

New Types of the Genus *Neoactinomyxum* Granata, 1922 (Actinosporea) from the Oligochaete Host *Tubifex tubifex* (Müller)

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Abstract: The actinosporean infection of the oligochaete fauna living in the mud of a fish farm located in northern, Egypt was studied. Three types of actinospores were isolated from the oligochaete which could be classified as *Neoactinomyxum*. The drawings depicting the actinospore types are presented on a plate and their characteristic dimensions summarized in a table. By comparison with previous described ones, this can be explained by the novelty of the present three forms. As well as, this study represents a new evidence supports the global dispersal of the genus *Neoactinomyxum*.

Key words: Actinosporea % *Neoactinomyxum* % Types % Fish farm % Oligochaete % Egypt

INTRODUCTION

Actinosporea was included in the Myxozoa group as an independent class of the Myxosporea [1]. Genera and species of actinosporeans should be named of even when no myxosporean stage is known [2]. The latter authors encouraged future workers to name and clearly describe new actinosporeans in accordance with the international Code of Zoological Nomenclature.

Revised key to the genus *Neoactinomyxum* within the family Sphaeroactinomyxidae by [3] that pansporoblasts contain 8 developing spores while Tetraspora, reflects the development of the spores in groups of four, valve cell processes appear as swellings, polar capsules extrude at the pole. On basis of morphology, actinosporean types were classified in 12 genera of the Actinosporea among them *Neoactinomyxum* Granata, 1922 [4]. Also, the latter authors reported that most actinosporean develop in an annelid host in pansporocyst within gut epithelium, the maturity stages usually having spore body, three polar capsules and characteristic caudal process a sporoplasm with secondary cells and some other distinct characteristics according to each group.

Many investigators described several species and types of *Neoactinomyxum* e.g. [1,5-13].

As reported by [12] that the international Code of Zoological Nomenclature should be applied to newly described actinosporeans, so as types with numbers [2,7]. So far, almost zooactinosporean types are known

[4] but there have yet been relatively few studies on the actinosporean fauna such as [1,4,10,14]. Thus the present study describes new types of *Neoactinomyxum* as well besides, it may be considered a first record of such genus in Egypt.

MATERIALS AND METHODS

Obviously, oligochaete specimens of *Branchiura sowerbyi* (Beddard), *Limnodrilus* sp. and *Tubifex tubifex* (Müller) were collected from El-Serow experimental fish farm. Such farm locates in northern Egypt that cultured with different fishes such as tilapias, carps, catfishes, etc.

The oligochaete specimens were collected during summer, transferred to glass aquarium and then examined in certain times over several months. Fresh isolated specimens and droplets of water were checked by light microscopy. The pansporocysts and released spores were photographed and schematically illustrated. Measurements of spores were given as about mean in micrometers. The comparison of these types was undertaken with the previous actinosporean species and types.

RESULTS

Three types of *Neoactinomyxum* were isolated from the oligochaete *Tubifex tubifex* from fish farm ponds.

Table 1: A comparison of main characteristic data of *Neoactinomyxum* (N) released by oligochaetes of those previous available described species and types and those found in the present study (Measurements were in μm). T: *Tubifex*, L: *Limnodrillus*, B: *Branchiura sworbyi*

<i>Neoactinomyxum</i> type (species)	Oligochaete host	Spore body dimensions	Polar capsule dimensions (length x width)	Caudal process dimensions (length x width)	Span between two caudal processes
<i>N. eiseniellae</i>					
(Ormiérez & Frézil, 1969)					
Marques & Ormiérez 1982	<i>T. tubifex</i>	6-8	-	11-14	-
<i>N. globosum</i>					
Granata, 1922 (Marques, 1984)	<i>L. udekemianus</i>	10-12	1-2	12-16	-
<i>N.</i> type 3 El-Mansy et al., 1998	<i>B. sworbyi</i> Water	22	2.8×2.3	8.5×16.0	20.2
<i>N.</i> type 4 El-Mansy et al., 1998	<i>B. sworbyi</i> Water	22.3	3.7×2.8	7.0×16.0	29.0
<i>N.</i> type 7 El-Mansy et al., 1998	Water	18.9	2.8×2.5	24.4×9.5	58.4
<i>N.</i> sp. Xio & Desser 1998	<i>L. hoffmeisteri</i>	12.0×10.0	3.0×2.0	24.0×23.0	-
<i>N.</i> type Molnár et al., 1999	<i>B. sworbyi</i>	25-28	2.5×0.5	9.0×15.1	-
<i>N.</i> type Negrodo & Mulcahy 2001	<i>L. variegatus</i>	15.6×12.9	3.8×2.7	18.1×25.6	-
<i>N.</i> type Özer et al., 2002	<i>T. tubifex</i>	17.6 (12-20)	-	29.1×18.8	-
<i>N.</i> type 1 (Present study)	<i>T. tubifex</i>	25.8×20.0	2.1×1.3	18.2×4.7	27.9
<i>N.</i> type 2 (Present study)	<i>T. tubifex</i>	27.9×23.7	3.0×2.6	22.1×6.7	32.1
<i>N.</i> type 3 (Present study)	<i>T. tubifex</i>	22.1×22.1	2.4×2.1	20.9×5.1	28.9

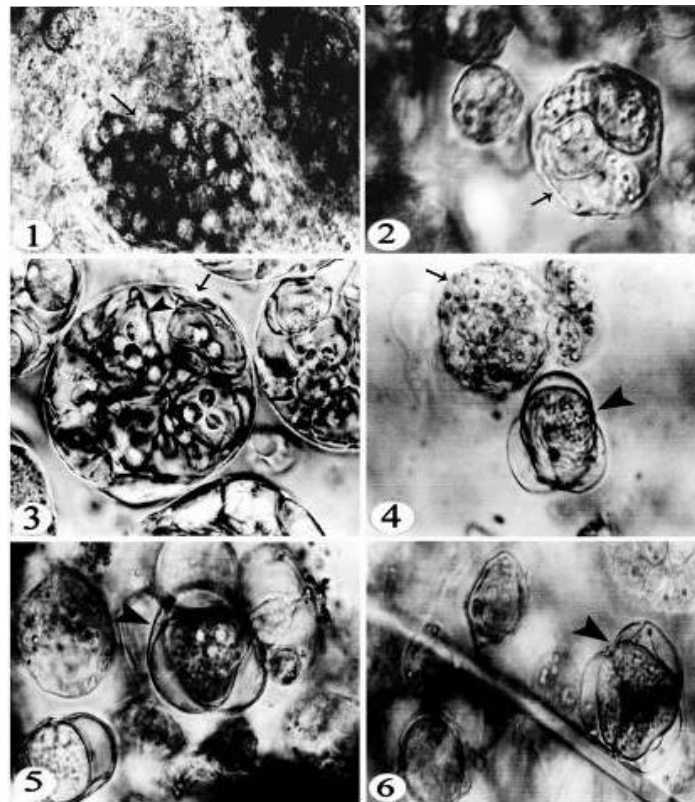


Fig. 1: Fresh squashed preparation of the oligochaete specimen showing early stage of pansporocyst (arrow) of *Neoactinomyxum* embedded in gut epithelium of the host, x1500.

Fig. 2: Fresh preparation showing stage of pansporocyst (arrow) of *Neoactinomyxum*, x1500.

Fig. 3: Mature pansporocyst (arrow) contains about eight spores (arrowhead). Note three polar capsules of the parasite, x1500.

Fig. 4: Fresh released spore of *Neoactinomyxum* type 1 (arrowhead) with discernible polar capsules, x1500.

Fig. 5: *Neoactinomyxum* type 2 (arrowhead) in apical view. Note spore body contains sporoplasm, three polar capsules and caudal processes, x1500.

Fig. 6: *Neoactinomyxum* type 3 (arrowhead) in apical view. Note spore morphology, x1500.

Collective group *Neoactinomyxum* Granata, 1922: Spores disc-like or triangular in apical view with three caudal process [12] three polar capsules extruded at the pole [3]. Described species and types have been mentioned in Table 1.

Light Microscopy: Neoactinospores containing different stages of pansporocysts (Figs. 1 to 3) most of contains 8 developing spores pansporocysts showing advanced spore formation could be recognized during live worms that examined microscopically with gentle passed down under a cover slip (Figs. 1 to 6). The main measurements of the *Neoactinomyxum* types found are presented in Table 1.

Description and measurements of the detected *Neoactinomyxum* forms *Neoactinomyxum* type 1 (Figs. 4, 7A).

The spore characterized by round spore body, three transparent flattened foliage-like shape caudal process of approximately equal size encircled the spore body of the spore in apical view. Caudal processes measured about 18.2 μm long and 4.7 μm wide. The spore body is disc-shaped and measured about 25.8 \times 20.0 μm in diameter. Uncounted small germ cells somewhat filled the sporoplasmic mass. At the top of the spore, three small polar

capsules were unclearly distinguished measured about 2.1 \times 1.3 μm in size. Pansporocysts was detected in fresh prepared specimen found with this type that is round and seems contain eight of early developing spores.

Description of *Neoactinomyxum* type 2 (Figs. 5, 7B):

Individual spores of this type with ovoid spore body in apical position has three small polar capsules and three as a unit of approximately equal sized caudal processes. Spore body 27.9 \times 23.7 μm in diameter. A minute round granule noticed within sporoplasmic mass. Three wall polar capsules measured about 3.0 \times 2.6 in diameter. Caudal process is transparent and connected with spore body in angles like position measured about 22.1 \times 6.7 μm in size.

Description of *Neoactinomyxum* type 3 (Figs. 6, 7C):

Mature spores composed of 3 round processes of approximately equal size, caudal processes bases enclosed epispore body measuring about 20.9 \times 5.1 μm in diameter. Spore body which measured about 22.1 \times 22.1 μm is disc-shaped in apical view contains minute granules probable are germ cells in sporoblast mass. There small encircled polar capsule in apical view measured about 2.4 \times 2.1 μm in diameter, the spore connected by suture like-shape divided the spore to have three valves.

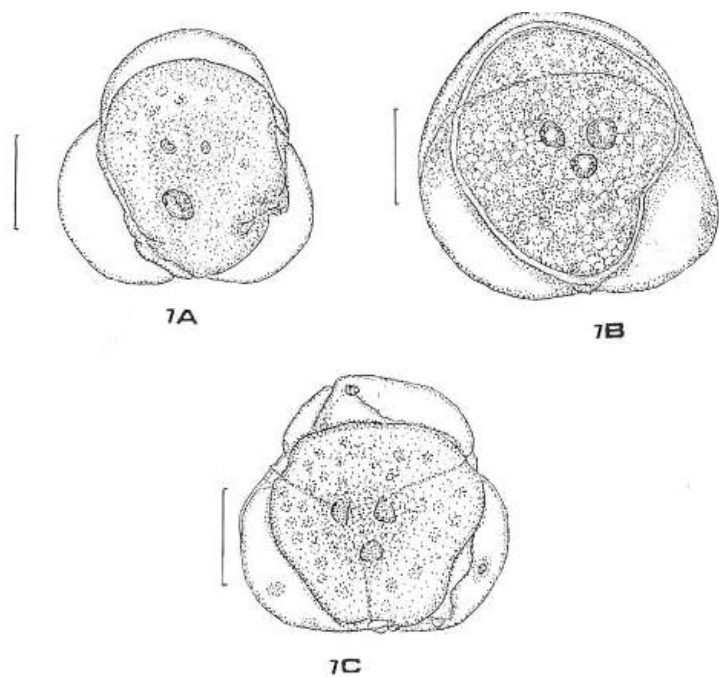


Fig. 7A: Line drawing of spore of *Neoactinomyxum* type 1. Scale bar-10 μm .
 Fig. 7B: Line drawing of spore of *Neoactinomyxum* type 2. Scale bar-10 μm .
 Fig. 7C: Line drawing of spore of *Neoactinomyxum* type 3. Scale bar-10 μm .

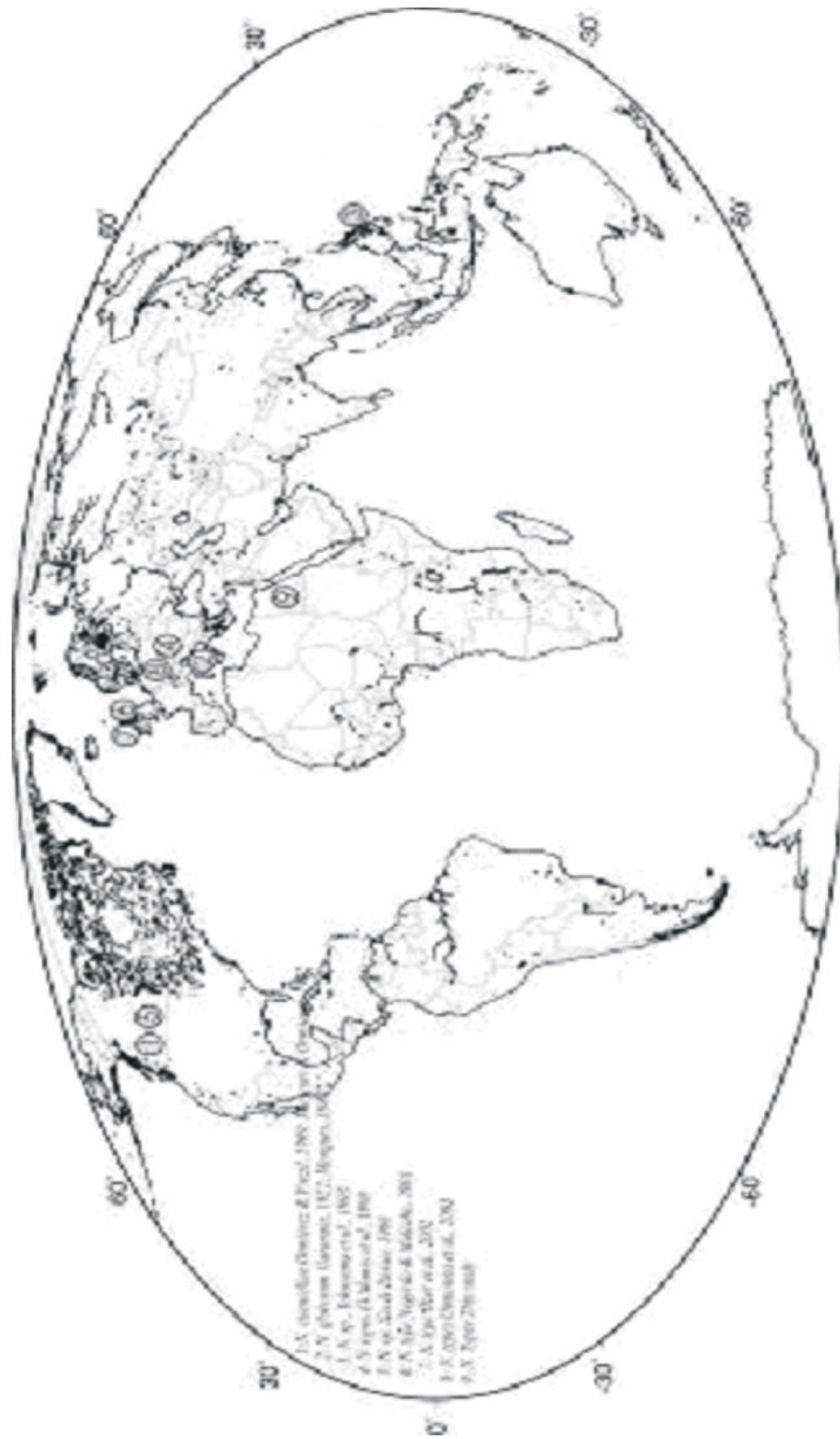


Fig. 8: Global spatial distribution pattern of the genus *Neoaetinoxum* Granata, 1922 (in available literature) released from aquatic oligochaete hosts as one of biological fauna seems to be considered as a cosmopolitan taxon may share in attribution of dispersal phenomena of biotic fauna

Taxonomic summary

Type host: *Tubifex tubifex* (Müller)
Type locality: El-Serow experimental fish farm, Egypt
Site of infection: Intestinal epithelia
Etymology: *Neoactinomyxum* types 1, 2, 3
Phototypes: In the collection of the author

Remarks on the present types: The form of first type resembles *Neoactinomyxum* type 4 [9] from water, *Branchiura sowerbyi* in shape and somewhat size and differs from those other previous described (Table 1) in shape and size and with minor similarity in shape to *Neoactinomyxum* sp. that reported by [8].

The form of *Neoactinomyxum* type 2 near to *N.* types 3, 7 from water and *Branchiura sowerbyi* [9] and somewhat to *N. eiseniellae* [5] but much different from second type in size of spore body and caudal process and type 7 and near in size to type 3 but still different.

Neoactinomyxum type 3 body is nearly similar to *N.* spore of *Sphaerospora renicola* [11] from *Branchiura sowerbyi* in shape and size but wide different from other types in Table 1 and with minor similarity to *Neoactinomyxum globosum* Granata, 1922 [6] from *L. udekemianus* with small spore body as well similar to *N. eiseniellae* [5] but differ in polar capsule, general shape and widely different from others reported in Table 1.

DISCUSSION

It seems that the genus *Neoactinomyxum* is isolated from oligochaetes in different localities and environments. In present study, three types of *Neoactinomyxum* were recorded from a fish farm. Fish species bred at this farm has previous detected myxosporeans [15].

In recent years, several authors have been studied actinosporean infection of oligochaetes. On basis of morphological and morphometric characteristics, actinosporeans is currently identified [1]. The genus *Neoactinomyxum* established by Granata, 1992, consists of three species [6] that some mentioned in Table 1. Herein the three *Neoactinomyxum* types seem different from those previously described by [16], [6] and [8]. Therefore, the present *Neoactinomyxum* types are different from known neoactinosporean types and species in shape and size thus they may be considered as novel types.

It is obvious that the *Neoactinomyxum* types are considered as cosmopolitan fauna. Its dispersion may be attributed by several occasions among them the

polychaete are ancestral to the oligochaete or they may both be derived from a common aquatic ancestor [17]. This study represents a new evidence supports the worldwide distribution of such fauna (Fig. 8).

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