاصيل البينية المختبرة في حدود 83% إلى 14% مع الفلفل الحار والذرة، على التوالي. النيماتودا الرمحية .*Hoplolaimus* spp تأثرت بشكل متوسط بالمحاصيل البينية المختبرة حيث تراوحت نسب التخفيض بين 80% و46% مع السمسم والذرة الصفراء على التوالي. وكانت الانخفاضات في نيماتودا الموالح دون المستوى حيث بلغت 4، 3، 25، 0، 22 و 30% مع الذرة، عباد الشمس، السمسم، فول الصويا، الباذنجان والفلفل الحار، على التوالي.

الكلمات المفتاحية: الزراعات البينية ، نيماتودا النبات ، نيماتودا تعقد الجذور.