

Examination of the neoaplectanid species *feltiae* Filipjev *carpocapsae* Weiser and *bibionis* Bovien (Nematoda : Rhabditida)

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SUMMARY

Morphological and hybridization studies were conducted with the Stanuszek population of *Neoaplectana feltiae*, Kozodoi population of *N. feltiae*, the SN strain of *N. bibionis* and the All strain of *N. carpocapsae* in order to resolve present confusion concerning the use of these names. Type slides of *N. feltiae* Filipjev and *N. bibionis* Bovien were also examined. Results show that the Stanuszek population of *N. feltiae* is conspecific with *N. carpocapsae* and that the Kozodoi population of *N. feltiae* is conspecific with *N. bibionis*. The specific name *carpocapsae* is re-instated and *feltiae* replaces *bibionis* since the former name has priority.

RÉSUMÉ

Examen des Neoaplectanides des espèces feltiae Filipjev, carpocapsae Wieser et bibionis Bovien (Nematoda : Rhabditida)

En vue de résoudre la confusion actuelle dans l'usage des noms d'espèces de *Neoaplectana*, des observations morphologiques et des expériences d'hybridation ont été réalisées sur *N. feltiae* (population Stanuszek et pop. Kozodoi), *N. bibionis* (souche SN) et *N. carpocapsae* (souche All). Des lames types de *N. feltiae* Filipjev et *N. bibionis* Bovien ont été également examinées. Il en résulte que la pop. Stanuszek de *N. feltiae* est conspécifique à *N. carpocapsae* et que la population Kozodoi de *N. feltiae* est conspécifique à *N. bibionis*. Le nom d'espèce *carpocapsae* est revalidé et celui de *feltiae* remplace *bibionis* auquel il est antérieur.

The genus of insect-parasitic rhabditids, *Neoaplectana*, was erected by Steiner (1929) to accommodate the species *glaseri*. Since then, other species have been described and a review of these species has been presented by Poinar (1979, 1986). These include *N. feltiae* Filipjev, 1934, *N. bibionis*, Bovien, 1937 and *N. carpocapsae* Weiser, 1955. Stanuszek (1970) isolated what he determined to be *N. feltiae* from caterpillars of the subfamily Agrotinae. He subsequently hybridized this *N. feltiae* isolate with the DD-136 strain of *N. carpocapsae* and synonymized the latter under the former taxon (1974 a, b). This synonymy was accepted by Wouts *et al.* (1982) who also listed *Neoaplectana* as a junior synonym of *Steinernema*. Poinar (1984) discussed these actions and indicated some discrepancies which required attention before these changes could be accepted. The present study is an attempt to resolve the *feltiae-bibionis-carpocapsae* question with hybridization and morphological studies.

Materials and methods

V. Veremtchuk (Plant Protection Institute, Leningrad) provided a paratype slide (Plant Protection Insti-

tute No. 23583) of two females of *N. feltiae*. The specimens had been determined by I. N. Filipjev in 1932 from the type host, *Agrotis* (= *Feltia*) *segetum* Schif. V. Veremtchuk also provided two other slides, one with a male (Plant Protection Institute No. 299) and the other with a female (Plant Protection Institute No. 328) of nematodes collected in the Soviet Union and determined by her as the *N. feltiae* of Filipjev. K. Lindhart (Danish Agricultural Institute in Copenhagen) provided the type slides of *N. bibionis* Bovien. All the above slides are now in the present author's collection.

Living *N. feltiae* were received from S. Stanuszek (Agricultural Institute, Warsaw) in 1976. Living *N. feltiae* were received from E. M. Kozodoi (Helminthology Laboratory, Moscow) in 1986. Both nematode determinations were made by the sender. Populations of living *N. bibionis* (SN strain) were isolated from soil in France by C. Scotto la Massese (INRA, Antibes) in 1978. Population of *N. carpocapsae* (All strain) originated from J. N. All in 1977. *N. bibionis* (SN) and *N. carpocapsae* (All) determinations were made by the present author based on the published descriptions of these species (Bovien, 1937; Weiser, 1955). All nematode populations were maintained on larvae of *Galleria mellonella* (L.) and

for morphological studies, all nematodes were heat killed (60°), fixed in TAF and processed to glycerin.

Hybridization studies were performed using the hanging insect blood drop method (Poinar, 1966). Twenty crosses (ten males and ten females of one population with equal numbers of the opposite sex of the other population in paired matings) were established for each pairing listed in Table 1.

Table 1

Results of hybridization experiments with *Neoaplectana feltiae* (Kozodoi and Stanuszek populations), *N. bibionis* and *N. carpocapsae*.

	<i>N. feltiae</i> (ex Kozodoi)	<i>N. bibionis</i> (SN)	<i>N. feltiae</i> (ex Stanuszek)	<i>N. carpocapsae</i> (All)
<i>N. feltiae</i> (ex Kozodoi)	+	+	-	-
<i>N. bibionis</i> (SN)	+	+	-	-
<i>N. feltiae</i> (ex Stanuszek)	-	-	+	+
<i>N. carpocapsae</i> (All)	-	-	+	+

+ = fertile hybrids formed (using individual males and females of one *Neoaplectana* population with the opposite sex of the other population).

- = no egg development.

Results

MORPHOLOGICAL STUDIES

An examination of the paratype slide of *N. feltiae* Filipjev and slide Nos. 299 and 328 provided by Veremtchuk and *N. feltiae* received from Kozodoi showed that they all belonged to the same species which agreed with Filipjev's (1934) published description of *N. feltiae*. Living *N. feltiae* populations received from Stanuszek were identical to the All strain of *N. carpocapsae*. The type slides of *N. bibionis* provided by Lindhardt and the SN strain of *N. bibionis* were conspecific with *N. feltiae* from Veremtchuk and Kozodoi.

HYBRIDIZATION STUDIES

Hybridization studies showed that *N. feltiae* from Stanuszek did not mate with *N. bibionis* or *N. feltiae* from Kozodoi, but did hybridize with *N. carpocapsae* (Tab. 1). However, *N. feltiae* from Kozodoi did cross with *N. bibionis* and produced fertile F₁ populations.

Discussion

In his 1934 description, Filipjev presented several characters which were not consistent with the later

descriptions of *N. feltiae* presented by Stanuszek (1974 a, b). Although Filipjev did not discuss infective juveniles in his paper, he reported three size categories of juveniles in the body cavity of females, 390-400 µm, 520-690 µm and 750-870 µm. The largest size group undoubtedly represented infective and preinfective juveniles. The infective juveniles of *N. feltiae* originally collected by Stanuszek (1970) ranged from 485-700 µm. However, in later studies of *N. feltiae*, Stanuszek (1974 a, b), described infective juveniles of 465-631 µm in length which are in the range of *N. carpocapsae*.

A second character of *N. feltiae* illustrated by Filipjev (1934) was the shape of the spicules which have an indistinct capitulum and lack a ventral arch. Although Stanuszek illustrated some variation within his population of *feltiae*, a distinct capitulum and ventral arch were always present. These characters are typical of *N. carpocapsae*. In his description of *N. feltiae*, Filipjev (1934) illustrated a male tail filament which measured 13 µm in length. In Stanuszek's (1974 a, b) populations, it is only 4 µm long. Again such a short filament is characteristic of *N. carpocapsae*. Filipjev (1934) also cited the distance from the head to the excretory pore as 180 µm in the female and 120 µm in the male. This mid-pharyngeal position of the excretory pore is also a characteristic of *N. bibionis*. In Stanuszek's (1974 a, b) descriptions, the distance from the head to excretory pore is given as 92-170 µm in the female and 50-100 µm in the male. This more anterior location of the excretory pore is characteristic of *N. carpocapsae*.

Stanuszek (1970) concluded that the population he isolated from Agrotinae caterpillars was *N. feltiae* on the basis of host similarity since the original *N. feltiae* was described from a caterpillar of *Agrotis segetum* (Filipjev, 1934). The potentially wide host range of neoaplectanids excludes the use of hosts to identify specific nematodes.

Conclusions

The results of the morphological and hybridization studies lead to the following conclusions. *N. feltiae* from Stanuszek differs morphologically from *N. feltiae* from Filipjev and Veremtchuk and differs morphologically and biologically from *N. feltiae* from Kozodoi. However, it is morphologically similar to *N. carpocapsae* and will hybridize with this species. Therefore *N. feltiae* of Stanuszek is a population of *N. carpocapsae*. The *N. feltiae* of Veremtchuk and Kozodoi agree morphologically with the original description of *N. feltiae* (Filipjev, 1934) and thus, represent the valid *N. feltiae*. On the basis of morphology and hybridization, *N. feltiae* and *N. bibionis* are conspecific and according to the law of priority in the Rules of Zoological Nomenclature, *bibionis* is a junior synonym of *feltiae*.

The results of the present investigation confirm, in part, the recent findings of Kozodoi, Voronov and

Spiridonov (1987) who, on the basis of hybridization, morphology and electrophoresis concluded that *N. feltiae* Filipjev and *N. bibionis* Bovien were conspecific.

Bovien (1937) described *N. bibionis* three years after Filipjev (1934) described *N. feltiae*, and never saw the latter description. Bovien (1937) stated that "Filipjev mentions the occurrence of a nematode belonging to *Neoaplectana* in a cutworm. As far as I know the species has not, however, been described or identified by the author. In his book Filipjev calls this species *Neoaplectana feltiae*, but does not give any diagnosis or figures of the nematode."

The following names should be considered as valid species in the genus *Neoaplectana* (synonyms are enclosed in parentheses): *N. carpocapsae* Weiser (*N. feltiae* Filipjev forma Stanuszek); *N. feltiae* Filipjev forma Filipjev (*N. bibionis* Bovien).

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