

## A New Host of Citrus Nematode, *Tylenchulus semipenetrans* Cobb, in Korea

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### 약용식물, 노루발(*Pyrola japonica*)에서의 감귤선충(*Tylenchulus semipenetrans* Cobb)의 기생

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**ABSTRACT :** During the course of study on plant parasitic nematodes associated with medicinal herbs in Korea, high population of different stages of citrus nematode, *Tylenchulus semipenetrans* was found in association with *Pyrola japonica* Klenze in Imsil, Chunbuk province. The second stage larvae and males were isolated from rhizosphere soil; immature and mature females were detached from the roots of infested plants of *Pyrola japonica*. Besides citrus it has been reported to parasitize on roots of *Syringa vulgaris*, *Diospyros lotus*, olive, grapevine, and pear in different parts of the world. This is the first record of *T. semipenetrans* parasitized on a medicinal plant, *Pyrola japonica*.

**Key words :** citrus nematode, new host, medicinal plant, *Pyrola japonica*, *Tylenchulus semipenetrans*.

*Tylenchulus semipenetrans* Cobb, 1913 is commonly known as citrus nematode, because it coincides with citriculture throughout the world. The adult female of *T. semipenetrans* is an obligate root parasite leading a semi-endoparasitic sedentary life. The front end of body embedded in the root tissues and posterior part of body behind the neck is swollen and remains out side. The female larvae feed on the surface cells of the root and only the young females penetrate deeply into cortex, some times reaching the pericycle; males and male larvae are non-parasitic (7). This nematode seems to have developed specialized races, strain or biotypes to attack plants outside Rutaceae (1, 5). It has been reported to parasitize grapevine in Australia, India, Japan and South Africa; on lilac (*Syringa vulgaris*) and persimmon (*Diospyros lotus*) in USA; olive in Australia and USA; pear and persimmon in Japan (7). However, there was no any report available on parasitization of *T. semipenetrans* on medicinal plants. This is the first report that a medicinal plant, *P. japonica* is recorded as a host of *T. semipenetrans*.

*P. japonica* is a very useful wild medicinal plant, which belongs to the family Pyrolaceae. This plant grows

in coniferous and coniferous-leaf bearing mixed forest, and is distributed throughout the country. Its leave contain saccharose, emulsins, arbutins, flavonoids and essential oils. It is used to cure chronic yellow liquorstasis of limbs and joint, artheritis, inflammation of limbs, pulmonary tuberculosis, hemoptysis, external and internal hemorrhage. The present study was aimed to identify the plant parasitic nematodes associated with medicinal herbs in different regions of the Korea including high altitude.

### MATERIALS AND METHODS

Soil and root samples were collected from around the roots of *Pyrola japonica* from Imsil, Chunbuk Province. Each soil sample was composit of 3~4 soil cores, collected up to a depth of 25 cm with the help of a hand shovel. Soil and roots put into plastic bags, were sealed and stored in refrigerator at 5°C. Nematodes were isolated from 300 ml soil sub-sample by sieving decantation and centrifugal sugar-flotation techniques (4). Isolated nematodes were killed and fixed in 70°C formalin-glycerin (F : G) 4~1 solution. To determine the degree of infection on roots, randomly selected 1-cm sections of roots were stained in hot acid fuschin-lactophenol and

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rinsed in water. After that, nematodes were counted at 60 magnifications.

Some specimens of each stage, immature and mature females, males and second stage larvae were dehydrated by Seinhort's glycerin rapid method (6) and mounted in anhydrous glycerin on glass slides for their microscopic study. The population of second stage larvae were counted under stereo-scopic binocular microscope at 60 magnifications.

## RESULTS AND DISCUSSION

High population of *Tylenchulus semipenetrans* was observed in soil and root samples collected from the rhizosphere of *Pyrola japonica* in Imsil, Chunbuk province. The individuals of second stage of 361~545 larvae were detected per 300 ml soil. The population of immature and mature females on infested plant roots was recorded as 2~5 per cm on feeder roots. The maximum number of nematodes was observed on apical portion of the roots; discoloration and necrosis of the piliferous root and hypodermal layer have been observed. Cohn (5) have also reported that maximum number of larvae enters surface layers of citrus seedling roots, when roots are 4~5 weeks old and few enters older than 9 weeks. The young females penetrate deeper and become established at a depth of several cortical cells. A "feeding site" around the head of the female is soon established. According to Vangundy & Kirkpatrick (10), this consists of 6~10 cortical cells, the so called "nurse cells". *T. semipenetrans* causes "slow decline" of citrus, the symptoms result in a general reduction in tree growth and vigour, yellowing and shedding of leaves and undersized fruits. Also, decline symptoms are more pronounced on uppermost part of the tree (7). Vineyards infested with this nematodes in Australia shows a general unthriftness which was reduced by fumigation (9). Typical symptoms of this nematode described above were visualized on several plants of *Pyrola japonica* in the present study. Necrosis of hypodermal layers of roots may be attributed to enzymatic hydrolysis of starch and proteins at feeding sites prevented by the inhibitors produced by the plants to counteract nematode enzymes.

Baines *et al.*, (1-3) have reported that citrus nematode had developed biotypes as large differences in infectivity of the *T. semipenetrans*, on 'Troyer' citrange (a hybrid of navel orange pollinated with *Poncirus trifoliata* Raf.) in orchards in California. Stokes (8) reported a "grass strain" parasitizing *Andropogon rhizomatus* but not 4 citrus root-

stock species. Another biotype of this nematode may exist in Israel as Cohn (5) observed that grape and olive free of the citrus nematode in Israel and considered their population to be different from those found in Australia or California. California Biotype-1 did not parasitize *Calodendrum capense* which was attacked in Israel. In the light of these variations in pathogenicity of citrus nematode, further investigations on identification of other hosts of *T. semipenetrans* and its biotypes in Korea is suggested.

## 요 약

약초와 관련된 식물 기생선충에 대한 연구 중 전북 임실군 산야에서 야생약초인 노루발(*Pyrola japonica*) 식물에서 현재까지 감귤을 위시하여 과수 및 관목식물에서만 발생되었던 감귤선충(*T. semipenetrans*)이 각각 다른 발육 형태로서 다소 높은 밀도로 식물의 뿌리에 기생하여 피해를 주고 있는 것이 발견되었다. 노루발약초의 뿌리에서 2령유충과 수컷, 성숙한 암컷과 미성숙된 암컷이 많이 검출되었다. *Tylenchulus semipenetrans*는 Tylenchida목, Criconematina아목, Tylenculoidea상과, Tylenchulidae과, Tylenchulinae아과에 속하는 절대기생성인 선충이다. 감귤선충(*T. semipenetrans*)은 전 세계적으로 감귤에 분포하고 있으며, 피해가 심한 편이다. 이 선충은 감귤 이외에도 수수꽃다리속, 고욤나무, 올리브, 포도, 배 등의 뿌리에 기생 피해를 주는 주요한 선충이다. 그러나 이번에는 약초에서 처음으로 본 선충이 기생하여 피해를 주는 것이 확인되어 교목이나 관목뿐만 아니라 초본성인 약초에도 기생하여 피해를 주는 것으로 확인되었으므로 금후에는 본 선충의 또 다른 기주와 병원성에 대해서 연구가 필요하다.

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