

Faculty of Agriculture - University of Jordan - Amman - Jordan

A PRELIMINARY REPORT ON THE PLANT-PARASITIC NEMATODES IN JORDAN

by

Z. HASHIM

Little is known about the plant-parasitic nematode fauna of Jordan. Abu-Gharbieh (1975), Abu-Gharbieh and Hammou (1972), Abu-Gharbieh *et al.* (1978), Anon. (1970, 1971) and Qasem (1970) reported the presence of root-knot nematodes (*Meloidogyne* spp.) in the irrigated lowlands: also, both *Anguina tritici* (Steinbuch) Chitw. and *Merlinius rugosus* (Siddiqi) Siddiqi were reported to occur in the country by Qasem (1970) and Hashim (1979) respectively. A list of nematode genera prevalent in Jordan has been published, but the only species referred to was *M. incognita* (Kofoid *et* White) Chitw. (Anon., 1970). In view of this limited knowledge, and as a preliminary step in determining where the major potential nematode problems lie, a list of the nematode species recently found associated with certain crops in Jordan is presented herein.

MATERIALS AND METHODS

Over 250 soil and root samples were collected from the following districts: the Jordan Valley (East Bank); the Southern Ghors (valleys south of the Dead Sea); Wadi Shu'aib (a valley descending from the mountains east of the Jordan Valley); Jubeiha, Sweileh, Salt, Jerash and Irbid in the hilly regions in the northwestern part of the country.

Nematodes were extracted from the soil by either the tray modification method of the Baermann funnel technique or the Flegg

sieving technique (Flegg and Hooper 1970). Vermiform endoparasites were recovered from infected roots by the maceration-filtration technique as described by Hooper (1970). Cyst-forming nematodes were extracted from air-dried soil by a 'flask' method (Shepherd, 1970). Specimens were subsequently killed by heat and then either mounted in water for immediate microscopic examination or fixed in TAF, stained in acid-fuchsin lactophenol and processed to glycerol by a rapid method (Baker, 1953).

RESULTS AND DISCUSSION

Table I shows the nematode species identified together with the plants with which they were associated and the districts where they were encountered. The predominant genera were *Helicotylenchus* Steiner, *Meloidogyne* Goeldi, *Pratylenchus* Filipjev, *Tylenchorhynchus* Cobb, *Tylenchulus* Cobb and *Xiphinema* Cobb.

The nematode fauna of the rainfed, elevated areas of Jordan resembles that of Europe, whilst that of the Jordan Valley and Southern Ghors shows a similarity to that of subtropical Africa. *Criconemoides informis* (Micol.) Taylor, *Ditylenchus dipsaci* (Kühn) Filipjev and *X. pachtaicum* (Tulaganov) Kirjanova, which were found mainly in the elevated regions, are typically temperate species that are widely distributed in Europe. On the other hand, *H. multicinctus* (Cobb) Golden, *Longidorus laevicapitatus* Williams and *M. javanica* (Treub) Chitwood, which were found principally in the low-lying irrigated regions, are prevalent in the warmer regions of the world, including subtropical Africa.

In the irrigated lowlands, vegetable crops such as tomato, eggplant and cucumber appeared to be most seriously affected by *Meloidogyne* species. Both *M. incognita* and *M. javanica* were identified, the latter more commonly. Plants infested with either species often had severely galled roots and *M. javanica*-infestations were sometimes associated with unthrifty growth. Root-knot nematodes were less common in the elevated districts.

P. penetrans (Cobb) Chitwood *et* Oteifa and *P. thornei* Sher *et* Allen may also be damaging to vegetables, such as tomato and common bean. They usually were recovered in low densities (10-50 nematodes/

100 ml of soil) but should, nevertheless, be regarded as potentially important pathogens because their migratory habit within roots can result in severe plant damage.

Other nematodes found on vegetables in Jordan include *Heterodera goettingiana* Liebscher, *T. dubius* (Bütschli) Filipjev, *Paratrichodorus minor* (Colbran) Siddiqi, *Trichodorus sparsus* Szczygiel, *H. pseudorobustus* (Steiner) Golden and *H. dihystra* (Cobb) Sher; of these, only *T. dubius* was regularly found. *P. minor* is of interest because it is a vector of plant viruses (tobraviruses).

H. multincinctus was found in nearly every banana plantation examined in the Jordan Valley; in the northern Jordan Valley, population densities of over 8,200 nematodes/100 g root sample were found. The severely necrotic roots which were consistently associated with the presence of this species are likely to be a cause of yield decline. *H. multincinctus* has previously been reported to be associated with serious decline of banana in the Middle East, namely the Jordan Valley (West Bank) (Minz *et al.*, 1960) and Lebanon (Sikora and Schlösser, 1973). *H. pseudorobustus*, *H. dihystra*, *Meloidogyne* sp. and *L. laevicapitatus* were relatively rare in the Jordan plantations and are probably of much less importance.

T. semipenetrans Cobb, the causal agent of 'slow decline' disease of citrus, was found throughout the citrus-growing areas of the Jordan Valley. However, it never occurred in markedly high densities (100-180 females/1 g roots), possibly owing to the high calcium content of the soil (Cohn *et al.*, 1965). It also occurred at Jerash and Wadi Shu'aib, though in much lower densities. In the Jerash groves, *H. digonicus* Perry and *H. pseudorobustus* were the commonest phytoparasitic nematode species.

Cohn (1969) has pointed out that the decline symptoms of citrus trees in Israel were associated with a critical infestation level of *T. semipenetrans* (40,000 larvae and males/10 g roots), and that such levels were rarely observed in the inland valleys. Since infestation levels were also relatively low in the citrus groves of Jordan, it seems unlikely that this nematode is causing appreciable yield reductions in this country.

In the rainfed, elevated localities, the predominant nematodes associated with olive, grape and other fruit trees were *H. digonicus* and *X. pachtaicum*, which were often found together. Their combined

Table I - *Plant-parasitic nematodes and associated plants in some localities in Jordan.*

Nematodes	Associated plants	Districts (1)
TYLENCHIDA		
<i>Amplimerlinius macrurus</i> (Goodey) Siddiqi	<i>Citrus</i> sp., <i>Juglans regia</i> L. <i>Lens esculenta</i> Moench <i>Olea europaea</i> L.	Jerash. Irbid. Salt.
<i>Aphelenchus</i> sp.	<i>O. europaea</i>	Jubeiha.
<i>Coslenchus costatus</i> (De Man) Siddiqi	<i>Citrus</i> sp. <i>Cucumis sativus</i> L. <i>Nicotiana tabacum</i> L.	Jerash. NJV. CJV.
<i>Criconemoides informis</i> (Micol.) Taylor	<i>O. europaea</i> , <i>Vitis vinifera</i> L.	Jubeiha.
<i>Crossonema</i> sp.	<i>Citrus</i> sp.	Jerash.
<i>Ditylenchus dipsaci</i> (Kühn) Filipjev	<i>Asphodelus microcarpus</i> Salzm. et Viv.	Subeihi (nr. Salt).
<i>Helicotylenchus</i> c. <i>abunaamai</i> Siddiqi	<i>Citrus</i> sp.	CJV; SG; SJV.
<i>H. digonicus</i> Perry	<i>Citrus</i> sp., <i>J. regia</i> , <i>Punica granatum</i> L., <i>Solanum nigrum</i> L. <i>Lactuca sativa</i> L. <i>O. europaea</i> <i>Pinus halepensis</i> Mill., <i>Pyrus communis</i> L., <i>V. vinifera</i> <i>Triticum</i> sp.	Jerash. WS. Jerash; Jubeiha; Salt; WS. Jubeiha. SJV.
<i>H. dihystra</i> (Cobb) Sher	<i>Brassica oleracea</i> cv. <i>capitata</i> L. <i>L. sativa</i> , <i>Phaseolus vulgaris</i> L. <i>Musa</i> L. (AAA Group) 'Dwarf Cavendish'	Salt. WS. SJV.
<i>H. multicinctus</i> (Cobb) Golden	<i>M.</i> (AAA Group) 'Dwarf Cavendish'	NJV; SJV.
<i>H. pseudorobustus</i> (Steiner) Golden	<i>B. oleracea</i> cv. <i>capitata</i> <i>Citrus</i> sp. <i>L. sativa</i> , <i>O. europaea</i> , <i>P. vulgaris</i> , <i>S. melongena</i> L. <i>M.</i> (AAA Group) 'Dwarf Cavendish' <i>Prunus armeniaca</i> L.	Salt. CJV; Jerash. WS. SJV. Jerash.

<i>H. tunisiensis</i> Siddiqi	<i>Cydonia oblonga</i> Mill., <i>Malus sylvestris</i> Mill., <i>P. communis</i> <i>O. europaea</i> , <i>P. armeniaca</i> <i>Vicia faba</i> L.	Jubeiha. Jerash. Salt.
<i>Hemicriconemoides cocophyllus</i> (Loos) Chitwood et Birchfield <i>Heterodera goettingiana</i> Liebscher *	<i>Citrus</i> sp. <i>L. esculenta</i> <i>V. faba</i>	CJV; Jerash; SJV. Irbid. Jerash.
<i>Macroposthonia rustica</i> (Micol.) De Grisse et Loof	<i>Triticum</i> sp. <i>V. vinifera</i>	SJV. Jubeiha.
<i>M. xenoplax</i> (Raski) De Grisse et Loof	<i>Citrus</i> sp. <i>J. regia</i> , <i>P. armeniaca</i> <i>Lycopersicon esculentum</i> Mill.	CJV. Jerash. NJV.
<i>Meloidogyne</i> (?) <i>arenaria</i> (Neal) Chitwood <i>M. incognita</i> (Kofoid et White) Chitwood	<i>S. melongena</i> <i>L. esculentum</i> <i>O. europaea</i> <i>S. melongena</i> , <i>S. nigrum</i>	WS. Jerash; NJV. SG. Jerash.
<i>M. javanica</i> (Treub) Chitwood	<i>B. oleracea</i> cv. <i>capitata</i> <i>C. sativus</i> <i>Cucurbita pepo</i> L. <i>Hibiscus esculentus</i> L. <i>L. esculentum</i> <i>O. europaea</i> <i>P. vulgaris</i> , <i>S. nigrum</i> <i>S. melongena</i>	NJV. CJV. SJV. Jerash; SJV. CJV; NJV; SG; SJV. Jerash; SG. Jerash. CJV; Jerash; SG; SJV; WS.
<i>Meloidogyne</i> sp. <i>Merlinius c. nanus</i> (Allen) Siddiqi	<i>M.</i> (AAA Group) 'Dwarf Cavendish' <i>B. oleracea</i> cv. <i>capitata</i> , <i>V. faba</i> <i>L. sativa</i> <i>O. europaea</i> , <i>V. vinifera</i> <i>P. avium</i> (L.) L. <i>Triticum</i> sp.	SJV. Salt. WS. Jubeiha; Salt. Jubeiha. Irbid.
<i>M. rugosus</i> (Siddiqi) Siddiqi	<i>M.</i> (AAA Group) 'Dwarf Cavendish', <i>Triticum</i> sp. <i>V. vinifera</i>	SJV. Salt.
<i>Nothocriconema duplivesitum</i> (Andrássy) De Grisse et Loof	<i>P. granatum</i>	Jerash.

(contd.)

Nematodes	Associated plants	Districts (1)
<i>Pratylenchus neglectus</i> (Rensch) Filipjev et Sch. Stek.	<i>Citrus</i> sp.	Jerash.
<i>P. penetrans</i> (Cobb) Chitwood et Oteifa	<i>L. esculentum</i> <i>P. vulgaris</i>	CJV. WS.
<i>P. thornei</i> Sher et Allen	<i>Cicer arietinum</i> L. <i>C. oblonga</i> , <i>M. sylvestris</i> , <i>O. europaea</i> , <i>P. communis</i>	Sweileh. Jubeiha.
	<i>J. regia</i> <i>L. esculenta</i> <i>L. esculentum</i> , <i>Zea mays</i> L. <i>M.</i> (AAA Group) 'Dwarf Cavendish', <i>P. vulgaris</i>	Jerash. Irbid. CJV.
<i>P. zae</i> Graham	<i>Triticum</i> sp.	SJV. Irbid; NJV.
<i>Psilenchus hilarulus</i> De Man	<i>Citrus</i> sp.	SG.
<i>Psilenchus</i> sp.	<i>M.</i> (AAA Group) 'Dwarf Cavendish' <i>V. faba</i>	SJV. Salt.
<i>Tylenchorhynchus clarus</i> Allen	<i>B. oleracea</i> cv. <i>capitata</i> <i>Citrus</i> sp., <i>O. europaea</i> <i>H. esculentus</i> , <i>Z. mays</i> <i>V. vinifera</i>	Salt. Jerash. CJV. Jubeiha.
<i>T. dubius</i> (Bütschli) Filipjev	<i>B. oleracea</i> cv. <i>capitata</i> <i>Citrus</i> sp. <i>C. sativus</i> , <i>H. esculentus</i> , <i>N. tabacum</i> <i>C. oblonga</i> , <i>O. europaea</i> , <i>P. communis</i> <i>L. esculentum</i> <i>M.</i> (AAA Group) 'Dwarf Cavendish', <i>S. melongena</i>	NJV; Salt. Jerash; SG. CJV. Jubeiha. CJV; NJV; SG.
<i>Tylenchorhynchus</i> sp.	<i>V. faba</i>	SJV.
<i>Tylenchulus semipenetrans</i> Cobb	<i>Citrus</i> sp.	Salt.
<i>Tylenchus</i> spp.	<i>O. europaea</i>	CJV; Jerash; NJV; SJV; WS. Jerash; Jubeiha.
<i>Zygotylenchus guevarai</i> (Tobar Jiménez) Braun et Loof	<i>Citrus</i> sp.	Jerash.

DORYLAIMIDA

<i>Longidorus africanus</i> Merny	<i>Citrus</i> sp. <i>L. esculentum</i>	CJV; Jerash. CJV.
<i>L. laevicapitatus</i> Williams	<i>M.</i> (AAA Group) 'Dwarf Cavendish'	SJV.
<i>L. siddiqii</i> Aboul-Eid	<i>Allium cepa</i> L., <i>Citrus</i> sp., <i>L. esculentum</i> <i>M.</i> (AAA) Group 'Dwarf Cavendish'	CJV. SJV.
	<i>O. europaea</i>	SG.
<i>L. vineacola</i> Sturhan <i>et</i> Weischer	<i>C. sativus</i>	CJV.
<i>Paratrichodorus</i> (<i>Nanidorus</i>) <i>minor</i> (Colbran) Siddiqi	<i>Citrus</i> sp., <i>L. esculentum</i>	CJV.
<i>P.</i> (<i>Paratrichodorus</i>) <i>c. tunisiensis</i> (Siddiqi) Siddiqi	<i>M. sylvestris</i>	Jubeiha.
<i>Trichodorus sparsus</i> Szczygiel	<i>Citrus</i> sp., <i>L. esculentum</i> <i>P. vulgaris</i>	SG. WS.
<i>Xiphinema index</i> Thorne <i>et</i> Allen	<i>Citrus</i> sp. <i>Ficus carica</i> L.	CJV. Salt.
<i>X. ingens</i> Luc <i>et</i> Dalmasso	<i>O. europaea</i>	Jubeiha.
<i>X. insigne</i> Loos	<i>Citrus</i> sp., <i>M.</i> (AAA Group) 'Dwarf Cavendish'	SJV.
<i>X. pachtaicum</i> (Tulaganov) Kirjanova	<i>Citrus</i> sp., <i>J. regia</i> , <i>P. granatum</i> <i>C. oblonga</i> , <i>M. sylvestris</i> , <i>P. avium</i> <i>F. carica</i> <i>O. europaea</i> <i>Triticum</i> sp. <i>V. vinifera</i>	Jerash. Jubeiha. Salt. Jerash; Jubeiha; NJV; Salt. SJV. Jubeiha; Sweileh.
<i>X. vuittenezi</i> Luc, Lima, Weischer <i>et</i> Flegg	<i>P. halepensis</i> , <i>V. vinifera</i>	Jubeiha.
<i>Xiphinema</i> sp.	<i>L. esculentum</i>	J. Valley

(¹) Code: CJV = central Jordan Valley; NJV = northern Jordan Valley; SJV = southern Jordan Valley; SG = southern Ghors; WS = Wadi Shu'aib.

(*) First found here by J. Bridge (pers. comm.).

pathogenic effect might be considerable, especially to olive on which they were most numerous (> 180 *H. digonicus* and > 100 *X. pach-taicum*/100 ml of soil).

P. thornei, *Nothocriconema duplicivestitum* (Andrássy) De Grisse *et* Loof, *Macroposthonia rustica* (Micol.) De Grisse *et* Loof and *M. xenoplax* (Raski) De Grisse *et* Loof may also be damaging to fruit trees in some of the rainfed areas. Moreover, the association of *X. index* Thorne *et* Allen and *X. vuittenezi* Luc, Lima, Weischer *et* Flegg with fruit trees in the elevated areas may be of significance as these species have been implicated in the transmission of plant viruses.

In the irrigated lowlands, the most important nematode parasites of olive seem to be *Meloidogyne* species and *L. siddiqii* Aboul-Eid (more than 75% of the root systems of plants infested with either *M. incognita* or *M. javanica* were galled; over 120 *L. siddiqii*/100 ml of soil occurred in the rhizosphere of olive). Both *M. incognita* and *M. javanica* have been shown to reduce top growth of olive (Diab and El-Eraki, 1968; Lamberti and Baines, 1969), and it is possible that the varieties cultivated in the lower regions of Jordan are similarly affected by these species. The pathogenicity of *L. siddiqii* to olive is not known, but Cohn reported it to be of economic importance in Israel (Lamberti, 1975).

More sampling is required in order to gain a better understanding of the distribution and potential pest status of *P. thornei*, species of *Merlinius* Siddiqi and other nematode species encountered on cereals in Jordan. In neighbouring Egypt, *P. thornei* was found to be relatively common on maize, where it may have been a factor in the deterioration of the crop (Oteifa, 1962).

The author wishes to express his gratitude to Mr. H. Saleh and Mr. M. Abbady for technical assistance, and to Dr. J. Bridge and Dr. M. R. Siddiqi for confirming some of the Nematological identifications.

S U M M A R Y

Soil and root samples were collected from around 30 plant species in Jordan (irrigated and rainfed areas). From these samples, 41 plant-parasitic nematode species, belonging to 20 genera, were recovered and identified. The predominant genera were *Helicotylenchus* Steiner, *Meloidogyne* Goeldi, *Pratylenchus* Filipjev,

Tylenchorhynchus Cobb, *Tylenchulus* Cobb and *Xiphinema* Cobb. Six species of *Helicotylenchus* were found in both irrigated and rainfed land. *H. digonicus* Perry was widespread in the elevated, rainfed regions, and *H. multicinctus* (Cobb) was common in the banana plantations. *Meloidogyne* species, particularly *M. javanica* (Treub) Chitw., were common throughout the irrigated regions, mainly infesting vegetables. Four species of *Pratylenchus* were identified, but only one, viz. *P. thornei* Sher et Allen, was common in both the irrigated and non-irrigated areas. *Tylenchorhynchus* species, notably *T. dubius* (Bütschli) Filipjev, were regularly found. *T. semipenetrans* Cobb occurred in moderate densities in most citrus groves. *Xiphinema* species were fairly widespread, being associated mainly with fruit trees: with the exception of *X. pachtaicum* (Tulaganov) Kirjanova, they were found in low densities.

R I A S S U N T O

Notizie preliminari sui nematodi fitoparassiti in Giordania

Sono stati raccolti campioni di terreno e radici nella rizosfera di 30 specie botaniche in Giordania. Sono state trovate 41 specie di nematodi fitoparassiti appartenenti a 20 generi. I generi più comuni sono stati: *Helicotylenchus* Steiner, *Meloidogyne* Goeldi, *Pratylenchus* Filipjev, *Tylenchorhynchus* Cobb, *Tylenchulus* Cobb e *Xiphinema* Cobb. Delle sei specie di *Helicotylenchus* trovate, *H. digonicus* (Cobb) Golden è presente nelle piantagioni di Banano. *Meloidogyne* spp., ed in particolare *M. javanica* (Treub) Chitw., sono comuni nelle regioni irrigue, in associazione con ortaggi. Sono state trovate quattro specie di *Pratylenchus*, ma solo *P. thornei* Sher et Allen è apparso essere diffuso nelle aree irrigue e non. *Tylenchorhynchus dubius* (Bütschli) Filipjev è risultato normalmente presente e *T. semipenetrans* Cobb è stato trovato in densità di popolazioni modeste, nella maggior parte degli agrumeti. Le specie di *Xiphinema* sono state trovate associate principalmente con fruttiferi; ad eccezione di *X. pachtaicum* (Tulaganov) Kirjanova le densità di popolazioni di questi nematodi erano molto basse.

L I T E R A T U R E C I T E D

- ABU-GHARBIEH W. I., 1975 - Population dynamics and effect of *Meloidogyne incognita* on different plantings of tomato in the central Jordan Valley. *Dirasat, Nat. Sci.*, 2: 61-68.
- ABU-GHARBIEH W. I. and HAMMOU A., 1972 - (Division of plant protection studies - The nematodes). (In Arabic). *Ann. Rep., Dept. Agric. Res. & Extn., Jordan*, 52-53.
- ABU-GHARBIEH W. I., MAKKOUK K. M. and SAGHIR A. R., 1978 - Response of different tomato cultivars to the root-knot nematode, tomato yellow leaf curl virus, and orobanche in Jordan. *Pl. Dis. Reprtr.*, 62: 263-266.
- ANON., 1970 - (Nematology section). (In Arabic). *Ann. Rep., Dept. Agric. Res. & Extn., Jordan*, 92-96.
- ANON., 1971 - (Division of plant protection studies - Nematology experiments). (In Arabic). *Ann. Rep., Dept. Agric. Res. & Extn., Jordan*, 54-55.
- BAKER A. D., 1953 - Rapid method for mounting nematodes in glycerine. *Can. Ent.*, 85: 77-78.

- COHN E., 1969 - The citrus nematode, *Tylenchulus semipenetrans* Cobb, as a pest of citrus in Israel. Proc. 1st Int. Citrus Symp., March, 1968, Riverside, Calif., vol. 2: 1013-1017.
- COHN E., MINZ G. and MONSELISE S.P., 1965 - The distribution, ecology and pathogenicity of the citrus nematode in Israel. *Israel J. agric. Res.*, 15: 187-200.
- DIAB K.A. and EL-ERAKI S., 1968 - Plant-parasitic nematodes associated with olive decline in the United Arab Republic. *Pl. Dis. Reprtr.*, 52: 150-154.
- FLEGG J.J.M. and HOOPER D.J., 1970 - Extraction of free-living stages from soil. In Laboratory Methods for Work with Plant and Soil Nematodes (ed. J.F. Southey), Her Majesty's Stationary Office, London, 5-22.
- HASHIM Z., 1979 - Description of the male and observations on the female of *Merlinius rugosus* (Siddiqi, 1963) Siddiqi, 1970 (Nematoda: Merliniinae) from Jordan. *Revue Nématol.* (In press).
- HOOPER D.J., 1970 - Extraction of nematodes from plant material. In Laboratory Methods for Work with Plant and Soil Nematodes (ed. J.F. Southey), Her Majesty's Stationary Office, London, 34-38.
- LAMBERTI F., 1975 - Taxonomy of *Longidorus* (Micoletzky) Filipjev and *Paralongidorus* Siddiqi, Hooper and Khan. In Nematode Vectors of Plant Viruses (ed. F. Lamberti, C.É. Taylor and J.W. Seinhorst), Plenum Publishing Co., London, New York, 71-90.
- LAMBERTI F. and BAINES R.C., 1969 - Pathogenicity of four species of *Meloidogyne* on three varieties of olive trees. *J. Nematol.*, 1: 111-115.
- MINZ G., ZIV D. and STRICH-HARARI D., 1960 - Decline of banana plantations caused by spiral nematodes in the Jordan Valley, and its control by DBCP. *Ktavim*, 10: 147-157.
- OTEIFA B.A., 1962 - Species of root-lesion nematodes commonly associated with economic crops in the delta of the U.A.R. *Pl. Dis. Reprtr.*, 48: 572-575.
- QASEM S., 1970 - Occurrence and distribution of plant diseases in Jordan. *Res. Bull., Jord. Sci. Res. Council, No. 1*, 28 p.
- SHEPHERD A.M., 1970 - Extraction and estimation of *Heterodera*. In Laboratory Methods for Work with Plant and Soil Nematodes (ed. J.F. Southey), Her Majesty's Stationary Office, London, 23-33.
- SIKORA R.A. and SCHLÖSSER E., 1973 - Nematodes and fungi associated with root systems of bananas in a state of decline in Lebanon. *Pl. Dis. Reprtr.*, 57: 615-618.

Accepted for publication on 27 June 1979.