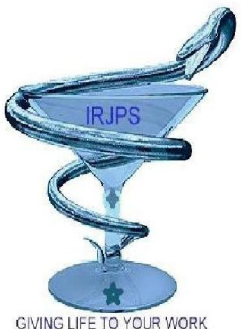
ORIGINAL RESEARCH



AN INVESTIGATION OF FUNGAL DISEASES ON OIL YIELDING SEEDS FROM AKOLA (MS, INDIA)

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ABSTRACT:

Seed is basically living tissue which is affected directly by seed moisture content and temperature for maintenance of viability of seed in storages. Seed borne fungi are not only important for their effect on germination and subsequently in causing field diseases but also for their effects on oil quantity and quality. India is one of the major oil seed grower and importer of edible oils. Its vegetable oil economy is world's forth largest after USA, China & Brazil. Many Deuteromycotian members such as *Alternaria, Fusarium*, *Curvularia* attack on oil yielding seeds which caucuses severe diseases to seeds. Losses to the tune of 20% in certain oil seed crops need our almost attention. Akola is a district in Vidarbha region in the state of Maharashtra in Central India. The studies on fungal diseases on oil yielding seeds of Akola region have remained untouched so far. Present study will focus on the fungal diseases of some oil yielding seeds from Akola.

KEY WORDS: Oil yielding seeds borne fungi, Deuteromycotian fungi.

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INTRODUCTION:

Oil is used for the food, fuel, lubrication and the manufacture of paints, plastics and other materials. Specially prepared oils are used in some religious ceremonies as purifying agents[2]. Oils may be animal, vegetable or petrochemical in origin and may be volatile or non-volatile. Plant oils or vegetable oils are derived from plant sources[12]. Essential oils are produced by the some plant in the leaves, flower, wood, bark, fruits, roots and in the seeds. Pressed vegetable oils are extracted from plant containing the oil usually the seed[11]. During the past few years fungal pathogen in oil seed have been recognized as major cause for economic losses, with the identification of certain important once based on their symptoms, etiology and also ecological zones[4]. The losses to tune of 20% in certain oil seed crops need our all most attention.[1] Many Deuteromycetian members such as *Alternaria, Fusarium*, *Curvularia* attack on oil yielding seeds which causes severe diseases to seeds[10].

Akola district in Vidarbha region in the state of Maharashtra, Akola is located at latitude 20-7° North longitude 77.07° the East. It is at an attitude of 925 ft (282 m) above sea level. It has a tropical savanna climate. Annual temperature range from a high of 48°C (118° F) to a low of 10°C (50° F).

Many oil yielding seeds such as cotton, soybean, sunflower, peanut etc. depends on the monsoon. Oil and Dal mills are becoming rampant in this region because of the crops taken. But from the last few years due to changes in the environment there are rapid changes in the gross cropped area[3]. One of the important reasons is fungal attack on the oil yielding seeds. A large number of fungal pathogen is transmitted through the seed and vegetative propagating parts[5,6]. This study will focus on the fungal diseases of some oil yielding seeds from Akola.

MATERIAL AND METHOD:

Extensive survey of diseases caused to the oil yielding seeds in Akola region was carried out from October 2014 to March 2015 and samples were taken from different localities. More than 12 infected oil yielding seeds of the plants were collected. The diseased seeds were collected separately in polythene bags and symptoms on different host were recorded. Completely rotten seeds were avoided for isolations as they contained mostly secondary infection. Collection was made in different seasons.

These seeds were first wash with distilled water and then with 90% alcohol. They were transfer aseptically to petri-plates containing Asthana and Hawkar's medium 'A' (5 g glucose, 3.5 g KNO_3, 1.75g KH_2PO_4, 0.75 g $MgSO_4$, $7H_2O$ and 15 g of agar agar).The petriplates were completely sterilized to avoid the secondary and bacterial infection. Inoculation was carried out in sterilized inoculation chamber at the temperature 27°C (± 2°C). After 2 or 3 days of inoculation the mycelium coming out of the disease tissue were picked up and transferred to another fresh plates. Morphological and cultural characters of the organisms were carefully recorded. Identification of isolates was made from stock cultures present in Mycological laboratory of the Shri Shivaji College Akola which were previously identified from Dr. P.D.K.V. Akola, and also from book "Illustrated Genera of Imperfect of Fungi" [4].

RESULTS AND DISCUSSION:

Seed infection by fungi may arise in various ways such as by floral infection, systemic invasion through the vascular system of the plant of the seed, direct penetration through pods or other fruits and invasion of the seed during storage and harvesting.

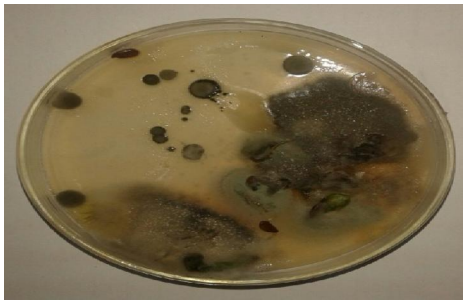
Taxonomical Study of the Isolates:

1. *Curvularia lunata* (Wakker) Boedijn:

Collected from seeds of *Brassica ropa* L. (Brassicaceae) from Shelu Bazar; November, 2014.

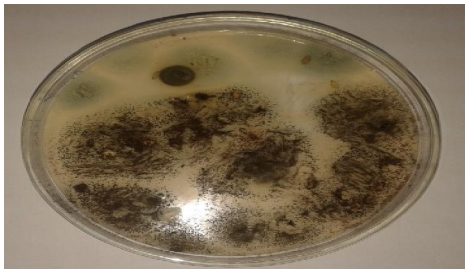
Plate No. I

A) Infected seeds of *Linum usitatissimum* L.



B) Petriplate culture showing fungal colonies caused by infected seeds of *Linum usitatissimum* L.

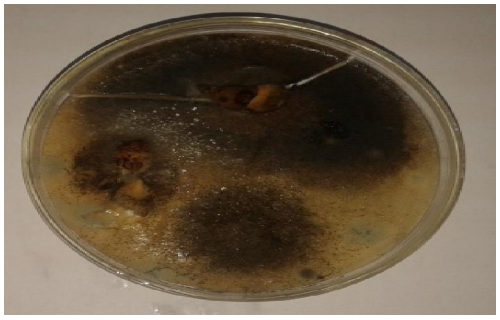
C) Infected seeds of *Sesamum indicum* L



D) Petriplate culture showing fungal colonies caused by infected seeds of *Sesamum indicum*

Plate No. II

A) Infected seeds of *Arachis hypogaea* L.



B) Petriplate culture showing fungal colonies caused by infected seeds of *Arachis hypogaea* L.

C) Infected seeds of *Brassica rapa* L.

D) Petriplate culture showing fungal colonies caused by infected seeds of *Brassica rapa* L.

Plate No. III

A) Infected seeds of *Glycine max* (L) Merr.

B) Petriplate culture showing fungal colonies caused by infected seeds of *Glycine max* (L) Merr.

C) Infected seeds of *Gossypium herbaceum* L.

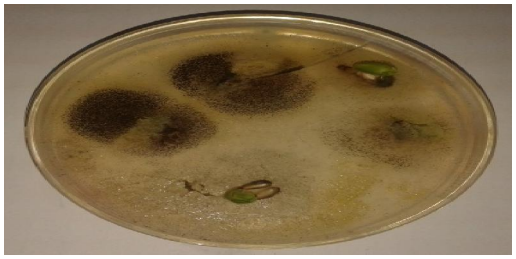
D) Petriplate culture showing fungal colonies caused by infected seeds of *Gossypium herbaceum* L.

Plate No. IV

A) Infected seeds of *Helianthus annuus* L.

B) Petriplate culture showing fungal colonies caused by infected seeds of *Helianthus annuus* L.

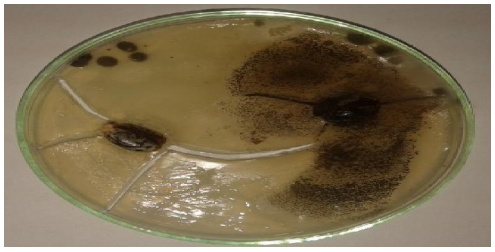
C) Infected seeds of *Carthamus tinctorius* L



D) Petriplate culture showing fungal colonies caused by infected seeds of *Carthamus tinctorius* L

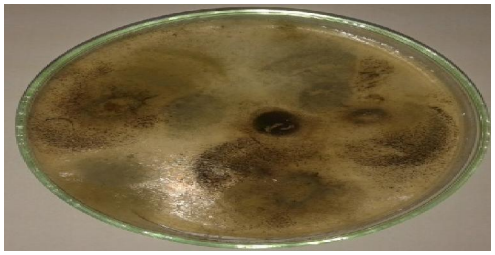
Plate No. V

A) Infected seeds of *Ricinus communis* L.



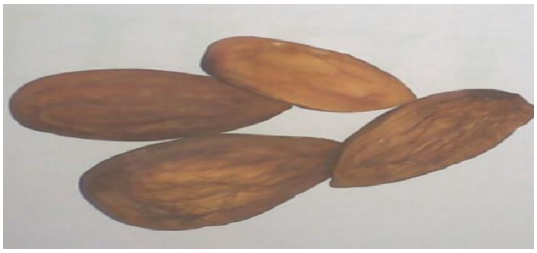
B) Petriplate culture showing fungal colonies caused by infected seeds of *Ricinus communis* L.

C) Infected seeds of *Buchanania lanzan* Spreng

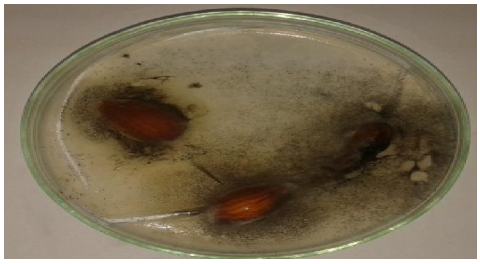


D) Petriplate culture showing fungal colonies caused by infected seeds of *Buchanania lanzan* Spreng

Plate No. VI

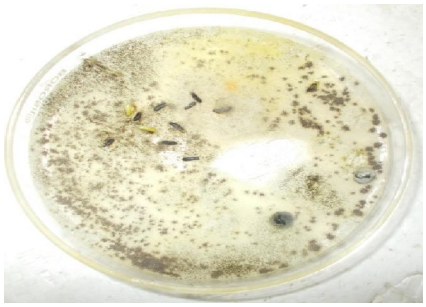


A) Infected seeds of *Terminalia catappa* L.



B) Petriplate culture showing fungal colonies caused by infected seeds of *Terminalia catappa* L.

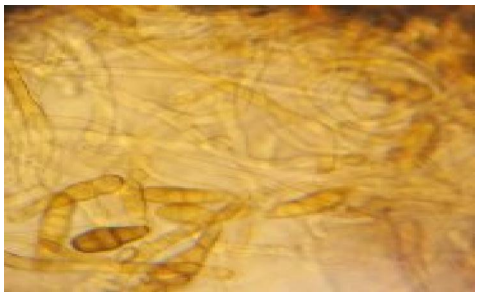
C) Infected seeds of *Guizotia abyssinica* (Lf.) Cass.



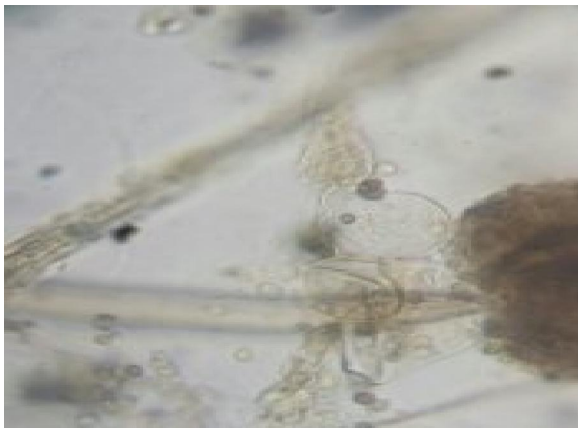
D) Petriplate culture showing fungal colonies caused by infected seeds of *Guizotia abyssinica* (Lf.) Cass.

Plate No. VII

A) Photomicrograph of Alterneria sp.



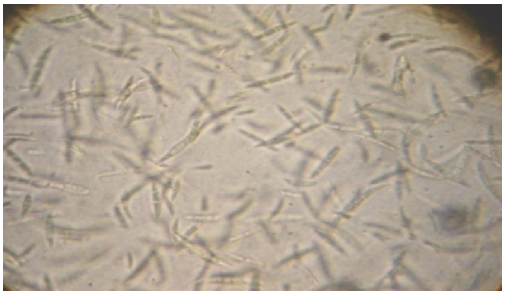
B) Photomicrograph of *Curvularia* lunata.



C) Photomicrograph of *Aspergillus niger*

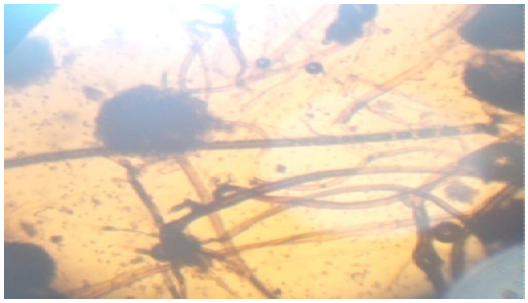
Plate No. VIII

A) Photomicrograph of *Mucor* sp.

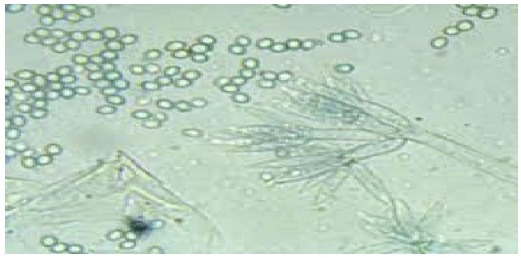


B) Photomicrograph of Conodia of Fusarium equiseti

C) Photomicrograph of *Cercospora sp.*



D) Photomicrograph of *Rhizopus sp*.



E) Photomocrograph of *Penicillin spp.*

Morphology of the Isolate:

In culture, the fungus appeared dark black. Mycelium composed of branched, septate, subhyaline to light brown hyphae; conidiophores erect, slightly bend, dark brown, unbranched, septate geniculate towards apex. Conidia produced acrogenously at the tip of conidiophores and on its successive growing points; conidia boat shaped, brown 3 septate; the third cell from the base conspicuously larger, broader and darker than the other cells; other cells slightly curved. subhyaline with rounded apical cell and subhyaline, somewhat obconical basal cell which bears a scar indicating point of attachment to the conidiophores.(Plate VII-B)

2. *Alternaria alternata* (Fr.) C. Keissler:

Collected from *Brassica rapa* L. (Brassicaceae) from Shelu Bazar, November, 2014.*Carthamus tinctorius* L. (Asteraceae) from Akola, April, 2015; *Helianthus annuus* L. (Asteraceae) from Akola, March 2015, *Buchanania lanzan* Spreng (Anacardiaceae) from Akola, February, 2015.

Morphology of Isolate:

Colonies usually black, hyphae dark brown, branched, conidiophores arising singly or in small groups, branched, flexuous, geniculate, pale to olivaceous or golden brown, smooth, thick with one or several conidial scars. Conidia formed in branched chain, obclavate, obpyriform, ovoid or ellipsoidal often with a short conical or cylindrical beak pale to mid golden brown, smooth or verruculose, with upto 8 transverse and usually several longitudinal or oblique septa (Plate VII-A).

3. *Fusarium equiseti* (Corda) Sacc :

The fungus was collected from *Glycine max* (L) Merr (Fabaceae) from Shelu Bazar, December, 2014, *Gossypium herbaceum* L. (Malvaceae) from Shelu Bazar, February, 2015, *Ricinus communis* L. (Euphorbiaceae) from Akola, February, 2015.

Morphology of Isolate:

Mycelium pale to dark brown, branched, septate, conidiophores simple, short branched, bearing a whorl phialides; conidia hyaline, variable and of two kinds in moist heads; macroconidia 5 to 6 celled; microconidia one celled, ovoid or oblong born singly on conidiophores; intermediate conidia 2 to 3 celled oblong or slightly curved (Plate VIII-B).

4. *Penicillium oxalicum* Currie & Thom :

Collected from *Sesamum indicum* L. (Pedaliaceae) from Akola, January, 2015.

Morphology of the Isolate :

Colonies broadly spreading velvety, heavily sporulating, forming conidia in chains. Mycelium submerged, septate, penicillia bivrticillate and asymmetrical borne on smooth walled conidiophores. Metulae forming chains which are broad; phialides borne in terminal clusters, conidia globular, elliptical, smooth (Plate IX-B).

5. *Aspergillus niger* V. Tiegh :

Recovered from *Linum usitatissimum* L. (Linaceae) from Shelu Bazar, January, 2015, *Sesamum indicum* L. (Pedaliaceae) from Kirana Market, Akola, January, 2015; *Brassica rapa* L. (Brassicaceae) from Shelu Bazar, November, 2014, *Gossypium herbaceum* L. (Malvaceae) from Shelu Bazar, February, 2015. *Carthamus tinctorius* L. (Asteraceae) from Akola, April 2015, *Helianthus annuus* L. (Asteracveae) from Shelu Bazar, March, 2015, *Buchanana lanzan* Spreng (Anacardiaceae) from Akola, February 2015, *Guizotia abyssinica* (Lf) Cass (Asteraceae) from Shelu Bazar, April 2015.

Morphology of Isolate :

Colonies white initially but soon turning black due to production of conidia. Hyphae hyaline, branched septate: Conidiophores unbranched, septate, hyaline, terminating in

globose vesicles, sterigmata flask-shaped, producing conidia in acropetal succession in chains. Conidia globose, one celled, verrucose, dark brown to greyish black (Plate VII-C).

6. *Mucor* sp. Fresen :

Collected from *Linum usitatissimum* L. (Linaceae) from Shelu Bazar, January 2015, *Sesamum indicum* L. (Pedaliaceae) from Akola, January, 2015, *Arachis hypogaea* L. (Fabaceae) from Akola, January 2015, Brassicarapa L. (Brassicaceae) Shelu Bazar, Novembr, 2014, *Glycine max* (L.) Merr (Fabaceae) Form Shelu Bazar, December, 2014, *Gossypium herbaceum* L. (Malvaceae) From Shelu Bazar, February, 2015, *Carthamus tinctorius* L. (Asteraceae) Akola, April 2015, *Helianthus annuus* L. (Asteraceae), From Shelu Bazar, March 2015, *Ricinus communis* L. (Euphorbiaceae), From Akola, February 2015, *Buchannia langan Spreng* (Anacardiaceae), From Akola, February 2015, *Terminalia Catappa* L. (Combretaceae) Akola, February 2015, *Guizotia abyssinica* (Lf.) Cass (Asteraceae) From Shelu Bazar, April 2015.

Morphology of Isolates:

Colonies cottony to fluffy, white to yellow, becoming dark – grey, with the development of sporangia, sporangiophores erect, simple or branched forming large, terminal, globose to spherical, multispored sporangia, without apophyses and with well-developed subtending, columellae. conspicious collarette present at the base of the columella. Sporangio spores hyaline, grey or brownish, globose to ellipsoidal, smooth walled or finely ornamented (Plate VIII A).

7. *Rhizopus* sp.

Collected from *Arachis hypogaea* L. (Fabaceae), From Akola, January, 2015, *Glycing max* (L.) Merr. (Fabaceae) From Shelu Bazar, December, 2015, *Gossybium herbacium* L. (Malvaceae) From Shelu Bazar, February 2015, *Carthamus tinctorius* L. (Asteraceae), Form Akola, April 2015, *Helianthus annuus* L. (Asteraceae), From Shelu Bazar, March 2015.

Morphology of Isolates:

Colonies cottony, white becoming grey or yellowish brown. Sporangiophores singly or in groups from nodes directly above the rhizoid, apophysate, columellate, multispored, sporangia globose, apophyses and columella form an umbrella like structure. Sporangiospores globose to avoid, one celled hyaline to brown and striate (Plate IX A).

8. *Cercospora* sp. Fres :

Collected from Arachis *hypogaea* L. (Fabaceae), Akola, January, 2015.

Morphology of Isolate:

Conidiophores dark, simple, arising in clusters and bursting out of conidia borne on new growing tips, hyaline or dark, filiform, several celled (Plate VIII C).

9. *Trichoderma* sp Pers :

Collected from *Linum usitatissimum* L. (Linaceae), From Shelu Bazar, January, 2015, *Sesamum indicum* L. (Pedaliaceae), From Akola, January 2015, *Brassica rapa* L. (Brassicaceae), From Shelu Bazar, November, 2014.

Morphology of Isolate:

Conidiophores hyaline much branched, not verticillate; phralides single or in groups, conidia hyaline, I-celled, oviode, borne in small terminal clusters green cushions (Plate IX C).

DISCUSSIONS:

Seeds are known to be colonized by varied types of fungi among which many are plant pathogens. The fungi may affect the seeds by causing seed abortion, shrunken seeds, reduced seed size, seed rot, sclerotisation or stromarization of seed size, seed necrosis, seed discolouration, reduction or complete loss of germinability, and some physiological changes[7].

During these investigations 12 infected Oil Yielding seed specimens were collected, out of which 7 fungal Genera belonging to Deuteromycetes and 2 genera from zygomycetes[8].

In Fabaceae members like *Arachis hypogaea* species like *Cercospora, Rhizopus, Mucor* were observed while on *Glycine max* species of *Fusarium, Mucor, Rhizopus* were dominant (Plate II-A, B, & Plate III-A,

In Asteraceae members like *Carthamus tinctorius* species of *mucor, Aspergillus, Rhizopus,* and *Alterneria* cause lot of damage of the seeds. On *Helianthus annuus* species of *Mucor, Rhizopus, Aspergillus* and *Alternaria* were dorminent while on *Guizotia Abyssinia* species *of Mucor* and *Aspergillus* were domined (Plate IV-C, D, A, B & Plate VI-C, D).

In Linaceae member like *Linum usitatissimum, Mucor, Aspergillus* and *Tichoderma* cause damage to the seeds(Plate I-A,B).

In Pedaliaceae member like *Sesamum indicum* species like *Penicillium, Aspergillus, Mucor, Trichoderma* cause sevear infection to seeds (Plate I-C, D).

In Brassicaceae member like *Brassica rapa* species of *Mucor, Curvularia, Alterneria, Trichoderma* and *Aspergillus* damage and seeds (Plate II C.D).

In Malvaceae member like *Gossypium herbaceum* species of *Fusarium, Rhizopus, Aspergillus* and *Mucor* cause severe damage to the seeds(Plate III C,D).

In Euphorbiaceae member like *Ricinus communis* species of *Fusarium, Mucor* cause severe damage; while in *Anacardiaceae* member like *Buchanania lanzan* species of *Alternaria Mucor* and *Aspergillus* showed severe infection to the seeds (Plate V A,B,C,D).

In Combretaceae member like*Terminalia catappa* species of *Mucor* showed its effect (Plate VI A,B).

The deleterious effects of seed borne fungi include: biodeterioration of seeds, when used as feed, reduced seed viability and germination of seedling vigour, poor stand of the crop in the field and low yields. Therefore, control of seed borne fungi is

extremely important and deleterious effects can be alleviated through integrated approaches[8,9].

CONCLUSION:

Oil yield seed borne out transmitted by Seed In some cases the transmission on seed is insignificant compared to the population of diseases organisms that exist in soil or on weed species. In other cases, the transmission on seed is the primary means by which a disease spreads. Fungi as compare to bacteria and viruses is the largest group of pathogens which causes specific seed diseases.[7,10] They are restricted to the outer layers of the plant, initiate infection by means of air borne spores and then proceed to spread by attacking nearby cells of the outer layers. Fungi are much less likely to enter the vascular system of the plant, and thus infected seed mostly when they either 'crawl' all the way to seed on the outside of the plant, or else send out spores that land on the seed. In either case, the fungal spores are on the outside of the seed, in the layers of the seed coat. Spores on the seed coat are more prone to either dry up and die, or else to get sloughed off with the seed coat during seed germination, thereby failing to cause disease on the next generation of plants.[4,11]

Use of anti-microbial agents, such as bleach acid, tri-sodium phosphate, or other commercial products are very important for minor seed borne transmission. Wet or dry heat is the number one method for sterilizing seed. Hot water treatment of 122°F (50°C) for 20-25 minutes or 119°F (47°C) are effective for most pathogens and less damaging to the seed. Physical treatments that have already been used in the past and treatments with plant extracts, natural compounds, bio-control agents, have proved to be effective in controlling seed borne pathogens.

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CONFLICT OF INTEREST REPORTED: NIL; SOURCE OF FUNDING: NONE REPORTED