ISSN–2277- 8721

EIIRJ Electronic International Interdisciplinary Research Journal

Volume–XIII, Issues – II March – April 2024

OPEN ACCESS Original Research Article

PHYSARUM ECHINOSPORUM: A POSSIBLE TOOL FOR AI

Dr. Anubha Pandey

NEET faculty in Private Classes

601-E wing, Amberheight, Near Green City, Ambernath east.

Dr. Varsha Bobade

Assistant Professor,

K. M. Agrawal College Kalyan

Dr. Sharda Vaidya

Former Associate Professor

Smt. C. H. M. College, Ulhasnagar

Abstract:

By exploring the potential of integrating AI with Slime mold has been helpful for advancement in health care facility, renewable energy source management, & transport technology etc. (Gharehchopogh et al, 2023). The major research Slime molds have focused on the common species P. polycephalum. These Slime molds are applicable for problem solving ability via SMA technology (Reddy and Manjula, 2023). Few significant features of P. polycephalum such as to search best route for their meal, specific oscillation of plasmodium makes it suitable for their research with AI and SMA.

This paper focuses the research towards other species such as P. echinosporum, that has similar features as that of P. polycephalum. These species are easily available in the Western part of India (Badlapur, Matheran etc.), easily able to grow in Oat agar media. The research on this species would be as helpful as P. polycephalum.

Keywords: SMA: Slime Mold Algorithm, AI: Artificial intelligence, P.polycephalum: Physarum polycephalum

Introduction:

Slime molds are a homogenous group of eukaryotic organisms, having unicellular multinucleate cell and plasmodial as well as sporangial stage as part of its life cycle. The organism is single celled multinucleate brainless organism known as plasmodium. The cytoplasm is covered by plasma membrane. In nature they grow on dead decaying plant parts (especially leaves) (Nannenga-Bremekamp,1971).

It can grow exclusively along the shortest path possible between two pieces of food to select suitable nutrient for their diet. This feature of *P. polycephalum* make it solve maze and other geometrical puzzle, and is helpful to solve mathematical algorithm and optimize the function of natural computation and many more technological tools (Tero *et al.*, 2005). During 2020-2023 period many researchers worked on integration of slime mold with AI and other modern technology. These technologies are helpful to solve many human survival-based issues. It is completely brain-less

ISSN–2277- 8721

EIIRJ Electronic International Interdisciplinary Research Journal

Volume–XIII, Issues – II March – April 2024

OPEN ACCESS Original Research Article

organism also without nerves, but its rummage behaviour for food becomes important for researcher to focus for its integration with modern technology (Gharehchopogh *et al.*, 2022). Slime molds have significant property to smell food, pulsate their way towards nutrient, and potential to remember thing without leaving trail, it can ameliorate if they get severed: these features also make it suitable for the research work in modern technology as for AI based and maze algorithm (Mortada, 2023).

Liang *et al.*, (2021) have generated the enhanced methodology of SMA in the form of CIS (Chaotic initialization strategy) to make it more applicable for human welfare. Enhanced SMA are able to support for optimization of learning machine parameters, able to evaluate structural damage and health care related issues and forecast urban water demands.

SM plasmodium grows tube like structure and form complex net, this feature helps to solve many transports related problems in metro cities. It can support biological computer to design modern transport system in urban infrastructure. Its two-phase growth pattern helps to make digital model of modern multi-objective network design (Kay *et al.*, 2022). The plasmodial stage of *P. polycephalum* has been used as model research organism, helpful in understanding the process of primitive intelligence and used to develop biological controlled robot (Keller and Everhart, 2010). Currently metaheuristic research is the most advance research technology. The slime molds play significant role on this platform as SMA algorithm from different optimization aspect. Metaheuristic study of SMA solve the issues related to wireless sensor network, optimal energy management, Economic Load dispatch problems, MRI segmentation, Mobile robots & security problems, (Gharehchopogh *et al*., 2023).

All this research has concentrated on the single genus and species as *P. polycephalum.* This review paper focuses on other species of the same genus that bear the similar characteristics. It may helpful for future research. *P. echinosporum* is also unicellular, plasmodial stage in their life cycle, it has same potential to search shortest pathway for food search, select the suitable diet, and its plasmodial growth pattern tube like fashion make suitable for future research work. The research focuses on the features which make this species suitable for future researcher working for integration of Al and SMA with slime molds.

The selected species can be cultured easily with suitable nutrient media (Oat agar). It has same potential for their growth pattern depends on the availability and concentration of Oat agar media (Pathak, A., 2019).

Material and Method: The nutrient requirement of Myxomycetes is very specific. For the growth, it requires source of nitrogen, carbon, vitamins etc. we can say that myxomycetes follow healthy diet. The culture media preparation was finalized after many trials and errors. They strictly follow the healthy diet. It was identified that similar to *P. polycephalum, P echinosporum* grows suitably on Oat agar media.

% of agar	% of Oats	Movement of slime molds
1%	0.5%	Slower movement
1%	1%	Faster movement
1%	2%	Much faster and able to form network of plasmodium

Fig: Effect of nutrient media on plasmodium growth

ISSN–2277- 8721

EIIRJ Electronic International Interdisciplinary Research Journal

Volume–XIII, Issues – II March – April 2024

OPEN ACCESS Original Research Article

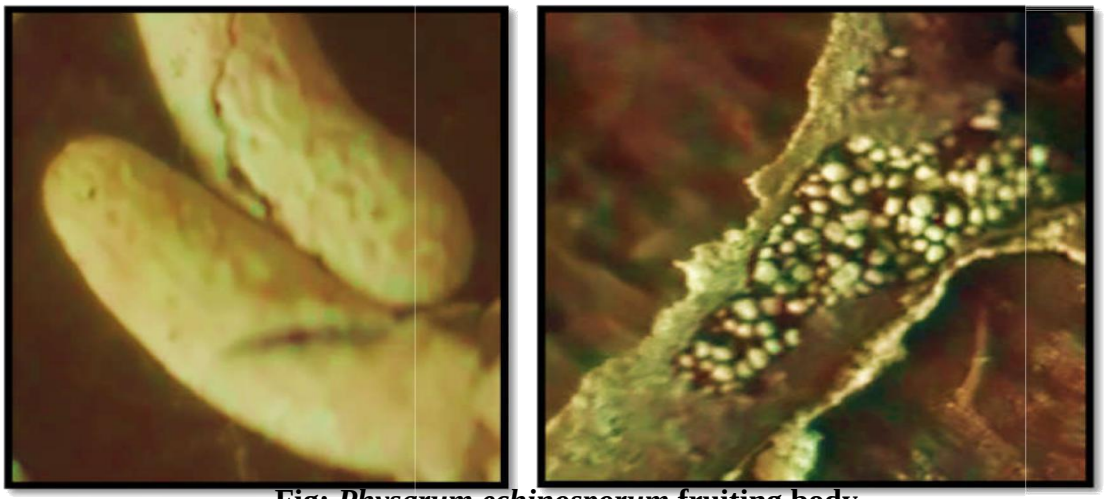


Fig: *Physarum echinosporum* fruiting body

The above data shows that how the oats agar media percentage effect the growth pattern of slime mold plasmodium. To prepare the culture media, used 2% oats, 1% agar solution and antibiotics and antifungal agents. The 2% oats agar media were much suitable for the growth of their plasmodium.

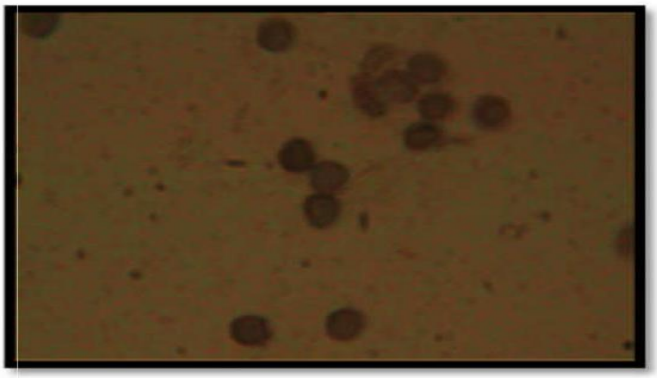


Fig: Spore of *P. echinosporum*

Movement in Culture media.

The significant feature of SM plasmodium is to search suitable diet for their growth, track the best route to reach their nutrients, again ameliorate if get severed apart. The continuous oscillation of their plasmodium and form complex tube-like network due to their levering and foraging behaviour helpful for future research. Due to this significant feature this *P. polycephalum* used as a model organism by the researchers.

The present research make attention towards other species of the same genus which would bear the same feature as continues oscillation of their plasmodium, make fan like network of plasmodium. *P. echinosporum* belongs to the same genus with few different morphological features. Hence it would be suitable for future project related to AI and SMA. The oscillation property depends on the quantity of nutrient in media. If it would be selected as 0.5% oat agar media then, its movement and oscillation was slower, but as the percentage reach up to 2%, its plasmodium ran faster and gave best feature for their application in modern technology.

ISSN–2277- 8721

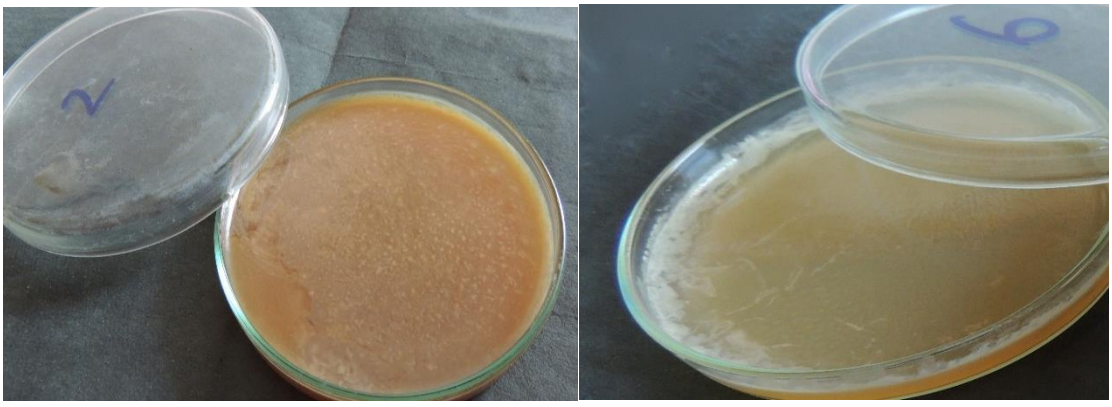
EIIRJ Electronic International Interdisciplinary Research Journal

Volume–XIII, Issues – II March – April 2024

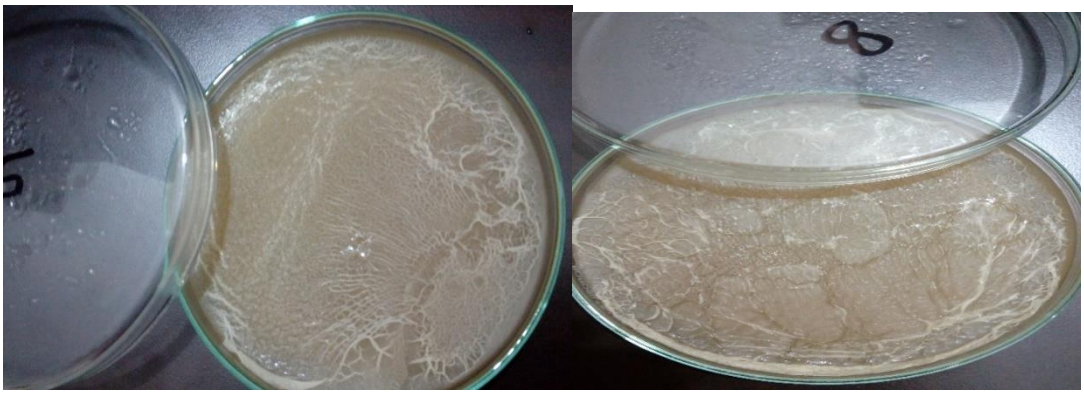
OPEN ACCESS Original Research Article

Other nutrient media like Carrot agar media were also selected. The selected slime mold was able to grow but not much faster. Other media was applied as Corn agar media. In this media too, the plasmodium could grow, but not significantly. Oat agar media was found to be most suitable for the growth of slime mold specially for *Physarum species*. The growth pattern on these three different culture media suggest that slime molds are selective for their diet. They are brain-less organism but able to smell their nutrient and react according to that. Where ever nutrient media were in high concentration in petri dish plasmodium moved faster towards it and made to condense network than the other side.

These features of this species similar to *Physarum polycephalum*. Its plasmodium growth pattern, nature of nutrient media selection makes it suitable for use in future research. The selected species was collected from the Badlapur, Matheran and nearby zone of Maharashtra (Pathak, 2019).



A B



C D

Fig: A: Culture media of *P. echinosporum* after four days. (Plasmodium start to form the network)
B. Plasmodium after 6-7 days
C & D: Plasmodium growth after 10-15 days (Plasmodium growth in network pattern)

Oats agar media composition: Oats 2%, agar-1%, distilled water, antibiotics and antifungal agents added

ISSN–2277- 8721

EIIRJ Electronic International Interdisciplinary Research Journal

Volume–XIII, Issues – II March – April 2024

OPEN ACCESS Original Research Article

Identifying feature of *P. echinosporum*:

The fruiting body is mostly plasmodiocarp, sometimes also sporangiate type. Fruiting body sessile and compressed laterally. Its size ranges from 0.3 to 0.6mm wide and 0.4 to 1mm height and up to 5mm long. The hypothallus is absent. The peridium is double layered. Peridium is white in colour and deposited with lime. Columella is absent. Capillitium is present in large quantity. Spores are black in colour. Shape of spore is globose and highly verrucose (Lister, 1924).

Conclusion:

The given research focuses on the Slime mold, a group of eukaryotic organisms and its application in modern technology like AI and SMA. The single species *P. polycephalum* has been focused for all research work, but there are other species that showed the same growth pattern and would be applicable with additional features. More research work with integration with other scientific departments may throw more light on this group makes a path for upcoming researcher to work with other species of slime molds (*P. echinosporum*) that have similar features and are easy to handle. In nature it can be easily collected and handled for the research.

Reference:

Adamtzky, A. (2010). Physarum machine making computers from slime mold. Word sci. Sing. Ser. A, (74) :8-30.

Aribowo, W., (2020)., Slime Mold Algorithm Training Neural Network in Automatic Voltage Regulator, Trends in Science. 19(3):2145.

Atsushi, T, K. Ryo, N. Toshiyuki, (2006), Physarum solver: A biologically inspired method of road-network navigation. PACS (Elsevier Science)363(1): 115-119.

Evangelidis, V., M. Antisthenis, I. Tsompanas, G. C. Sirakulis and A. Adamtzky, (2016). Application of Slime Mold Computing on Archaeological Research, Springer International Publishing, Switzerland. 978(3):349-372.

Gharehchopogh, F. S., A. Ucan, T. Ibricki, B. Arasten and G. Isik, (2023). Slime Mould Algorithm: A Comprehensive survey of its variants and applications, Archives of Comp. Meth. in Eng. Vol: 30: 2683-2723

Gharehchopogh, F.S., M Namazi, L. Ebrahimi and B. Abdollahzadeh, (2022) Advances in Sparrow search algorithm: A Comprehensive survey. Archi. of Comp. meth. in Eng.30: 427-455.

Irving. T., (2022), Using a virtual slime mold to design a subway network less prone to distruption. PHYS.ORG: 1-10.

Kadam, P., (2010). Study of myxomycetes from Badlapur and adjacent area. PhD. Thesis. Uni. Mum, 1-117.

Kay, R., M. Anthony, C. katrycz, and B. D. Hatton, (2022). Stepwise slime mold growth as a template for urban design. Nat. port. (12): 1322 (1-15).

Keller, H. W., and S. E. Everhart, (2010). Importance of myxomycetes in biological research and teaching, Fungi.3(1): 13-27.

Li, P. S., H. Chen, M. Wang, A. A. Heieri, S. Mirjalili, (2020). Slime Mould Algorithm: A new method for stochastic optimization., fou. Gen. Comp. Sys. (111): 300-323.

Liang, X., D. Wu, Y. Liu, M. He and L. Sun, (2021). An Enhanced Slime mold algorithm for Digital IIR filter designs. Discrete Dynamic in Nature and Society. 5333278: 1-23.

Lister, G., (1924). Mycetozoa from North India, Jour.Bot. 62:16-20. As cited by Thind, K. S. 1977. The Myxomycetes of India. Publication Grewal S. S. 1-451.

ISSN–2277- 8721

EIIRJ Electronic International Interdisciplinary Research Journal

Volume–XIII, Issues – II March – April 2024

OPEN ACCESS Original Research Article

Martada, I., (2023). Exploring the potential of Integrating AI with Slime Mould for advancements in health care, renewable energy and transportation technology, Springer Singapore, ISBN-981-99-7433:1-7

Nannenga-Bremekamp, N. E., (1971). Notes on Myxomycetes XVII, Ibid. 74: 352-65.

Pathak, A. (2018). Genomic study of Slime Molds. PhD. Thesis. Uni. Mum, 1-130.

Phate, P., and R. L. Mishra, (2014,a). Culture of Hemitrichia serpula on wide range of agar medium, Inter. Jour. Cur. Micro. App. Sci. 3(2): 480-488.

Phate, P., and R. L. Mishra, (2014,b). First report on spore-to-spore agar culture of Stemonitis axifera t. macrob from Maharashtra, India, Inter. Jour. App. Res. 4(1).: 81-84.

Reddy, S. V., and M. Manjula, (2023). Voltage Regulation and Power Loss Reduction in DN with DG When Load Changes Using MOSMA, B. Raj et al. (Eds.): ICETE 2023, AER, 223, 579-587.

Son, P. V. H., L. N. Q. Khoi. (2023). Applying artificial intelligence to solving optimization in construction management: Hybrid slime mold algorithm with opposite based learning (2023), Proc. of thi. Inter. Conf. on sust. Civ. engi & arch. (31) :978-981

Stephenson, S. L. (2003). Myxomycetes associated with decaying fronds of nikau palm (Rhopalostylis sapida) in New Zealand. NZJ Bot (41): 311-317.

Stephenson, S. L. and H Stephenson, (2000). Myxomycetes a handbook of slime molds. Timber Press. 1-183.

Thind, K. S., (1977). "The Myxomycetes of India", Publication Gerwal S.S.: 1-451.

Cite This Article:

Dr. Pandey A., Dr. Bobade V. & Dr. Vaidya S. (2024). *Physarum echinosporum: A possible tool for AI.* In Electronic International Interdisciplinary Research Journal: Vol. XIII (Number II, pp. 14–19).

DOI. *https://doi.org/10.5281/zenodo.10941927*