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FEATURE

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Professor S.M. Agarwal, a Pioneer Biospeleologist from Free India

It was the mid-twentieth century when universally an emerging field of science 'Biospeleology' was struggling to get grip on the scientific arena. Besides bioinventory of cave animals biologists had started to work on evolution, genetics and physiological aspects of cave animals in modern manner. It was the time when a German scientist Curt Kosswig (1903-1982) was busy to put forward his theory of "rudimentation" i.e., about the loss of structures in cave organisms. Albert Vandel (1894-1980) was contemplating to bring out the pioneer volume on Biospeleology published in two languages, French (1964) and English (1965). Remarkable works in the subject were being carried out in North America by L. Hubricht (Tennesse), T.C. Barr (Kentucky), J.R. Holsinger (Virginia and West Virginia), J.R. Reddell (Texas). In the same era, Shankar Tiwari (geographer) and S.M. Agarwal (biologist) from India in their early stage of career were actively busy to explore the subject in Indian context.

As a renowned biologist, Prof. Shyam Murti Agarwal (Ex-Vice Chancellor of Pt. Ravishankar Shukla University; 1985-1989) does not require any specific introduction. Beyond the bio-inventory works of cave organisms, Prof. Agarwal was the 1st researcher in India who had initiated work on various physiological aspects of cave organisms to strengthen the subject biospeleology. During his academic career more than thirty Ph.D. students completed their dissertation works on various aspects of zoology under his kind supervision, among which two theses on Biospeleology are also included. His works on Biospeleology exist as a classic contribution in Indian context. Here, we are trying to bring forward his views regarding the present status of subject in India. Why in India till date the subject remains in its infancy? What is his opinion to strengthen the subject in coming future. Here we are presenting the answers given by him to us regarding the subject.

- When and where did you first hear about the subject "cave biology", and how you started your academic journey towards cave biology ?

Reply- Shankar Tiwari, a school mate and I shared a rented quarter while being in the teaching staff of Robertson College (then), Jabalpur, Central India (then). During Diwali vacations in 1956, Shankar Tiwari visited Kotumsar cave and brought on return a collection of animals, which included a fish, a frog, bat and several others. I got curious, even exited and in the next holidays I went with him to the cave.

Two forms of life, one a fish in different shades of pigmentation (even albinic) and a gryllid interested me most. I collected some material of both forms and returned to Jabalpur, I sent them to British Museum, London for identification. They identified the fish as *Nemacheilus evezardi* Day (now, *Indoreonectes evezardi*), while gryllid sp. was absolutely unknown to them. They advised me to correspond with Chopard, an authority on Gryllids. Chopard identified the gryllid as *Arachronimus*. During all this, I was involved with my studies on a parasite sp. of fish and was working for my Ph.D., which I completed in 1963.
In 1964, I was transferred to Science College , Raipur, Madhya Pradesh (then) and became a Professor in Biology in 1965. At this time I asked a

colleague to work on the regression of eye in the fish N.evezardi. Yet another scholar I entrusted with the study of the gryllid. After extensive scan of literature we were convinced that Chopard's identification of Arachnomus needed correction and that was done by us. We named the gryllid, *Kempiola shankari*. The scholar, Krishna Mohan Sinha registered for his Ph.D. and worked on the sensory physiology of *K.shankari*. Yet another student I entrusted the study of rectalpads of *K.shankari*. But that was left half way because he got a good job.

In 1978 I shifted to Bioscince department of Pt. Ravishankar Shukla University (infact I founded it in 1978) I thought of the cave fish again and asked another scholar to work on the some aspects of biochemistry of the cave fish *N.evezardi*. On superannuation in 1990 I passed on studieson this cavefish to a senior faculty member of the department.

- Have you ever met any renowned biospeleologist of your days (personally, telephonically or by any other means)? Who are they?

Reply- Personally no; through letter correspondence- Georges Thinès, Norman Bertram Marshall (British Museum), Lucien Chopard, LeRoy. As I have said that in 1990 I superannuated and away from Lab, library and literature, it is difficult to recollect the other names of experts.

- What are the species you encountered in Kotumsar cave while you initiated bioinventory work of the cave ? If you tally the bioinventory work recently published by us what difference you get in them?

Reply- I was not interested in faunistic or floristic survey of Kotumsar cave. The two forms of life, Nemacheilus evezardi and Kempiola shankari only interested me. Systematic study was not my forte. I was interested in studying how cave life affected the physiology of these forms of life.

Q- Most of your cave biology works were restricted to the Regions of Chhattisgarh (then a part of Madhya Pradesh), didn't you ever plan to move beyond it?

Reply- Could not have. Teaching then was a very serious proposition, only with an extra zeal research could be undertaken and caves generally far away from the places of posting, besides their in accessibility in those days, I could not have thought of other caves.

- Could you share any of the exciting experience from your work on cave biology ?

Reply- Getting inside the cave was in itself a thrilling experience; the twilight zone was very narrow then. One had to descend with the help of ropes. Inside the cave it was all clay moist soil and one had to move on all fours. It was very slippery. The stalactite and stalagmite rocks and projections with musical notes when touched with stick or some other object were all fascinating. Water dripping from the roof and feeding the small pools inside the cave and suddenly a cluster of those gryllids appearing from nowhere were all very exciting. I enjoyed the experience when I went into the cave for the first time. I went perhaps half a dozen times more.

In one of these visits, it started raining and it was a most exciting event that we saw pools of water entering into the mouth of the cave. This suggested that the normal pigmented variety of fish got into the cave through these water pools. Those that got in, could not come out and with very long passage of time began to lose their epigean traits and began to lose pigmentation and some very few even lost all pigmentation and became albinic and their eyes got covered with fold of skin. These we called blind fishes. We studied the eyes thoroughly and concluded that the eyes only regressed. Could the high concentration of calcium in water pools or alternatively, complete darkness affecting melatonin titre in the body be the cause for loss of pigmentation and for the regression of eye, it is an enigma. I deeply regret I

could not get the work completed to fruition.

- - In India till date, the subject remains in its infancy, what could be the possible reason you think behind it ?

Reply- 1) Caves are very distant from the places of work. Research involves collection of materials any number of times and inaccessibility of the cave is a very limiting factor.
2) Researches in Biology, by and large have followed a trend and much depends on the expertise of the guides. They suggest problems and scholars work on them. In our time there were hardly any biospeleologists in our country, India. I had heard of only one blind fish *Horaglanis krishnai*. I am told that there are quite some more cave biologists now. It would perhaps be very necessary to have a research Institute promoting researches in Cave Biology. Perhaps it would need to be funded generously by the University Grant Commission, Council of Scientific and Industrial Research and/or Government of India. But this is only a fond hope.

- With gifted abilities that enable teaching excellence you tread in the highest academic levels and share with persons of all ages and interests. Don't you feel ever to do something for proper flourishment of biospeleology?

Reply- While in harness, I did my utmost to contribute to the study of cave fish and the gryllid. On retirement in July 1990, I was not welcome to the department I founded. This is so with all competent Professors in all Universities. For fear of competition they become persona non grata. However, ICAR (Indian Council of Agriculture Research) assigned me the position of panel member for 3 consecutive terms, almost an unusual gesture of goodwill. I was with them for 9 years and later with Fisheries University (Central Institute of Fisheries Education, Mumbai) at Mumbai for 6 years. But there was never a project on cave biology for sanction. Study of cave biology has been my first love, but I regret I couldn't do more than I did.

- Your valuable tips and suggestions for the flourishment of the "National Cave Research and Protection Organization".

Reply- I am not properly aware of your setup or the facilities available there. It would perhaps be useful to get recognized by one two of the Universities and affer facilities of research promising scholars. They could also take outside experts as guides.

Presently Prof. Agarwal is enjoying his retirement life with his wife and other family members in Indrawati Colony, Raipur. During a conversation he expressed his sorrow that till now several physiological aspects of gryllid *Kempiola shankari* and cave fish *Nemacheilus evezardi* remain unsolved and he wished that somebody must come forward and find out the answers.

Some of his major contributions to the biospeleology is given below:

Theses guided by Prof. Agarwal-

1973: Studies on taxonomy bionomics and anatomy of a cave gryllid. By K.M. Sinha.

1984: Biochemical studies of some tissues of *Nemacheilus evezardi* Day from Kotumsar Cave. By- R.K. Pradhan.

Some Relevant Paper Published by Prof. Agarwal:

Sinha, K.M. & Agarwal S.M. (1977): A new cavernicolous orthoptera *Kempiola shankari* n.sp. (Orthoptera: Phalangopsida) from Madhya Pradesh. *Ind For.* 103:150–152

Sinha, K.M., Agarwal, S.M. (1982): Pterothoracic Muscles of the Cave-cricket *Kempiola shankari* Sinha and Agarwal (Orthoptera, Phalangopsidae). *Ind For.* 108:757-782

Pradhan, R.K. & Agarwal, S.M. (1984): Studies on *Nemacheilus evezardi* Day from Kotumsar Cave 1-chromatophores. *Geobios New Reports.* 3:128–130

Pradhan R.K., Pati A.K. & Agarwal S.M. (1989): Meal scheduling modulation of circadian rhythm of phototactic behavior in cave dwelling fish. *Chronobiol. Int* .6(33):245–249

Agarwal, S.M. & Sinha, K.M. (1987): *Homoeogryllus indicus* sp. Nov. (Orthoptera: Phalangopsidae) from Madhya Pradesh, India. *J. Bom. Nat. Hist. Soc.*, 84: 398-400

by- Jayant Biswas