

AFS 2016029/17401

Radial Growth Phase of *Aspergillus* Species in Selected Food Substances (Tomato, Onion, Pepper and Carrot) at Different Temperatures

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(Received April 6, 2016; Accepted in revised form December 9, 2016)

ABSTRACT: This study was carried out to determine the effect of temperature on radial growth phase of *Aspergillus* spp. *Aspergillus niger* was isolated from apparently spoiled samples of onion, tomato and carrot. These food samples were obtained from different locations. Isolation of *A. niger* was done using Potato Dextrose Agar (PDA). *A. niger* which was inoculated at the centre of the PDA plate was observed for radial growth for a period of seven days at 12 hourly interval, twice daily at 28°C and 37°C respectively. It was generally observed that *A. niger* grew better at 28°C than at 37°C, though there were some exceptions observed in carrot (from Jos), which had a radial growth of 0.80cm and 4.25cm at day one and three respectively. Tomato (from Benin) had a radial growth of 0.85cm at day one, and 4.55 cm at day six. Spring onion also had growth of 1.00cm and 3.80cm at day one and four respectively. Statistics showed that the *P*-value for the growth of *A. niger* was 0.0192 at 28°C and 0.0275 at 37°C which suggest that radial growth at both temperatures were significant (*P* < 0.05). Having this study in mind, vegetables should be stored at very low temperatures to prevent food spoilage by this organism.

Keywords: *Aspergillus niger*, Radial growth, Temperature, Food substances,

Introduction

Radial growth phase is the early pattern of growth of cutaneous malignant melanoma in which tumor cells spread laterally into the epidermis. Tomato is an herbaceous, sprawling plant in the family *Solanaceae* that is typically cultivated for the purpose of harvesting its fruit for human consumption. It typically reaches about 1-3m in height and has a woody stem that often vines over other plants. The leaves are usually 10-25cm long, odd pinnate, with 5-9 leaflets on petioles (Acquaa, 2002). Tomato consumption has been associated with decrease risk of breast cancer (Zhang *et al.*, 2009), and might be strongly protective against neurodegenerative diseases (Rao *et al.*, 2002). *Capsicum* spp have been known since the beginning of civilization in the Western Hemisphere. It has been a part of the human diet since about 7500 B.C (MacNeish, 1964). The pharmaceutical industry uses capsaicin as a counter-irritant calm for external application (Carmichael, 1991). Carrot (*Daucus carota*) gets its characteristic and bright orange colour from β carotene, which is metabolized into vitamin A in humans. Carrots are also rich in dietary fiber, antioxidant and minerals, massive over consumption of carrots can cause caroteriosis, a benign condition in which the skin turns orange (Philip, 2007). It has been suggested that an increased consumption of onion (*Allium cepa*) reduce the risk of diseases ranging from common cold and heart disease, diabetes and other diseases. In India, some sects do not eat onion due to its allergic aphrodisiac properties (Fredrick, 1998). For all varieties of onions, the more phenols and flavinoids they contain, the more antioxidant and anti-cancer activity they provide.

One of the oldest named genera of fungi, *Aspergillus* received its name from Micheli in 1729. In viewing the microscopic spore-bearing creature, Micheli was reminded of a device used by the Roman Catholic clergy to sprinkle Holy water during a part of the liturgy called the asperges (Ainsworth, 1976). This study was carried out to determine the effect of temperature on radial growth phase of *Aspergillus* spp in other to ascertain the ideal storage temperature on selected food substances.

Materials and Methods

Sample Collection: Samples of pepper, tomato, carrot and onion grown in different parts of Nigeria and sold at New Benin market, Benin City which lies between longitude 5.40⁰E and latitude 6.00⁰N located in the Southern part of Nigeria, were used for this study.

Preparation of Culture Media: Potato-dextrose Agar (PDA) was prepared according to manufacturer’s instructions.

Radial Growth Assay: A wire loop was used to take inoculums from the spoilt vegetables samples and inoculated in already prepared Potato-dextrose Agar (PDA), using different Petri dishes for each of the vegetable sample and left to grow at room temperature (28±2 °C). Pure cultures were thereafter collected from the different Petri dishes and stored in PDA slants. Fungal isolates from plates were prepared into mounts on microscopic slides and examined under the microscope for comparison of fungal morphology with description given by Samson and Reenen-Hoekstra (1988). The pure cultures were then transferred onto petri-dishes for the radial growth assay. The assay was carried out at 28⁰C and 37⁰C at every 12 h interval (twice daily) for seven days. Measurement of growth was done using a meter-rule (that is from the centre of the Petri- dish to the circumference of the *Asperillus* sp. (Palacios-Cabrera *et al.* 2005).

Results and Discussion

Radial growth (cm) of *Apergillus* sp. was observed and recorded. This was done for seven days and at 28°C and 37°C.

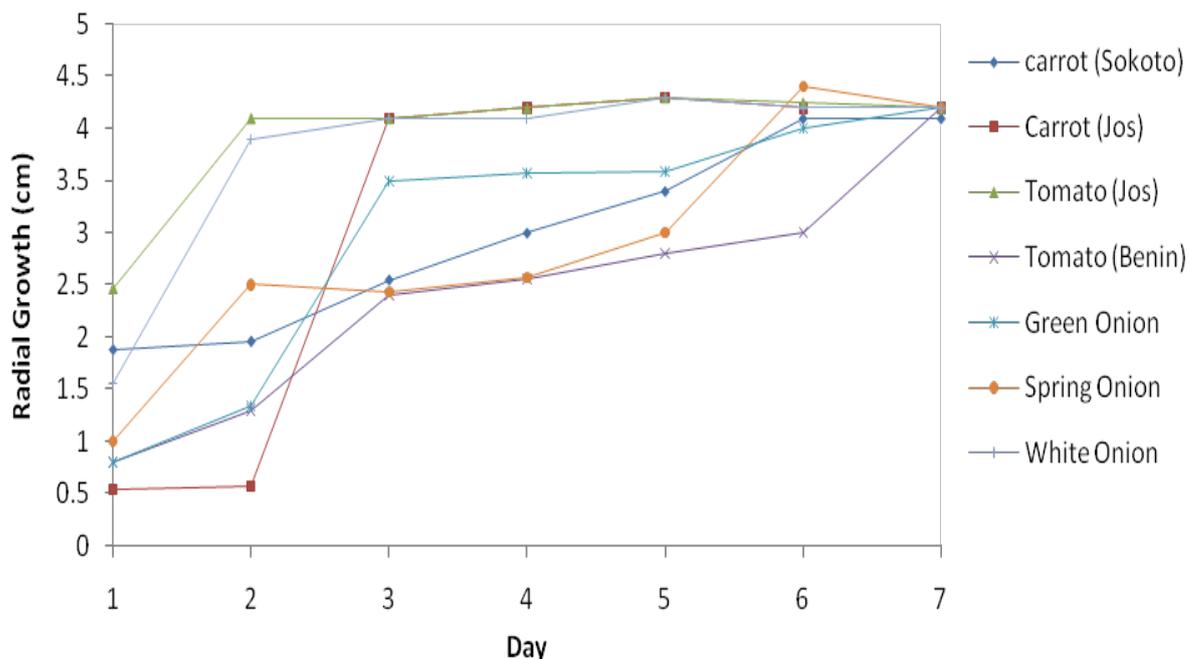


Figure 1: Radial growth (cm) of *Aspergillus niger* at 28°C at 07:00 GMT

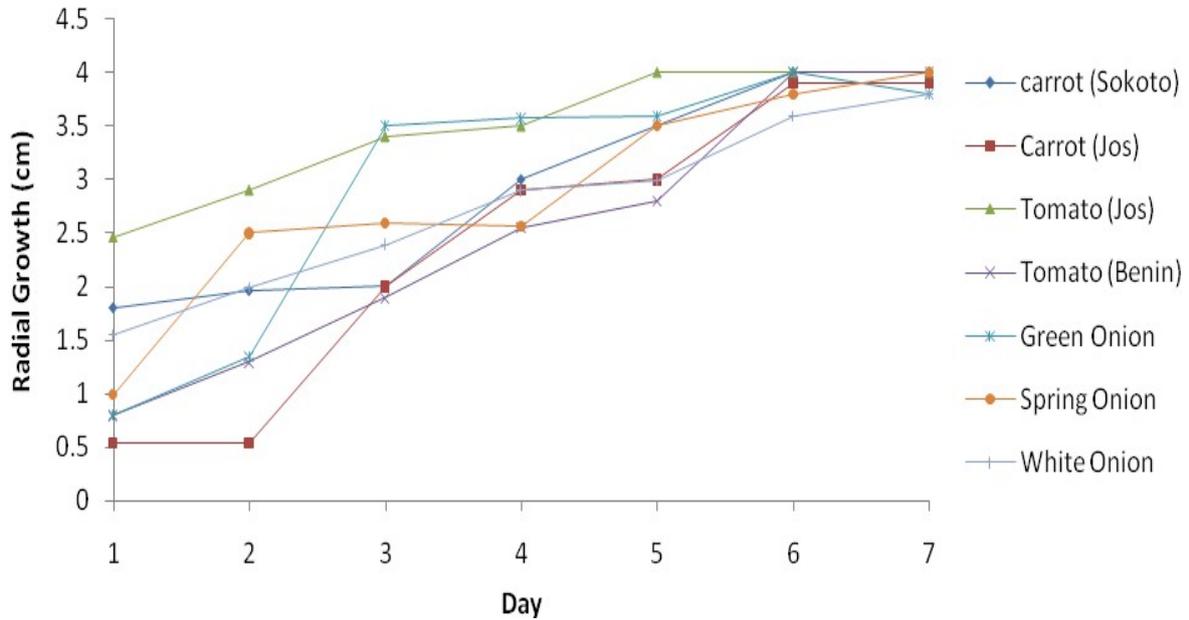


Figure 2: Radial growth (cm) of *Aspergillus niger* at 28 °C at 19:00 GMT

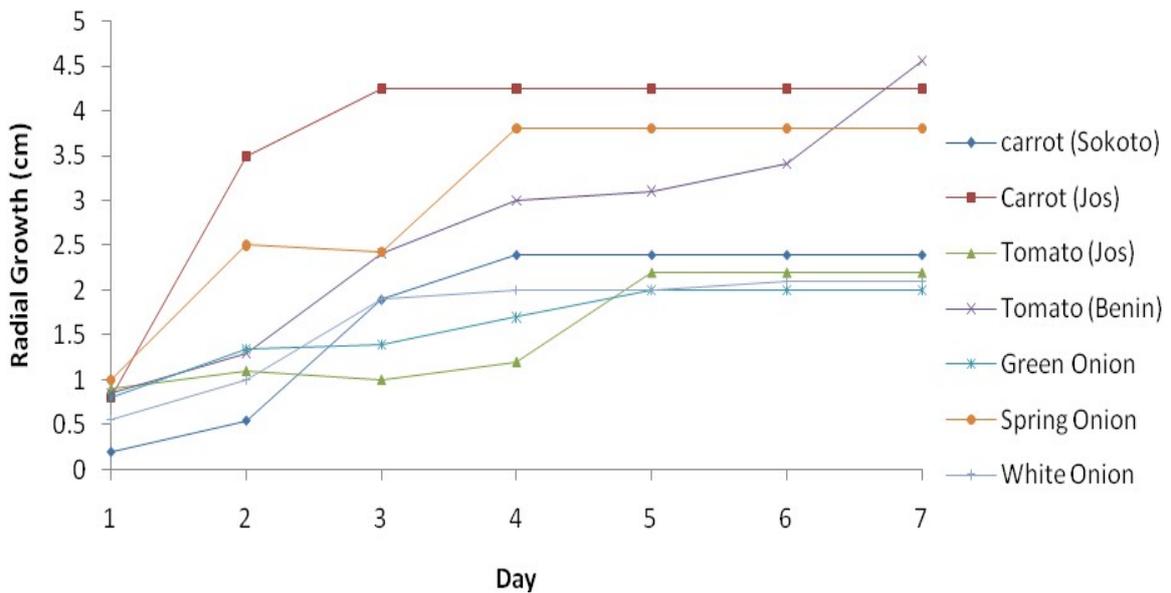


Figure 3: Radial growth (cm) of *Aspergillus niger* at 37°C at 07:00 GMT

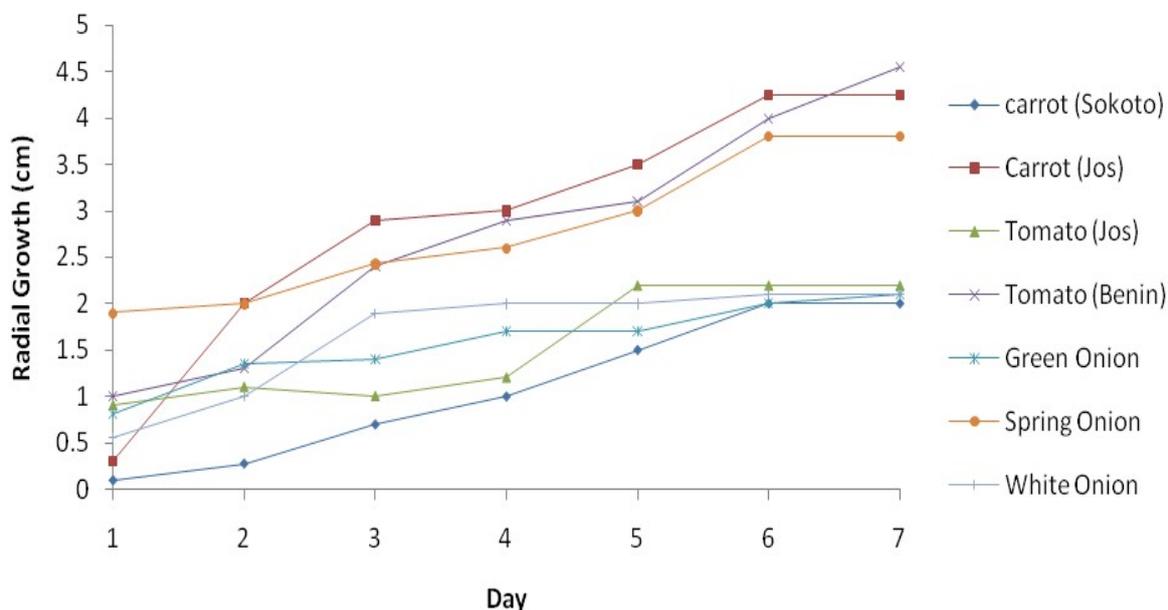


Figure 4: Radial growth (cm) of *Aspergillus niger* at 37°C at 19:00 GMT

Throughout this experiment *Aspergillus niger* was observed to grow in all vegetable items except pepper. It was observed that *A. niger* grew well at both 28 °C and 37 °C, though its optimal temperature is at 30 °C as reported by Astoreca *et al.* (2007) and Palacios-Cabrera *et al.* (2005) in a similar study. Although growth occurred at both temperatures, it occurred best (at a faster rate) at 28 °C (Figure 1). In a similar research it was observed that *A. niger* grew better between temperatures ranging from 25 °C to 30 °C, rather than growing in lower temperatures or higher temperatures though they can grow in a wide range of temperatures even up to 42°C (Astoreca *et al.*, 2007). It was observed that *A. niger* obtained from carrot (Jos), spring onion and tomato (Benin) had a higher growth rate at 37 °C than at 28 °C (Figure 3). This could be due to the individual species differences, that is, different strains of *A. niger*. Statistical analysis showed that radial growth of *A. niger* at both temperatures was significant on daily basis ($P < 0.05$). No growth of *A. niger* was recorded in pepper, this is probably due to phyto-chemicals that are present in pepper.

Conclusion

From the findings of this study, *Aspergillus niger* which is a common food spoilage organism can grow in a wide range of temperatures. Therefore, vegetables should be stored at very low temperatures to prevent food spoilage by this organism.

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