

Short Communication

A note on host diversity of *Criconema* spp.

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Key words: *Criconema*, host diversity, host range, Nematode

Nematode species of the genus *Criconema* (Tylenchida: Criconemidae) are widely distributed and parasitize many plant species from very primitive orders to advanced ones. They are migratory ectoparasites and feed on root tips or along more mature roots. Reports like Rathore and Ali (2014) and Rathore (2017) reveal that most nematode species prefer feeding on plants of certain taxonomic group (s). In the present study an attempt has been made to precisely trace the host plant affinity of twenty-five *Criconema* species feeding on diverse plant species. Host species of various *Criconema* species reported by Nemaplex (2018) and others in literature were aligned with families and orders following the modern system of classification, i.e., APG IV system (2016). According to this system, angiosperms are classified in different clades and clades into different orders and subsequently into different families. Affinity of each *Criconema* species with its host plants was numerically determined by calculating General Association Index (GAI), and for a group of species in a particular clade(s) by having Specific Association Index (SAI) following the system of Rathore and Tiwari (2016). The status of nematode species was further supported by the classification of Berneys and Chapman (1994).

Association and affinity of 25 *Criconema* species presented in Table 1 revealed that 35.35 % plants were preferred in Rosids followed by monocots (25.252 %) and Asterid (20.202 %). Though, Rosids and Asterids are different clades but both possess dicotyledonous plants. The combination of two clades proves that dicotyledons

showed preference over monocots. Superrosids and Superasterids were represented by a few host plants only. However, Magnoliids and Gymnosperms substantially contributed in the host range of this nematode species. Though Rosids revealed greater preference over Asterids, the percent host families and orders were similar in number as reflected by similar SAI values. The SAI value was slightly higher for monocots that indicate stronger affinity. The same was higher for gymnosperms (0.467) in comparison to Magnoliids (0.413) (Table 1).

Perusal of taxonomic position of host species in Table 2 revealed that 68 % of *Criconema* spp. were monophagous and strictly fed on one host species. Of these, 20 % from Magnoliids were monophagous (*C. acriculum*, *C. grassiator*, *C. karacsi*, *C. magnolia*, *C. petasum*); 20 % from Rosids (*C. demani*, *C. featherensis*, *C. mangiferae*, *C. parmistum*, *C. ravidum*); 12 % from Asterids (*C. annulifer*, *C. acanum*, *C. celetum*); 12 % from monocots (*C. paucianmulatum*, *C. quasiclemani*, *C. warrenense*) and 4 % from gymnosperms (*C. neoaxestis*). Twenty-eight percent *Criconema* spp. were polyphagous and one oligophagous. GAI was 1.0 for all monophagous and oligophagous species, whereas the same was less than 1 for polyphagous species. Rosids contributed in the host range of all the polyphagous *Criconema* spp., while the association of host plants from other clades was more or less 50 %.

Maximum numbers of *Criconema* spp. were harboured by host families like Lauraceae (5), Magnoliaceae (5) in Magnoliids; Poaceae (5) in monocots; Fagaceae (4) and Rosaceae (4) in Rosids and Pinaceae (3) in gymnosperms.

Table 1: Association of *Criconema* species to different host parameters

Taxonomic clades	Host species	Host genera	Host families	Host orders	SAI
Magnoliids	10 (10.101)	10 (10.753)	10 (14.705)	9 (15.789)	0.413
Monocots	25 (25.252)	25 (26.882)	14 (20.588)	11 (19.298)	0.54
Superrosids	1 (1.010)	1 (1.075)	1 (1.470)	1 (1.754)	1
Rosids	35 (35.353)	30 (32.258)	22 (32.353)	19 (33.334)	0.52
Superasterids	3 (3.050)	3 (3.226)	3 (4.412)	1 (1.754)	0.714
Asterids	20 (20.202)	19 (20.430)	13 (19.118)	11 (19.298)	0.512
Gymnosperms	5 (5.000)	5 (5.376)	5 (7.353)	5 (8.772)	0.467

Figures in parentheses are per cent values; SAI=Specific Association Index

Table 2: Taxonomic position of host plants of *Criconema* spp.

S. No.	<i>Criconemaspp.</i>	Host species	No. of hostspecies	GAI	Status
1	<i>C. acriculum</i>	Magnoliids: Lauraceae (1) <i>Umbellularia californica</i>	1	1	Monophagous
2	<i>C. annulifer</i>	Asterids: Aquifoliaceae (1) <i>Ilex aquifolium</i>	1	1	Monophagous
3	<i>C. acanum</i>	Asterids: Asteraceae (1) <i>Solidago</i> sp.	1	1	Monophagous
4	<i>C. arkaense</i>	Monocots-Poaceae (2) <i>Arrhenatherum</i> sp., <i>Paspalum</i> sp.;Rosids: Cannabaceae (1) <i>Celtis accidentalis</i> ,Sapindaceae (1) <i>Acer saccharum</i>	4	0.6	Polyphagous
5	<i>C. celetum</i>	Asterids: Gesneriaceae (1) <i>Saintpaulia</i> sp.	1	1	Monophagous
6	<i>C. crotaloides</i>	Magnoliids: Lauraceae (1) <i>Umbelluria californica</i> ; Rosids:Rosaceae (1) <i>Rubusparviflorus</i> ; Asterids: Ericaceae (1) <i>Arctostaphylos manzanita</i> ; Gymnosperms:Pinaceae (1) <i>Pseudotsuga menziesii</i>	4	0.5	Polyphagous
7	<i>C. demani</i>	Rosids: Betulaceae (1) <i>Betula papyrifera</i>	1	1	Monophagous
8	<i>C. featherensis</i>	Rosids: Vitaceae (1) <i>Vitis californica</i>	1	1	Monophagous
9	<i>C. giardi</i>	Magnoliids: Lauraceae (1) <i>Persea americana</i> , Magnoliaceae (1) <i>Magnolia grandiflora</i> ;Rosids: Moraceae (1) <i>Ficus carica</i> , Rosaceae (1) <i>Fragaria x ananassa</i>	4	0.6	Polyphagous
10	<i>C. grassator</i>	Magnoliids: Magnoliaceae (1) <i>Liriodendron tulipifera</i>	1	1	Monophagous
11	<i>C. kavacsi</i>	Magnoliids: Lauraceae (1) <i>Umbellularia californica</i>	1	1	Monophagous
12	<i>C. magnoliae</i>	Magnoliids: Magnoliaceae (1) <i>Magnolia grandiflora</i>	1	1	Monophagous
13	<i>C. mangiferum</i>	Rosids: Anacardiaceae (1) <i>Mangifera indica</i>	1	1	Monophagous
14	<i>C. mutabile</i>	Magnoliids:Lauraceae (1) <i>Persea americana</i> , Monocots: Araceae (1) <i>Philodendron</i> sp., Arecaceae (1) <i>Palmaceae</i> sp., Asparagaceae (1) <i>Yucca</i> sp., Bromeliaceae(2) <i>Billbergia</i> sp., <i>Bromeliaceae</i> sp.. Dioscoreaceae (1) <i>Dioscorea</i> sp., Musaceae (1) <i>Musa</i> sp., Poaceae (10) <i>Arrhenatherum</i> sp., <i>Avena sativa</i> , <i>Axonopus</i> sp., <i>Bambusa</i> sp., <i>Cynodon dactylon</i> , <i>Echinochloa</i> sp., <i>Hordeum vulgare</i> , <i>Sorghum bicolor</i> , <i>Zea mays</i> , <i>Zoysia</i> p.,Typhaceae (1) <i>Typha</i> sp., Zingiberaceae (1) <i>Zingiber</i> sp.,Superasterids: Amaranthaceae (1) <i>Beta vulgaris</i> ,Cactaceae (1) <i>Cactaceae</i> sp., Nyctaginaceae (1) <i>bougainvillea</i> sp.; Rosids: Fabaceae (3) <i>Medicago sativa</i> , <i>Trifolium repens</i> , <i>Vigna unguiculata</i> , Juglandaceae (2) <i>Juglanshendsii</i> , <i>Juglans</i> sp., Malvaceae (1) <i>Gossypium hirsutum</i> , Moraceae (1) <i>Morus</i> sp., Rosaceae (8) <i>Fragariachiloensis</i> , <i>Malus sylvestris</i> , <i>Prunus domestica</i> , <i>Prunus dulcis</i> , <i>Prunus persica</i> , <i>Pyracantha</i> sp., <i>Pyrus communis</i> , <i>Rosa</i> sp., Rutaceae (2) <i>Citrus sinensis</i> , <i>Citrus</i> sp., Sapindaceae (1) <i>Acer</i> sp.; Vitaceae (1) <i>Vitis vinifera</i> Superrosids: Altingiaceae (1) <i>Liquidamber</i> sp.;Asterids: Acanthaceae (1) <i>Acanthus</i> sp., Aquifoliaceae(1) <i>Ilex</i> sp., Araliaceae (1) <i>Aralis</i> sp., Asteraceae (5) <i>Arctiumlappa</i> , <i>Baccharis</i> sp., <i>Dahlia</i> sp. <i>Tagetes erecta</i> , <i>Tagetes</i> sp., Convolvulaceae (2) <i>Dicondra</i> sp., <i>Ipomoea batatas</i> , Ericaceae (1) <i>Rhododendron</i> sp., Oleaceae (2) <i>Ligustrum</i> sp., <i>Syringea</i> sp., Solanaceae (2) <i>Nicotiana</i> sp., <i>Solanum lycopersicum</i> , Theaceae (1) <i>Camellia</i> sp.Gymnosperms: Pinaceae (1) <i>Pinussp</i>	60	0.564	Polyphagous
15	<i>C. neoaxestis</i>	Gymnosperms: Pinaceae (1) <i>Cedus lebanii</i>			
16	<i>C. paucianmulatum</i>	Monocot: Poaceae (1) <i>Zea mays</i>	1	1	Monophagous
17	<i>C. permistum</i>	Rosids: Vitaceae (1) <i>Vitis vinifera</i>	1	1	Monophagous
18	<i>C. petasum</i>	Magnoliids: Magnoliaceae (1) <i>Liriodendron tulipifera</i>	1	1	Monophagous
19	<i>C. quasiclemane</i>	Monocot: Cyperaceae (1) <i>Scirpus americanus</i>	1	1	Monophagous
20	<i>C. ravidum</i>	Rosids: Fagaceae (1) <i>Quercus</i> sp.	1	1	Monophagous
21	<i>C. sphagni</i>	Magnoliids: Magnoliaceae (1) <i>Liriodendron</i>	1	1	Monophagous

		<i>tulipifera</i> ; Monocots: Poaceae (1) <i>Arrhenatherum</i> sp.; Rosids: Fagaceae (1) <i>Quercus</i> sp.	3	0.556	Polyphagous
22	<i>C. tribule</i>	Rosids: Fagaceae (2) <i>Fagus</i> sp., <i>Quercus</i> sp.	2	1	Oligophagus
23	<i>C. vishwanathum</i>	Rosids: Rosaceae (2) <i>Prunus domestica</i> , <i>Prunus persica</i> Gymnosperms: Cupressaceae (1) <i>Juniperus oxycedrus</i>	3	0.833	Polyphagous
24	<i>C. warrenense</i>	Monocots: Poaceae (1) <i>Paspalum</i> sp.	1	1	Monophagous
25	<i>C. zantene</i>	Rosids: Fagaceae (1) <i>Quercus</i> sp.; Gymnosperms: Podocarpaceae (1) <i>Podocarpus</i> sp.	2	0.667	Polyphagous

C. mutabile parasitized maximum number of host species (Table 3).

Though *Criconeuma* spp. parasitize many varieties of host species, nevertheless they tend to prefer woody plants. To examine this issue further, all the host families except gymnosperms were aligned according to the classification of Hutchinson (1973). He classified angiosperms into monocotyledons and dicotyledons. Hutchinson divided monocotyledons into calyciferae (calyx bearers-with distinct (usually green) calyx and corolla), corolliferae (calyx and corolla are more or less similar), and glumiflorae (perianth is much more reduced or represented by lodicules), whereas dicotyledons were partitioned into Lignosae (fundamentally woody plants) and Herbaceae (fundamentally herbaceous group of plants). *Criconeuma* spp. parasitized plants from 28 families (Magnoliids, Superrosids, Rosids, Superasterids, Asterids) and according to Hutchinson's classification 21 aligned with Lignosae and 7 with Herbaceae indicating greater preference towards woody plants (75 %). It will be worthwhile to mention that among monocotyledons 50 % families had plants from Corolliferae. Family Poaceae was most dominating family in monocotyledons. Since, *Criconeuma* spp. showed greater preference towards woody plants, it is suggested that cultivated crops prone to these nematode species should be grown away from forest areas.

ACKNOWLEDGMENTS

Author is grateful to Shri Akhilesh Rathore for help in retrieving the information.

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Received: December 5, 2019

Accepted: December 28, 2019