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Assessing the Role of Differentiated Instruction in English Language Teaching: A Study Review on Adaptive Learning

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The purpose of this review paper is to assess the role of differentiated instruction (DI) in English language teaching and learning. The literature survey has been chosen so as to address the objectives of the study which are studying the role of DI in English Language Teaching. It also concentrated in the studying the procedures and techniques undertaken for teaching English. Lastly, this paper also explores the factors affecting DI in classrooms. Secondary sources were used to collect the information needed for this study. The most important finding from the study was that DI has a tremendous positive impact in helping students learn English. Another chief finding was the importance of training teachers in various approaches and methods for implementing differentiated instruction.

Keywords: Instruction, English Language Teaching and Adaptive Learning.

Introduction

English Language Teaching is an active industry that seeks to provide an education in English to speakers whose native language is different. For people learning English, it can be a second, foreign or additional language depending on the country. Education is imparted to learners for improving their skills in reading, speaking and writing. As with most forms of education, there exist many methods and views on teaching English. Before we look at differentiated instruction, it is essential to have a brief look at a couple of studies that havebeen conducted outside the context of this aspect in order to achieve an introductory understanding of English Language Learning. Hossain (2018) noted that Reed and Railsback provided an overview of the four major instructional

methods for serving English language learners (ELL), characterized by the degree to which the native language of the student is utilised (13-17). They are as follows:

a) The instructional methods using the native language employ the ELLs' native language to provide education. The teacher is usually fluent in the particular native tongue.
b) Instructional methods that utilize the native language as support impart education mostly by translating the material in English to the primary language.
c) Instructional methods using English as a second language use three approaches, based on grammar, communication, and content
d) The sheltered instruction method, also known as Structured Immersion involves teaching grade-level subject matter in English in understandable ways and engrossing students academically while advancing the development of the English language.

This particular study has not elaborated on the impact of these methods but it did provide ten tips for teachers to improve instruction - enunciating clearly, writing legibly, developing good classroom routines, repeating and reviewing information frequently, avoiding slang, announcing lesson objectives and listing instructions, putting forth new content in the context of known content, dispensing information in varied ways, quent summaries and lastly acknowledging student success (Hossain, 2018).

Pawlak, M. (2019) referred to the empirical research of O'Malley, et al., which identified the range, type, and frequency of learning strategies used by beginner and intermediate level ESL students and the type of tasks associated with such strategies. The major finding of this study was that intermediate students made use of metacognitive strategies more than beginner students. The former group undertook the approaches of advanced organization, directed and selective attention, self-management, advance preparation, self-monitoring, self-evaluation, and so on. The beginner students, on the other hand, used more cognitive strategies such as repetition, resourcing, directed physical responses, translation, note-taking, deduction, imagery, contextualization, and many others (Pawlak, M. (2019).

According to Baecher et al. (2012) differentiated instruction is one of the methods used in language learning. The scholars identified ten principles of differentiated instructions for ELLs, which may help in guiding teachers to address the needs of all students. These principles are as follows (Baecher et al. 2012, pp.16-18):

a) Assessing the strengths and weaknesses of various learners in reading, writing, listening and speaking.
b) Laying down a common content objective and determining the kind of linguistic input required by the learners.
c) Making differentiation a manageable task for oneself to assure that the process does not become too daunting or time-consuming.
d) Making learning manageable for the students.
e) Identifying appropriate base activities for both lower proficiency students and higher efficiency students.
f) Pairing students of similar ability with each other instead of putting a higher-level student with a lower one.
g) Assuring flexibility in groupings instead of being fixed, since students, especially of lower calibre can feel conscious if they are always grouped together.
h) Allowing students to choose activities from time to time
i) Understanding that cognitive complexity is linked with language proficiency, and use the right tools for different levels of cognitive complexity.
j) Allotting equal time for all students for differentiated tasks

The studies discussed in this section prove to us that ELL appears to be a sector with inexhaustible research potential. There are numerous contexts and aspects that researchers may conduct research in this field. This review paper will focus on DI in particular.

Objectives

The objectives of the study have been devised as follows:

- To study the role of differentiated instruction in English Language Teaching.
- To study the strategies and methods adopted by the teachers for teaching English
- as a language.
- To explore the factors influencing differentiated instruction in classrooms.

Literature Review

In this section, pre-existing works related to the current subject matter will be reviewed,with the purpose of identifying their research gap, thereby establishing the need for thisstudy.

Differentiated Instruction

It is a philosophy of teaching that considers the learning style or ability of the individual student before devising a lesson plan. The primary utility of this framework is that it helps students with differing learning abilities to grasp and understand things better. The study by Lawrence-Brown as noted by Lindner, et al (2019), asserts that DI can provide appropriate education to students whose ability ranges from gifted to those with learning disabilities. The use of this method creates an environment wherein all learners can be successful, rather than favouring a few select students. The availability of a wide variety of methods and a balance of challenge and success has benefits for all students. Assistive technology, peer tutoring, and adult help, emphasis on important concepts and skills, providing clear examples, breaking down of concepts and skills, making connections with previous knowledge and experience were provided as some of the measures that could help address varying needs of the student. The endgame was to eventually reduce assistance, wherein independence would be encouraged.

Naka (2018) examined the extent to which DI was used in classes where English was taught as a foreign language at the University of Gjakova in Kosovo. A sample of 130 students was considered for the study. They were interviewed about the methods of teaching employed in their English classes. It was found that the teachers did not use much of the DI methods during classes (Naka, 2018, p.107). Teachers pay more attention to the implementation of syllabus than to student needs. This means that the teacher decides the material without forming an understanding of the language abilities of different students. Students who participated in the study also recommended that teachers should consider individual student needs since a 'one-size fits all' approach is unsuitable for learning a foreign language (Naka, 2018).

As identified by Reis, et al. (2011) the ways to adapt reading comprehension program, is subject to entail DI along with a focus on engagement in reading influenced reading comprehension and fluency of children. This is evident as compared to children undergoing a regular reading program. The scholars noted that the program implemented is called the Schoolwide Enrichment Reading-Model, which typifies a model for individualized reading instruction rather than a fixed curriculum. After selecting a sample of students from five elementary schools in the United States, teachers were given the right training. Each school had a two-hour block in which 1 hour was devoted to a regular reading program and the other hour was devoted to the Sem-R program. Then grade appropriate instructional activities were implemented. The study found that DI and enrichment teaching

methods resulted in higher levels of fluency and comprehension in some students (Reis, et al., 2011).

Self Efficiency and Role of Teacher in Classroom

According to Dixon et. al. (2014) the efficiency of teacher was an important factor in the implementation of differentiation, regardless of the level or area taught. They focused on three problems - differentiated instruction, professional development, and teacher efficacy as well as beliefs of self-efficacy. The researchers conducting the study believe that education programs for teachers should instruct them in the philosophy behind differentiation and the process of instruction so that the teachers may enter the classroom prepared for learning diversity. Professional development based on how to differentiate and why it is needed should also happen side by side with the previous approach. The study found that teachers with more professional development felt more efficient in differentiating instruction in their classes (Dixon, et al., 2014).

De Neve, et al. (2015) analysed that the teachers' job and personal resources in the learning of DI remains in the beginning teacher. The most primary finding was that the resources have an impact on the learning process of beginning teacher. The next major finding was that the self-efficacy of teachers is necessary for commencing their professionalization in differentiated instruction. It was observed that self-efficacy determined the way beginning teacher reported changes in differentiated instruction. Teacher autonomy was also found to be an influential factor in the self-reported changes of beginning teacher. As autonomy went up, the more likely teachers were to express better levels of self-efficacy. This, in turn, led to an increased reportage of the implementation of differentiated instruction.

In the United States, Alternative Certification programs were instituted so that people with bachelor degrees or higher (from any field) could be recruited for the teaching profession. The study conducted by Tricarico and Yendol-Hoppey (2012) probed the development of alternative certification candidates as planners and implementers of differentiated instruction. The findings of this study dictated that:

- College relationships, compelling classroom management, the capacity to plan for a standard, comprehending students' needs as well as an openness to feedback either promoted or hampered the apprentice's ability to plan for differentiated instruction.

- In order to be successful at differentiating instruction, apprentices are required to expand on new knowledge, administer the same and be open to feedback.
- Trainees with better self-supervising abilities have higher rates of success in planning and implementation of differentiated instruction.

Teaching Experience and Beliefs in Relation to Differentiated Instruction (DI)

Suprayogi, et al. (2017) handled a study that linked the implementation of DI by teachers to variables such as self-efficacy, teaching beliefs, teaching experience, professional development, teacher certification, and classroom size. Citing a couple of old studies, Suprayogi, et al. (2017) defined self-efficacy as the teacher's belief in their aptitude for implementing differentiating instruction in their teaching exercises. Beginning teacher who believed in their means to address differing student needs adapt their instructional methods easier and can also persist in finding the right method if one fails. The teaching experience was also found likely to impact implementation. Teachers with comparatively few years of experience (0-5 years) were more enthusiastic about adopting new changesin contrast to teachers with a lot of experience (<20 years). Teachers with more experiences resisted changes and found fault with the new practices. Mid-level experienced teachers (6-20 years) felt competent about implementation but were wary about developing new skills.

This study dedicated to assess the relationship between self-efficacy, teacher experience and beliefs, and the reported level of implementation in Indonesian primary schools. The results found a marked relation between implementation and teachers' self-efficacy. There was also an association between constructivist teaching beliefs and implementation but it was less significant than the previous relation.

At the onset, Stepanik and Vlckova-Mejvaldovajana (2019) referred to Johnson's research that focused on surveying the relationship between two variables – the theoretical beliefs of ESL (English as a second language) teachers about language learning and teaching, and the instructional practice they undertake while instructing non-native speakers of English. The study was conducted in two phases, each raising two questions. First, a Multidimensional TESL Theoretical Orientation Profile was developed to verify the extent to which theoretical convictions about language learning held by the teachers impacted their manner of instruction.

In phase 1, several sources of data on the theoretical beliefs of thirty ESL teachers were collected, in order to ascertain the extent to which these beliefs about learning and teaching reflect the methodological cleaving in this field (Sun, et al. 2020). The main intent was to characterize the beliefs. Three orientations of theoretical beliefs were found to be predominant among the teachers, skill-based, rule-based and function-based. Teachers who taught for about 14 years were more disposed to use skill-based approaches. Teachers who were more inclined towards rule-based approaches had been teaching for an average of 8.5 years. The function-based approach was preferred by those who had been teaching for an average of 4.5 years.

Phase 2 was involved in observing and analysing the instruction dispensed by three ESL teachers with different theoretical beliefs to discover the degree to which their instructional practices aligned with their particular beliefs (StEpanik and Vlckova- Mejvaldovajana, 2019). Donna, Greg, and Martha were the names of the subjects. For Donna, a skill-based theoretical positioning guided the way she provided instruction in her classes. Greg was found to have a dominant rule-based approach that directed the
manner of his teaching. Most of Martha's instructional practices were found to line up with the function-based theoretical alignment that was dominant in her.

4. Findings and Discussions

The inferences from the various papers surveyed are as follows:

- Lawrence-Brown's study asserts that implementing differential instruction reinforces the classroom as a community where students of the same age can be encouraged as individual learners (Lindner, et al (2019). Linder, et al. (2019) noted that this study calls for more and better inclusion of students with differing levels of ability,including those with special needs. Since disabled and special needs students were also a focus of this study, it talks about enriching and prioritizing the curriculum to fit the needs of these students as well. However, the shortcoming of this research is that it does not dispense much information on how differential instruction has been implemented so far in different schools. There is no focus on English language learning or teaching also.

- Naka (2018) carried out to identify the extent of implementation of DI in a college. It was found that the teachers did not give much importance to DI and devoted more effort into designing a syllabus.

The study is limited in its scope as it was conducted in only two departments at the University of Gjakova.

- Reis et al. (2011) focused on improving reading through the use of differentiated instruction. The Schoolwide Enrichment Reading Model was the program discusseddensely by these scholars. However, their research fails to account for other aspects of learning such as writing, listening or speaking skills.

- The research done by Dixon et al. (2014) had two major hypotheses. The first one stated that greater efficacy of teachers, as well as belief in their self-efficacy, would belinked to better levels of DI in their classes. According to the second one, increased professional development in differentiation would be related to increased levels of teacher efficacy and beliefs of self-efficacy. Their research confirmed both hypotheses. As for the limitations of this study was that only two school districts were used, the respondents were mostly white and there was no research on the kind of professional development training that would help teachers.

- De Neve, et al. (2015) on the ways teacher autonomy is related to teacher selfefficacy. Their study exposed that both autonomy and self-efficacy influenced the selfreported changes of beginning teacher. Their study is limited in finding the relationship between autonomy, efficacy and self-reported changes when there are other variables that could also play a role. The study only recorded self-reported changes rather than observing the actual behaviour of teachers in the classroom.

- Tricarico and Yendol-Hoppey (2012) worked on the limitation of discovering the factors that affected the ability of a trainee (a person undergoing training as part of the Alternative Certification Program), in order to plan for DI. It does not address the abilities of teachers who have entered the workforce through other programs or means.

- The study performed by Suprayogi et al. (2017) devoted their research in finding the relationship between the implementation of DI and different variables in the primaryschools of Indonesia. The study also failed to catalogue solid measures of DI or address teacher's understanding of student diversity. In addition to this, it was found that therewas a lot of difference in the way teachers spoke about

implementing the methods and actually carrying them out in a classroom.

- Johnson's study was interested in the theoretical leanings of teachers in language learning and teaching and the impact of this on their methods of teaching. The Multidimensional TESL Theoretical Orientation Profile was created to characterize the theoretical beliefs of teachers without taking into account of the cultural, social or political standpoints, as held by them (Stepanik and Vlckova-Mejvaldovajana, 2019; Sun, et al. 2020). The instructional practices of only three teachers were examined in phase 2 of the study, which makes for a rather limited scope.

The literature survey so far has opened up relevant discussions about instructional methods of education. Differentiated instruction, in particular, has proved to be beneficial in English Language Learning. Reading, writing, listening and speaking are the skills that are crucial in understanding a language. It is clear that DI has a huge potential to help teachers and students impart and receive education for language learning.

Conclusion and Recommendations

The various studies we have examined in this paper all vary in their treatment of DI only slightly. One thing that can be unanimously said for all of them is that DI is something that can improve the learning process for students. Though there are many factors shaping the implementation of it, the overall impression is that the philosophy of DI can work in the interests of the learning community.

Most of the studies appear to have focused on schools for their research, ignoring other educational institutions. Only one study, which was led by Naka (2018) that chose students of two departments in a Polish university as subjects for research. While this study also had its limitations, it revealed that there was a need for implementing DI in other educational establishments. Future areas for research could involve collecting the opinions of other stakeholders in education field, such as parents or guardians and students. A lot of the studies examine in this paper have laid a heavy focus on the judgments and outlooks of teachers, ignoring the parties receiving the education - students. The impact of the social, cultural and political background of teachers and students on the methods of teaching and learning could also be a possible area of study in future.

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Studies on The Feed Efficacy, Growth Rate and Economic Traits of Silkworm Bombyx Mori L. Fed with Vitamin - B Complex Treated Mr- 2 Mulberry Leaves

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Silkworm Bombyx mori L is an important economic insect and also a tool to convert leaf protein into silk protein. This study was carried out to determine the feed efficacy, growth and economic parameters of silkworm Bombyx mori L. The V instar larvae fed by MR-2 mulberry (Morus alba) leaves and fed with B-complex vitamins (B1, B2, B3, B6 and B12) treated MR-2 mulberry leaves in relation to feed efficacy parameters like food consumption (FC), food utilization (FU) and approximate digestibility (AD). Morphometric parameters like length and weight of V instar larvae. Economic parameters like cocoon weight (CW), pupa weight (PW) shell weight (SW) and shell ratio (SR). The B-complex vitamins were treated to throughout the larval period. In the present study, it has been observed that the feed efficacy, growth and economic parameters of B. mori enhanced by 0.5, 1.0 and 1.5% of B-complex vitamin. This study has been indicated that the B-complex vitamin exhibits the presence of more growth stimulant activity and can be used to increase the silk yield in commercial silkworm rearing with reference to sericulture.

Keywords: Silkworm, Mulberry, Vitamin B complex and Feed Efficacy.

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Studies on The Feed Efficacy

Sericulture depends on rearing of silkworms (Bombyx mori L.) on mulberry leaves, which is its traditional food; there are more than 1000 varieties of silkworms worldwide (monovoltine, bivoltine and multivoltine). For this consideration the existence of mulberry plantations is binding. Silk and eggs production are directly correlated with larval growth and mulberry trees development (Bhattacharyya et al., 2016). Silkworm (Bombyxmori L.) is a monophagous insect which has special significance in sericulture industry.

In traditional food system, the mulberry leaves must be fresh enough to meet the nutritive demands and preferences of silkworms (Kanafi et al., 2007; Vlaic et al., 2008); this system face some others disadvantages, as high cost of mulberry fields plantations, the space request (rearing rooms), leaves transportation and intensive labour. One of the alternatives for improving larval feeding is enrichment of mulberry leaves with different supplementary nutrients such as vitamins (Kanafi et al., 2007). Saha and Khan, (1996) have reported the same effects from multi-vitamins. Vitamins are a group of organic compounds needed only in minute quantities in the diet that are essential for specific metabolic reactions within the cell and necessary for normal growth and maintenance of health.

Supplementation of mulberry leaves with Vitamin B enhanced resistance in silkworm larvae against conditions of environmental stress which resulted in body weight increment as compared to control (Das and Medda, 1998; Rahmathulla et al., 2005; Raman et al., 2007). Vitamin B1 (thiamine) is important for energy metabolism (National Research Council (U.S), 1987). Vitamin B2 (riboflavin) is important in promoting the release of energy from carbohydrates, fats and proteins "i.e. in the metabolic pathway for ATP production". The enrichment of mulberry leaves with riboflavin at 77 ppm enhanced certain economic characters of silkworm, and improved silk production in north climatic conditions of Iran (Rajabi et al., 2007).

Vitamin B3 (niacin) comes in two forms, nicotinic acid and nicotinamide. Niacin is important for the release of energy from carbohydrates and fats, the metabolism of proteins and production of several hormones (National Research Council (U.S), 1987). Deficiency of vitamin B3 in the diet structure does not improve by adding tryptophan, but nicotinamide, NAD and NADP are proper substitutes for resumption of normal larval growth. Vitamin B6 (pyridoxine) is necessary for the proper functioning of over 60 enzymes that participate in amino acid metabolism. It is also involved in carbohydrate and fat metabolism. Without pyridoxine or its derivatives no larva reached the third instar under aseptic condition. Pyridoxine is important in protein metabolism and its deficiency in mammals' results in alamin) plays important

role in silkworm because it is a co-factor of propionate metabolism which is important substrate for biosynthesis of juvenile hormone in insects (Halarnkar and Blomquist, 1989). The present study has been aimed to find out the feed efficacy and growth rate of vitamin B complex treated MR2 mulberry leaves with regard to food utilization by larvae and ultimate impact on the pupal and cocoon parameters of silkworm B. mori.

Materials and Methods

Experimental Animal -Bombyx Mori

The silkworm, B. mori (Lepidoptera) CSR2 strains were used in this study. Eggs of CSR2 obtained from the Grainagecentre, Sericulture Department in the Regional Deputy Director's office, Tenkasi, Tamil Nadu.

Silkworm Feed

The control animals fed regularly with mulberry leaves throughout the period. The experimental group fed with the prepared modified diet. Different concentrations of vitamin B complex solution (0.5%, 1.0% and 1.5%), were prepared. Fresh MR2 mulberry leaves were separately soaked in these concentrations for 15 min and then were dried in air for 10 min. The treated mulberry leaves were used to feed the fifth-instar larvae of the silkworm Bombyx mori. They were maintained up to the cocoon stage. Four groups of fifth instar larvae were made, which include one untreated control group and three experimental group. Each group was reared 20 larvae.

Estimation of Nutritional and Economical Parameters

The nutritional traits estimation study was carried out on the fifth-instar larvae. On the first day of the fifth instar, from the entire larvae, five healthy silkworms in each group were selected for estimation on nutritional traits analysis. Accurately weighed fresh mulberry leaves were fed two times a day to the experimental group and the control. Simultaneously, daily increases in larval weight were recorded separately. Left over leaves and excreta were collected and recorded on each subsequent day. When the larvae finished feeding, they were shifted to the mountage for spinning. Cocoons were harvested 4–5 days later after completion of cocoon spinning. Harvested cocoons were used for calculate the pupa weight, cocoon weight, shell weight

and shell ratio. During the silkworm nutritional study, data were collected on the biomass of larvae for the food consumption (FC), Food Utilization (FU) Approximate digestibility (AD).

Food Consumption (FC), Food Utilization (FU), Approximate Digestibility (AD) and Shell Ration was calculated by following formula

*Food Consumption (FC) gm = Dry weight of leaves offered - Dry weight of residual leaves

*Food Utilization (FU) gm = Weight of food consumed - Weight of faecal matter

*Approximate Digestibility (AD) % =

Dry weight of food eaten - Dry weight of faecal produced / Dry weight of food eaten x 100

Cocoon shell ratio % = cocoon shell weight / cocoon weight X 100

Statistical analysis

All the data were presented as mean ± standard deviation of mean. The significance was calculated at 5% level (values are significant when P< 0.05).

Results

Analysis of Nutritional Parameters

Feed efficacy characters like Food Consumption (FC), Food Utilization (FU), and Approximate Digestibility (AD) data of V instar larvae of B. mori fed with control MR2 mulberry leaves and B-complex vitamins treated MR2 mulberry leaves were presented in Table 1. The food consumption (gm) of control group larvae (33.14±1.3 gm), 0.5 % concentration group (41.87±1.530 gm), 1.0 % concentration group (43.19±1.191gm) and 1.5 % concentration group (58.58±2.04 gm) respectively. The food utilization (gm) of control group larvae (25.05±1.003 gm), 0.5 % concentration group (43.16±1.639 gm), 1.0 % concentration group (54.08±1.951gm) and 1.5 % concentration group (63.87±1.94 gm) respectively. The approximate digestibility (%) of control group larvae (78.24±2.022 %), 0.5 % concentration group (80.1±2.61 %), 1.0 % concentration group (80.28±3.05 %) and 1.5 % concentration group (86.08±3.05 %) respectively.

The morphometric data of length and weight of larval parameters of Bombyx mori larvae fed with control MR-2 mulberry leaves and B-complex vitamins MR2 mulberry leaves were also presented in Table 1. The mean length and weight of V instar larvae of control group was 3.32±0.0.147 cm and 4.5±0.84 gm. 0.5 % concentration group (3.35±0.182 cm and 4.56±0.724 gm), 1.0 % concentration group (3.4±0.241 cm and 4.98±0.522 gm), and 1.5 % concentration of group (3.41±0.333 cm and 5.01±1.002 gm), respectively.

Table 2 shows that the data of control and B-complex vitamins MR-2 mulberry leaves fed V instar B. mori larvae produced cocoon's weight (CW), pupal weight (PW), shell weight (SW) and shell ratio (SR). The economical parameters are significantly increased in experimental groups of larvae as well as compared with control group larvae. In these observations, the B-complex vitamins treated larvae the nutritional, morphometric and economical parameters were significantly increased than the control group.

Table - 1

Nutritional traits and morphometric traits of V instar larvae of *Bombyx mori* fed with control and B- complex vitamins treated MR2 mulberry leaves

Experimental Groups / Concentration (%)	V instar				
	Food consumption rate (FC) gm	Food Utilization (FU) gm	Approximate Digestibility (AD) %	Larva Length (cm)	Larva Weight (gm)
Control	33.14±1.300	25.05±1.003	78.24±2.022	3.32±0.147	4.5±0.84
0.5	41.87 ±1.53 (26.34)	43.16±1.639 (72.29)	80.1±2.61 (2.37)	3.35±0.182 (0.90)	4.56±0.724 (1.33)
1.0	43.91±1.191 (32.49)	54.08±1.951 (115.8)	80.28±3.05 (2.60)	3.4±0.241 (2.40)	4.98±0.552 (10.6)
1.5	58.58±2.04 (76.76)	63.87±1.94 (154.9)	86.08±3.05 (10.02)	3.41±0.33 (2.71)	5.01±1.002 (11.3)

Table - 2
Economic traits of control and B-complex vitamins treated MR2 mulberry leaves fed V instar larvae of *Bombyx mori* produced cocoon

Experimental Groups / Concentration (%)	Cocoon Weight (mg)	Pupa Weight (mg)	Shell Weight (mg)	Shell Ratio (%)
Control	801±3.18	670±3.18	131±1.801	16.35±0.498
0.5	823±5.57 (2.74)	683±2.557 (1.94)	140±1.557 (6.87)	17.01±1.212 (4.03)
1.0	834±4.916 (4.11)	688±2.916 (2.68)	146±1.916 (11.45)	17.50±1.068 (7.03)
1.5	842±3.880 (5.11)	694±2.880 (3.58)	148±1.880 (12.97)	17.57±0.733 (7.46)

Discussion

In the present study, feed efficacy, growth and economic traits are significantly increased in some groups. Many researchers showed that the larval characters improve by different concentrations of supplementary compounds such as ascorbic acid, folic acid, thiamin (Etebari et al., 2004). The growth and development of silkworm is under the continuous influence of factors operating within and outside of the body (Murugan et al., 1998).

In silkworm, 97% of the total food intake during the last two instars and the feed utilization study confined to V instar larvae as 80-85% of the total leaves consumed in this instar as silkworm very active metabolically at this stage (Rahmathulla et al., 2005).

Suprakash& Pal (2002) also found that vitamin B complex significantly improved growth and development, with beneficial effects on the economic characteristics of the cocoon. Further, it has been revealed from the present study that the weight of cocoon was maximum in silkworm larvae when fed with vitamin B complex treated mulberry leaves than MR2 leaf variety. All the parameters governing yield and quality of cocoon were influenced significantly when the leaf was fed by the larvae. The present investigation revealed that the rearing performance of silkworm was significantly influenced by the leaf variety with vitamin B complex.

The weight of V instar larvae was found to be increased when the worms were fed with vitamin B complex treated mulberry leaves followed by MR2 leaf variety. The feed efficacy of different mulberry feed varieties such as MR2 and vitamin C treated mulberry leaves on larval growth and development was also reported (Chenthilnayaki et al., 2004). Balasundaram et al., (2008) have reported that their study could efficiently be utilized in the feed improvement programme making any project considering larval weight, cocoon weight and pupal weight as a criterion, considering the importance of silk content in any particular feed.

Conclusion

In the present study, the treatment of Vitamin B complex at the concentration of 1.5% may have beneficial effects on the feed efficacy, growth of the silkworm larval, pupal and cocoon weight and shell ratio also increased the quantity of silk production by enhancing the feed efficacy than other concentrations and control. So, this supplementation could be prescribed to the farmers to get more quantity of silk.

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Effect of Different Salinities and Ph on the Growth of Copepods Apocyclops Royi

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The present study was to optimize the growth of Cyclops in different salinities of sea water. The growth of the animals mainly depends on the biological and physiological factors. Copepods are one of the most abundant and diverse food sources for fin fishes and shell fishes. For proper growth and high production suitable conditions are required for their survival. Here the present studies are to investigate the effect of growth of Cyclops in different salinity levels (10, 20, 30,40, 50,60 ppt) and also in different pH levels (6, 7, 8, 9, 10). This experiment was continued for 20th days and it is cultured in 500 ml conical flasks and the Cyclops is fed with microalgae (Pavlova) with cell density of 1.5lakh/ml. The highest significant population growth was achieved in 30ppt were maximum cyclops recorded as 5.6 animals/ml and in pH the maximum number of Cyclops recorded as 7.5animals/ml in pH8. The results concluded that the copepods Apocyclposroyi is capable of withstanding the abrupt changes in salinities but there are limits to tolerance, with an optical level of 30ppt and it is highly significant ($p<0.05$) on the Cyclops population.This salinity level is achieved the highest population growth of Cyclops.

Keywords: Apocyclops Royi, Population Growth, Microalgae and Salinity.

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Aquaculture is one of the fastest-growing worldwide industries that supply animal protein to face the demand of an increasing global population [1]. Copepods constitute an important component of food chain in aquatic systems. The nutritional quality of copepods is accepted to be highly acceptable for larvae prawns and finfishes [17]. Some cyclopoid copepods have a dormant phase in their lifecycle that seems fundamentally identical to diapauses in insects [2]. Marine copepods are a potential source of live feed for marine fish aviculture. Cyclops are tiny copepods or crustaceans that are found in many freshwater and saltwater bodies. The name derived from, the single eye located in the middle of their head. Cyclops range from 0.5 to 5mm long, possess antennae, a segmented body and five pair of legs. The front section of the adult is oval in shape and includes the head as well as five thoracic segments, six thoracic segments, four abdominal segments and two caudal appendages. The cyclops larvae are called nauplii then they attain mysis, zoea, post zoea and adult. They are omnivorous, eating algae and a variety of other microscopic derbis. Females are more abundant than males and have paired egg sacs that are carried at the back of body. When water conditions are ideal, Cyclops will rapidly multiply [8].

Among all the environmental parameters, temperature and salinity have been reported as the major variables affecting copepod species. The salinity significantly affects the population dynamics of the copepod O. rigida [13]. Many authors have reported that the variation in salinity strongly influences population growth, growth rate, composition, survival, and hatching success of several species of marine copepods [2],[5- 7],[9 -12],[14 -16]. The effects of different salinity levels (0–35 ppt) influences the population growth and also influence in different developmental stages of the copepod Apocyclopsroyi [11]. The current study aim is to evaluate the population growth of copepode Apocyclopsroyin under different pH and salilnity levels.

Materials and Methods

Collection of Micro Algae Sample and Mass Culture of Algae

Isolated micro algae were collected from the research centre. The collected algal species are Pavlova sps. The twenty litre capacity glass tank was used for the mass culturing of algae. The tank was washed thoroughly with tap water and washed with soap water. To completely remove the soap solution, the tank was rinsed many times with fresh water. The sea water was enriched with required quantity of Walne's medium. The 10-20% of the inoculums of growing phase were transferred in to the mass culture tank with 15 litres of

medium. Finally, the culture tanks were placed under direct sunlight with continuous aeration.

Collection and Identification of Zooplankton

The samples were collected from the saltpan. The zooplankton collection involves primarily the filtration of water by which using net, and collecting the sample in bottles or in water sample. For identification of zooplankton is very common and abundant forms from particular area, the live specimens are put in a drop of distilled water and examined under the microscope. The zooplankton was closely visualized and observed under the microscope, the desired zooplankton was picked with the help of micropipette individually.

Taxonomic Position of Isolated Apocyclops Royi

Phylum : Arthropoda
Subphylum: Crustacea
Class :Maxillopoda
Subclass :Copepoda
Order :Cyclopodia
Family :Cyclopidae
Genus :Apocyclops
Species :royi

Stock Maintenance and Mass Culture of Apocyclops Royi

Algae were taken from the stock culture and maintained in a proper condition. Algal density (pavlova sps) was estimated by Haemocytometer. Algal density was maintained at 1.5 lakh cells/ml. After isolation, the animals were fed with fresh Pavlova algae at every 12 hours of interval. The culture containing conical flask were changed daily in order to sedimentedfaecal matter. It is continued till the density reaches upto 14individuals/ml. The algal density is maintained. In mass culture 30litres of salt water were taken and filtered then maintained at room temperatureof 28±1°C. The salt concentration was adjusted to 30ppt using refractosalinometer. So, the Cyclops reproduces very fast. Finally, it attains the density of 14 cyclops/ml.

Effect of Different Ph and Salinity on Growth of Cyclops

The Cyclops were collected from the culture and cultivated in different range of pH such as (6,7,8,9 and 10) in different conical flasks. The pH was maintained by adding of sodium hydroxide and hydrochloric acid. The pH was measured by using pH meter. After 20 days the brood pouch was formed. The duration of brood formation fluctuated based on different pH in culturing medium of Cyclops. To increase the number of Cyclops they were reared at different salinities (10, 20, 30, 40, 50 and 60 ppt). 100 cyclops were allowed in 500ml of conical flask containing algal medium. The number of Cyclops were counted every alternative days with the help of 1 ml pipette.

Data Analysis

All analyses were performed using the Real Statistics and Numerical Analysis for Excel (Num XL) tool packs version 2016, embedded on Excel and the results were reported as mean ± S.E and two-way ANOVA results done by a computer.

Results

In order to study the effect of different salinity and pH on the growth of Cyclops were observed and recorded. (Table -1) shows that the population growth Cyclops were studied by subjecting them in to different salinities such as 10, 20,30, 40, 50 and 60ppt. In each salinity range the animals were continuously observed 20 days from the day of inoculation. The animals tested for different salinities were provided with all the optimum parameters except salinity.

In 10ppt the Cyclops recorded for 20 days were 4.0, 4.0, 4.6, 3.1, 2.9, 1.6, 0.6 and 0 animals/ml respectively. In 20ppt the Cyclops were 4.0, 4.0, 4.6, 4.6, 4.0, 3.3, 2.3, 1.6, 0.6, 0.3 and 0 animals /ml for 20 days respectively. In 30ppt the Cyclops were recorded as 4.0, 4.6, 5.0, 5.3, 5.4, 5.6, 3.0, 2.0 and 1.0 animals/ml for 20 days respectively. In 40ppt the Cyclops were recorded as 4.0, 4.3, 4.8, 4.3, 2.0, 1.6, 1.3, 0.3 and0 animals /ml for 20 days respectively. In 50ppt the animals were 4.0, 4.0, 3.0, 2.6, 1.5, 0.5, 0.3, 0, 0 and 0 animals /ml for 20 days respectively. In 60ppt the animals were 4.0, 3.3, 3.0, 2.6, 1.6, 0.1, 0, 0 and 0 animals /ml for 20 days respectively. Among the six tested salinities value the maximum increase in population were observed at 30ppt where the

maximum number of Cyclops recorded was 5.6animals/ml and the declining phase started on 8th day

The role of different pH on the population changes in Cyclops were studied in each pH range, the animals were continuously studied for 20 days from inoculation. The animals tested for different pH were provided with all the optimum parameters except pH. In pH 6 the Cyclops recorded for 20 days were 6.0, 6.0, 6.4, 6.1, 5.4, 4.1, 3.0, 1.0 and 0 animals/ml respectively. In pH 7 the Cyclops were 6.1, 6.0, 6.4, 6.3, 5.9, 5.0, 3.6, 2.2 and 1.0 animals /ml for 20 days respectively.

In pH 8 the Cyclops were recorded as 6.0, 6.6, 7.1, 7.4, 7.5, 7.2, 6.4, 5.2 and 4.9 animals/ml for 20 days respectively. In pH 9 the Cyclops were recorded as 6.1, 6.2, 6.5, 6.4, 6.0, 5.2, 4.0, 3.1 and 2.0 animals /ml for 20 days respectively. In pH10 the animals were 6.0, 6.0, 6.1, 5.9, 5.0, 5.0, 4.2, 2.9 and 0.8 animals /ml for 20 days respectively. Among the five tested pH values, the maximum increase in population were observed at pH 8 where the maximum number of Cyclops recorded was 7.5animals/ml and the declining phase started on 8th day. In most of the pH range the declining phase started on 9th day (Table – 2).

The data obtained on the effect of salinity and pH on population change in cyclops were analysed using two-way ANOVA. The result obtained for this analysis showed salinity and pH had a significant ($P<0.05$) effect on the Cyclops population (Table- 3 and 4).

Table : 1
Effect of different Salinity Levels on the Growth of Cyclops

Days	No. of Cyclops /ml in different salinity(ppt)					
	10	20	30	40	50	60
1	4.0±0.47	4.0±0.47	4.0±0.47	4.0±.0.47	4.0±0.47	4.0±0.47
3	4.0±0.81	4.0±0.81	4.6±1.24	4.3±0.47	2.0±0.81	3.3±0.47
5	4.6±0.47	4.6±0.81	5.0±0.81	4.8±0.47	3.0±0.81	3.0±0.47
7	3.1±0.81	4.0±0.81	5.3±0.47	4.3±0.47	2.6±0.47	2.6±0.47
9	2.9±0.81	3.3±0.47	5.3±0.47	2.0±0.81	1.5±0.47	1.6±0.47
11	1.6±0.47	2.3±0.47	5.4±0.81	1.6±0.47	0.5±0.47	0.1±0.47

13	0.6±0.47	1.6±0.47	5.6±0.47	1.3±0.47	0.3±0.47	0
15	0	0.6±0.47	3.0±0.81	0.3±0.47	0	0
17	0	0.3±0.47	2.0±0.81	0	0	0
19	0	0	1.0±0	0	0	0

Table: 2
Effect of different pH levels on the growth of cyclops

Days	No. of Cyclops/ml in different pH				
	6	7	8	9	10
1	6.0±0.47	6.1±0.24	6.0±.0.47	6.1±0.12	6.0±0.47
3	6.0±0.81	6.0±0.24	6.6±0.47	6.2±0.24	6.0±0.47
5	6.4±0.24	6.4±0.81	7.1±0.47	6.5±0.24	6.1±0.47
7	6.1±0.47	6.3±0.24	7.4±0.47	6.4±0.81	5.9±0.47
9	5.4±0.12	5.9±0.47	7.5±0.81	6.0±0.24	5.0±0.47
11	4.1±0.81	5.0±0.24	7.2±0.47	5.2±0.47	4.2±0.47
13	3.0±0.24	3.6±0.88	6.4±0.47	4.0±0.81	2.9±0.12
15	1.0 ±0.47	2.2±0.81	5.3±0.47	3.1±0.12	0. 8±0.88
17	0.1±0.47	1.0±0.24	4.9±0.12	2.0±0.24	0
19	0	0	0	0	0

Table.3
Effect of Salinity change in Cyclops (Two-way ANOVA)

Source of variation	*SS*	*df*	*MS*	*F*	*P- value*	*F crit*
Salinity	142.0294	10	14.20294	27.19196	7.51E-17	2.026143
Days	54.37894	5	10.87579	20.82203	3.47E-11	2.400409
Error	26.11606	50	0.522321			
Total	222.5244	65				

P< 0.05- Highly Significant

Table: 4
Effect of pH on Cyclops (Two-way ANOVA)

Source of variation	*SS*	*df*	*MS*	*F*	*P- value*	*F crit*
pH	133.1298	8	16.64122	32.11127	3.58E-17	2.244396
Days	32.65244	4	8.16311	15.75172	3.19E-11	2.668437
Error	16.58356	32	0.518236			
Total	182.3658	44				

P< 0.05- Highly Significant

Discussion

The aim of the present study was to optimize the growth of Cyclops on different physical parameters such as salinity and pH. The isolated Cyclops Apocyclposroyi were fed with the microalgae pavlova cultured in a Conway medium. Studying the effects of the salinities on the different growth population parameters, such as population growth and growth rates, of copepod species might clarify the population dynamics in extensive aquaculture ponds or their wild habitats. In addition, a comprehension of ideal salinity could improve copepod productivity in aquaculture environments [11].

In the current study, different salinity levels (10, 20, 30, 40,50 and 60 ppt) were used to determine the optimal salinity level for the population growth, population growth rate, of Apocyclopsroyi. The results showed that the salinity levels significantly affected the population growth, population growth rate, and population growth is high in 30ppt. In the current study showed that after 13th day of culture, the Cyclops cultured in 30ppt of salinity showed the highest significant growth production.growth 5.6±0.47/ml. In contrast, the lowest significant population growth and growth rate were revealed in both the low and high-salinity levels of 5, 10, 15, and 30 ppt. [1], who reported a significantly lower population growth of Cyclopoida copepod, A. royi, was obtained in both the low- and high-salinity levels of 5, 30, and 35 ppt, after a 14-day culture period. [13], who reported that salinity levels strongly influence the population and developmental stages of copepod, O. rigida, with consideration of lower salinity resulting in longer development times. More over the Cyclops in different pH also influence their growth rate, pH 8 were found to be optimum physical factor which help to increase the population and animal size in cyclpos. Our results concluded that the adult copepods, Apocyclopsroyi, were unable to tolerate rapid changes in the salinity from 30 ppt to lower than 15 ppt.

Conclusion

Generally, this experiment has proved the effects of different salinity levels on the different growth population parameters of the copepod species is useful in clarifying its population dynamics in marine aquaculture, as well as defining its feasibility to be utilized as live prey in marine hatcheries. The salinity levels and pH of the culture water significantly influence the population growth, population growth rate, and the percentages of developmental stages of cultured Apocyclopsroyi.

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Phytochemical Analysis of Acalypha Indica (L.) Using Various Solvents

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Acalyphaindica (L.) is the common medicinal plant which belongs to the family Euphorbiaceae. The objective of the present study is to investigate the various phytochemicals from the acetone, ethanol, hexane and aqueous extracts of Acalyphaindica (L.). From the plant extracts, the analysis was carried out to find the presence of the phytochemicals such as amino acids, glycosides, flavonoids, tannins, terpenoids, alkaloids, phenols, steroids, saponins and reducing sugars. When compared to the other extracts, the acetone extract of experimental plant showed the higher number of phytochemicals. The generated data from the different extracts of Acalyphaindica (L.) plant provided the basis for its wide uses in the traditional and folk medicine.

Keywords: AcalyphaIndica (L.), Solvent, Extracts and Phytochemicals.

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India is a varietal emporium of medicinal plants and is one of the richest countries in the world in regard to genetic resources of medicinal plants. It exhibits a wide range in topography and climate, which has a bearing on its vegetation and floristic composition. Moreover, the agroclimatic conditions are conductive for introducing and domesticating a new exotic plant variety (Martins et al., 2001). India is rich in medicinal plant diversity. India is rich in all three levels of biodiversity, as species diversity, genetic diversity and habitat diversity. India has a rich heritage of knowledge on plant-based drugs both for use in preventive and curative medicines. A country like India is very much suited for development drugs from medicinal plants. A large number of these plants grow wild and exploited especially for use in indigenous pharmaceutical houses. Some of these plants produce valuable drugs, which have high export potention (Lawrence, 1964).

The medicinal values of plants lay some substances that produce a definite physiological action on the human body. The most important substances are the bioactive compounds of plants are alkaloids, flavonoids, tannins, phenolic compounds, etc. In recent years, secondary plant metabolites (Phytochemicals), previously with unknown pharmacological activities, have been extensively investigated as a source of medicinal agents (Krishnaraju et al., 2005). Based on the screening methodologies, the therapeutic values of many herbal medicines have already been established. Although, herbal medicines are obtained from natural sources and considered as safe for human beings. On the contrary, they would have some adverse effects due to the presence of other active ingredients (Izzo and Ernest, 2009).

Selvamani and Balamurugan (2015) investigated the preliminary phytochemical analysis of acetone extract of Acalyphaindica (L.) plant. Phytochemical screening of leaves extract revealed the presence of alkaloids, tannins, steroids, saponins, flavonoids, cardiac glycosides and phenolic compounds. Due to the presence of these phytochemical constituents, the medicinal plant possesses antimicrobial activity. The present study is to investigate the qualitative phytochemical constituents of Acalyphaindica (L.) by using various solvents.

Materials and Methods

Fresh plant material of Acalyphaindica L. (Indian Copperleaf) were collected from the location of Poovangaparambu, Kanyakumari District. The plants were identified taxonomically. Acalyphaindica (L.) belongs to the family Euphorbiaceae. It is a common herb growing up to 75cm tall with ovate leaves.

Flowers are green, unisexual found in catkin inflorescence. It occurs widely throughout the tropics of the old world. It also occurs in India, South East Asia and Oceania. It has been introduced to areas of the new world with favourable climates.

The plants were washed and the adhering dirt's were removed and shade dried. The dried parts were stored in sealed and labelled containers for use. The shade-dried powder of plant material of Acalyphaindica (10 g) was macerated separately with 60 ml of sterile distilled water using mortar and pestle. The macerated extracts were first filtered through four layer of muslin cloth and then filtrate was centrifuged at 8,000 rpm for 15 min at room temperature. Supernatant was filtered through Whatman No.1 filter paper and heat sterilized at 120oC for 30 min. The extracts were preserved aseptically in a brown bottle at 4°C until further use (Sukanya et al., 2009).

For the preparation of solvent extracts, 10g of shade-dried powder of plant materials were filled separately in the thimble and extracted with 60ml each of acetone, ethanol and hexane by using a soxhlet extractor for 48hrs and all the extracts were concentrated using rotary evaporator. After complete solvent evaporation, each of the solvent extracts was weighed and preserved at 4oC in air tight bottle until further use. Preliminary phytochemical tests for the identification of amino acids, glycosides, flavonoids, tannins, terpenoids, alkaloids, phenols, steroids, saponins and reducing sugars were carried out for all the extracts by the methods described by Harborne (1973).

Results and Discussion

The phytochemical analysis of Acalyphaindica (L.) using different solvents were studied and the results are shown in the Table 1and Figure 1. The maximum number of compounds (8) were present in the acetone extract. The acetone extracts showed the presence of amino acids, glycosides, flavonoids, tannins, alkaloids, phenols, steroids and reducing sugars. This result was correlated with the result of Prem et al. (2016) reported that the plant leaf extracts of Acalyphaindica (L.) showed an abundant production of phytochemicals as secondary metabolites and they can be used in the pharmaceutical industries for producing a potent drug. The minimum number of compounds (6) were noticed in the hexane and aqueous extracts

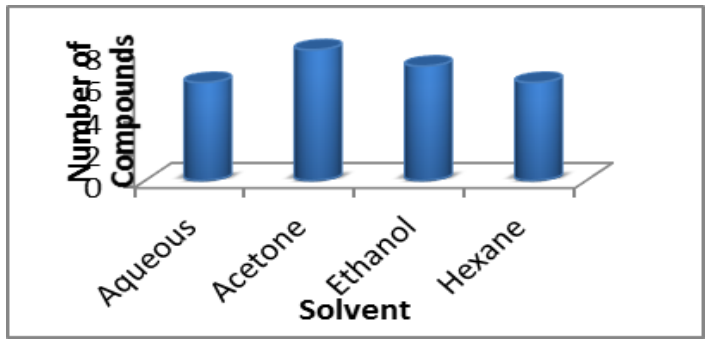
Table - 1

Phytochemical analysis of Acalyphaindica (L.) plant using various solvents

Chemical Constituents	Aqueous extract	Acetone	Ethanol	Hexane
Amino acids	_	+	+	_
Glycosides	++	++	_	+++
Flavonoids	+++	+	_	+
Tannins	_	+++	+	_
Terpenoids	+	_	++	+
Alkaloids	+	+	+	++
Phenols	+++	+	++	+
Steroids	_	+++	++	++
Saponins	+	_	++	_
Reducing sugars	_	+	_	_

Note: (+++) - High (++) - Medium (+) - Low (-) - Absent

Fig.1. Phytochemical analysis of Acalyphaindica (L.) plant using various solvents



Summary and Conclusion

Herbal medicine has become a popular form of health care even though several differences exist between herbal and conventional pharmacological treatments. Several specific herbal extracts have been demonstrated to be efficacious for specific conditions. Even though public do the carry risk of taking allopathic medicine instead of herbal treatments. Phytochemical analysis is very useful in the evaluation of some active biological components of Acalyphaindica L. Results of the analysis showed the presence of most of the secondary metabolites like amino acids, glycosides, flavonoids, tannins, alkaloids, phenols, steroids and reducing sugars. This present investigation revealed that the plant extracts of Acalyphaindica (L.) used as an alternative for curing certain diseases and these plants are proving to be an increasingly valuable reservoir of bioactive compounds of substantial medicinal merits

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A Study on Problems and Prospects of Spices Cultivators

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India is "the land of spices" and the glory of known throughout the world. The various spices cultivate from India, which is cultivated in state of Kerala, Tamil Nadu and Karnataka. The various kinds of spices are grown in our state. The post-harvest losses in grains and horticultural crops have been affected by more problems. The cultivators are practicing various control measures to protect the spices from losses caused by various factors. Hence, it is essential to know the difference grain storage practices followed by cultivators, so that effective storage practices can be recommended to the farmers. Severe incidence of diseases and natural climate, inadequate knowledge, high labour charges also affecting the production and marketing of spices cultivation in Tamil Nadu. This paper highlights with the present status of cultivation of spices and the problems and prospects by the spice's cultivators.

Key words: Spices Cultivation, Export, Spices and Cultivators.

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India being the "Land of spices", is the largest producer, consumer and exporter of the variety of spices in the world. About 60 spices are grown in the country out of 109 spices listed by ISO (International Organization for Standardization). Blessed with varied climatic conditions, almost all the states grow at least one or more spices. The important spices that are cultivated in the country are black pepper, cardamom, ginger, turmeric, chilies, tree spices and a group of seed spices and herbal spices. The states having major share in production of spices are Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Rajasthan, Gujarat, Orissa and Madhya Pradesh. North-Eastern region and Andaman and Nicobar Islands have also been identified as potential for growing spices.

Review of Literature

The Economics Times line Newspaper Report (2018) reveals "Exports of Spices increase in 7.42%" observed that India is one of the Major producers and Exporters of spices and spices products across the world. During 2017 - 2018 spices and spices products values at US$ 10,28,060 million, has been exported from the country as against US$9,47,970 Million in 2017 – 2016, which is increased of 8 per cent. During the period of June -2018 India exported spices worth Rs 1,674 cores as compared to Rs 1502 cores in the same period in 2017. In the same period Garlic registered a growth in value of 705 from the export .the total export of spices increases 5 per cent to reach US$ 278.15 core for 2017 – 2018.

Musthafa (2018) in his article " Growth and structure of spices Export in India" In observation during 2016 -2017 a total of 9,47,790 tons of spices and spices products valued Rs.17664.61 crore (US$ 2633.30 Million) has been exported from the country as against 843,225 tones valued Rs 16238.23 crore (US$ 2482.83 Million) in 2015 -16 registering an increase of 12% in volume, 9% in rupee terms and 6 % in Dollar terms of value as compared to the total export target of spices fixed for the period 2016 -17, total export of spices has exceed the largest in terms of both volume and value.

Sunitha & Ramola Pon Malar (2014) in their article 'A study on production pepper and the problems faced by the producer and traders "In observation that identified with some of the producers and traders from the literature five problems related to production were framed. The problems such as lack of skilled labours, Climate change and high labour cost, diseases to the pepper plant and lack of financial support from the Government are named producers problems. The trader's problems such as inadequate financial facility, lack of monetary support from the government, Inadequate financial

facility, Lack of Monetary support from the government, inadequate financial facilities, price in flucation in the market and implementation of government rules and policies.

Scope of the Study

This present study is confined the problems and prospects of spices cultivators. This state is notable for cultivation of largest area under various spices, particularly chilly, turmeric, and contribution of large shares of these produces. The soil and agro- climatic conditions of the most suitable for growing spices cultivation.

This study has been highlighting the problems and prospects a of the spice's cultivators and area, production, productivity of spices in Tamil Nadu. All the crops are foreign exchange earners to the country and hence very important to the economy. Even slight change in climate has a substantial influence on the agricultural development in the state. Hence, the present study has been made to problems faced by the spice's cultivators in spices cultivation.

List of Spices Cultivated from Tamil Nadu

SI.NO	Name of the spices	Area	Production	Productivity
1	Chilies	58476	31230	0.53
2	Tamarind	19761	63502	3.21
3	Turmeric	33666	169071	5.01
4	Coriander	15977	6315	0.40
5	Cardamom	3650	330	0.09
6	Pepper	2790	343	0.23
7	Curry leaves	2287	514575	225.00
8	Other spices	923	1846	2.00
9	Ginger	864	13867	16.05
10	Clove	719	675	0.94
11	Garlic	330	1954	5.92
12	Mint	215	322.5	1.50

Source: Spices Board, Department ofHorticulture and Plantation Crops

Prospects of Spices Cultivation in Tamil Nadu

A spice may have an extra use, usually medicinal, religious, cosmetic or perfume production or as vegetable. For example, turmeric roots are consumed as a vegetable and garlic as an antibiotic. A condiment is an edible substance added to food to important a particular flavour, enhance its flavor, India produces 70 % of the global production of spices in 2018 Tamil Nadu. In Tamil Nadu a Varity of spices like chilies, Turmeric, Tamarind, Coriander, Cardamom, pepper, curry leaves, and other minor spices like Garlic, Ginger, Clove, mint are grown out of the total Horticulture are (92,2005

Ha) spices occupies 15.12% (139358 Ha) of the area and 5.62% (804331 M.T) of production in the state.

Spices are grown in the variety of climatic condition in the state. Chilies and coriander are the major spices grown in semi and tracts of Thoothukudi, Ramanathapuram Sivagangai, Virudhunagar and Tirunelveli districts and chilies is the major spices export from India. In Western Ghats districts like Coimbatore, Dindigul, Theni, Tirunelveli and Virudhunagar 90% of the cardamom is cultivated. Ginger, Garlic and pepper are the special spices crops grown in Dindigul and The Nilgiri districts. Clove is a unique crop cultivated in 600 H.a in the Rainfall area of Kanyakumari District.

Turmeric the water loving crop extensively cultivated in Erode, Salem, Dharmapuri, Namakkal, Villupuram districts where adequate irrigation water is available. Tamarind and curry leaves in the tree spices grown in the almost all districts except Nilgiri.

Tamil Nadu Contributes 27% of the total exports of spices through Chennai and Tuticorin ports. Tamil Nadu is the largest producer of clove and Tamarind in the country. The Spices board have established Sivagangai spices park in 2008 which is dedicated to Coriander, Tamarind, Chili, Erode-Salam variety of Turmeric and Medicinal plants.

India has exported 62 varieties of spices in its destination countries. Top spices exports from India are Red chili, pepper and turmeric. These varieties of Indian spices exports approximately 70% of the total exports in 2017. Cumin is the most exported spices from India as India did US$212 Million i.e. 39% of the spice's exports from cumin only during April-June 2017. During 2017 -2018 spices and spices products values at US$ 10,28,060 million, has been exported from the country as against US$9,47,970 Million in 2017 – 2016, which

is increased of 8 per cent. During the period of June -2018 India exported spices worth Rs 1,674 cores as compared to Rs 1502 cores in the same period in 2017. In the same period Garlic registered a growth in value of 705 from the export. the total export of spices increases 5 per cent to reach US$ 278.15 core for 2017 – 2018.

Problems of the Spices Cultivators

The spices cultivator can be affected lot of problems. but some problems can be given below.

1) Post Harvest Losses

The post – harvest losses of food grains and oil seeds are estimated to be 10 -20 per cent while that of different horticultural crops vary from 15 to 50 per cent in the developing countries including India. the losses during storage are mainly due to the storage method adopted by the cultivators and management practices adopted by the cultivators. The damage is affecting both quantity and quality of grains. Hence it is essential to know the different grain storage practices followed by the cultivators, so that effective storage practices can be recommended to the cultivators.

2) Diseases

India has the largest area under spices cultivation in the world but its productivity is one of the lowest among major spices producing countries, Diseases such as root rot, viral diseases, little leaf diseases, wrinkled leaf diseases caused by viruses are also becoming increasingly important in recent year because of their widespread occurrence and heavy yield loss the considered very important among diseases affecting spices in Tamil Nadu. At present diseases is widespread causing severe yield loss especially in Kerala in parts of Tamil Nadu in India.

3) Financial Assistance

The most important problem in spices cultivation is the lack of sufficient finance. Eighty-five per cent of the farmers depend on agricultural income for their livelihood. So, the majority of their income went for their own livelihood. This resulted in reducing the level of inputs for proper cultivation of spices. Likewise, the cost of fertilizers doubled recently. The growers have to spend about Rs. 225,00.00 per hectare for replanting and nursing of the new

plants which will start bearing only after a lapse of 18 months or 2 years. Though a subsidy of 20 per cent per hectare is provided by the Spices Board, only 30 per cent of growers get the benefit of it and there is no financial assistance from other agencies.

4) Organic Manure

Organic manure is also used for cultivation spices. The usually used organic manures are Neem cake, waste leaf and such other natural wastes, i.e., earth worm compost.

5) Organic Manure Users

The study reveals that 100 per cent of cultivators are using the organic manure for their cultivation of spices. Most of the growers reported that if manure alone is used next year's production will show a decreasing trend and may also cause loss of their plantation due to several diseases. At the same time growers are aware about the side effect of fertilizers which may cause for different types of diseases for men and decreases the fertility of land etc. They argue that spices cultivation must be transformed into organic manure.

6) Price Fluctuations

Stable and remunerative price is a pre-requisite for increasing production and productivity of any commodity. So far as spices is concerned, farmers are uncertain about the price they can earn from the market. Prices are determined in spices auction. There is absolutely no mechanism to regulate the price. So the wide fluctuations in the market price are very much adversely affecting the cultivation of spices. When price increase farmers concentrate more on this and invest a lot into the farm. But the following year the price may go down and it will lead to high loss of production.

7) Non-Availability of Improved Varieties

Non-availability of high yielding improved varieties of cardamom plants suitable to different areas is another problem. Because of this reason most of the cultivators have to use ordinary planting materials with low productivity for replanting.

8) Absence of Open Market

All most of the farmers are of the opinion that they are not getting reasonable price for their product because of the auction method. The farmers have no voice in deciding the price of their product. They argue that if there is open market it will lead to high price for their product.

9) Labour Problem

Lack of labours and high wages demanded by the labours are other problems faced by the farmers. For marginal farmers, works are done by themselves and for large and small farmers hired labours are needed. But now-a-days, the number of labours is very less and they demand high salary.

10) Unfavorable Weather Conditions

The experience of grower's shows that the most important single factor that influences of production and productivity of spices is climate. The failure of monsoon is highly detrimental to the plants as well as yield. About 90% of cultivators of the studied areas reported that the most important factor that influences production and productivity is climate

Suggestion

Marginal growers should be given crop loan to conduct seasonal operations. Loan should also be provided to growers having no patta. Price of fertilizers should be controlled. Fertilizers and other chemicals used for plant protection should be supplied to the marginal, financially weak and small growers on credit basis and that too at a subsidized rate. Insufficient institutional assistance and awareness also affects the farmers. None of the growers get assistance from any agency other than Spices Board. The reason for not availing the scheme of Spices Board is non-awareness of such scheme. open market must be needed for the spice's products. Many of cultivators indicated migration of agricultural labours while few had indicated inadequate agricultural action plan, some stated unseasonal rains and also natural disasters. Few opined inadequacies in maintaining water levels and improper maintenance.

Maximum number of cultivators had indicated that lack of skilled labour missing in their field which indicates that the labours leave the agricultural field due to insufficiency in their present earnings and also getting

better income than the present farming. Few cultivators indicated the transport facility and cost of transporting their goods. It is recommended that the government shall take initiative to transport their produces at free of cost and help them in avoiding transport crisis and cost factors. It is understood that few of the respondents had agreed about the pricing for their products, while some stated better harvest without tilling, few stated high yield /growth and productivity which are all the positive side for the spice's cultivation for the cultivators.

Conclusion

Spices is the most of the valuable commercial plantation crops in Tamil Nadu. spices on inconvenient natural condition, overdoing chemical fertilizer and pesticide etc often causes low productivity with diseases are mass death. The major reason for spices cultivation affected a problem of diseases. The spices board extension service personal should be more practical in education and brining awareness among growers regarding the scientific dosages and farm management practices. Market information system should be improved so that cultivators could be aware of the auction price, export price and international demand through the spices board field office staff. To overcome the problems of distress sales, they can establish auction centers and also link up with credit at this stage may help them overcome the exploitation by the middlemen.

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The Legacy of Sumerian's

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Sumaria is the earliest known civilization in the historical region of southern Mesopotamia (now southern Iraq), emerging during the Chalcolithic and early Bronze Ages between the sixth and fifth millennium BC. It is also one of the first civilizations in the world, along with ancient Egypt, the Caral-Supe civilization, the Indus Valley civilization, the Minoan civilization, and ancient China. Living along the valleys of the Tigris and Euphrates, Sumerian farmers grew an abundance of grain and other crops, the surplus from which enabled them to form urban settlements.

Keywords: Sumerian, Mesopotamia, Akkadians and Dynasties.

Sumeria was first permanently settled by West Asian people who spoke the Sumerian language a non-Semitic and non-Indo-European agglutinative language isolate. In contrast to its Semitic neighbours, it was not an inflected language. Others have suggested that the Sumerians were a North African people who migrated from the Green Sahara into the Middle East and were responsible for the spread of farming in the Middle East. However, with evidence strongly suggesting the first farmers originated from the Fertile Crescent, this suggestion is often discarded. Alternatively. A recent (2013) genetic analysis of four ancient Mesopotamian skeletal DNA samples suggests an association of the Sumerians with Indus Valley Civilization, possibly as a result of ancient Indus-Mesopotamia relations. According to some data, the Sumerians are associated with the Hurrians and Urartians, and the Caucasus is considered their homeland.

They drained the marshes for agriculture, developed trade, and established industries, including weaving, leatherwork, metalwork, masonry, and pottery. Sumerian civilization took form in the Uruk period (4th millennium BC), continuing into the Jemdet Nasr and Early Dynastic periods. During the 3rd millennium BC, a close cultural symbiosis developed between the Sumerians, who spoke a language isolate, and Akkadians, which gave rise to widespread bilingualism. The influence of Sumerian on Akkadian (and vice versa) is evident in all areas. The Sumerian city of Eridu, on the coast of the Persian Gulf, is considered to have been one of the oldest cities, where three separate cultures may have fused: that of peasant Ubaidian farmers, living in mud-brick huts and practicing irrigation; that of mobile nomadic Semitic pastoralists living in black tents and following herds of sheep and goats; and that of fisher folk, living in reed huts in the marshlands, who may have been the ancestors of the Sumerians.

Ubaid Period

The Ubaid period is marked by a distinctive style of fine quality painted pottery which spread throughout Mesopotamia and the Persian Gulf. The oldest evidence for occupation comes from Tell el-'Oueili'. Environmental conditions in southern Mesopotamia were favourable to human occupation. It appears that this culture was derived from the Samarrian culture from northern Mesopotomia. It is not known whether or not these were the actual Sumerians who are identified with the later Uruk culture.

Uruk Period

Artifacts, and even colonies of this Uruk civilization have been found over a wide area—from the Taurus Mountains in Turkey, to the Mediterranean Sea in the west, and as far east as western Iran. The Uruk period civilization, exported by Sumerian traders and colonists had an effect on all surrounding peoples, who gradually evolved their own comparable, competing economies and cultures. Lumerian cities during the Uruk period were probably theocratic and were most likely headed by a priest-king (ensi), assisted by a council of elders, including both men and women. It is quite possible that the later Sumerian pantheon was modeled upon this political structure. There was little evidence of organized warfare or professional soldiers during the Uruk period, during this period Uruk became the most urbanized city in the world, surpassing for the first time 50,000 inhabitants. The ancient Sumerian king list includes the early dynasties of several prominent cities from this period. The

first set of names on the list is of kings said to have reigned before a major flood occurred. These early names may be fictional, and include some legendary and mythological figures, such as Alulim and Dumizid.

Early Dynastic Period

The syllabic writing started to develop from the early pictograms. The center of Sumerian culture remained in southern Mesopotamia, even though rulers soon began expanding into neighboring areas, and neighboring Semitic groups. The earliest king authenticated through archaeological evidence is Enmebaragesi of Kish (Early Dynastic I), whose name is also mentioned in the Epic of Gilgamesh—leading to the suggestion that Gilgamesh himself might have been a historical king of Uruk. As the Epic of Gilgamesh shows, this period was associated with increased war. Cities became walled, and increased in size as undefended villages in southern Mesopotamia disappeared. The dynasty of Lagash (2500–2270 BC), though omitted from the king list, is well attested through several important monuments and many archaeological finds.

Gutian Period

Following the downfall of the Akkadian Empire at the hands of Gutians, another native Sumerian ruler, Gudea of Lagash, rose to local prominence and continued the practices of the Sargonid kings' claims to divinity. The previous Lagash dynasty, Gudea and his descendants also promoted artistic development.

Population

Uruk, one of Sumer's largest cities, has been estimated to have had a population of 50,000–80,000 at its height; given the other cities in Sumer, and the large agricultural population, a rough estimate for Sumer's population might be 0.8 million to 1.5 million. The world population at this time has been estimated at about 27 million. The Sumerians spoke a language isolate, but a number of linguists have claimed to detect a substrate language of unknown. The archaeological record shows clear uninterrupted cultural continuity from the time of the early Ubaid period (5300–4700 BC C-14) settlements in southern Mesopotamia. The Sumerian people who settled here farmed the lands in this region that were made fertile by silt deposited by the Tigris and the Euphrates.

Some archaeologists have speculated that the original speakers of ancient Sumerian may have been farmers, who moved down from the north of Mesopotamia after perfecting irrigation agriculture there. The Ubaid period pottery of southern Mesopotamia has been connected via ChogaMami transitional ware to the pottery of the Samarra period culture. They were the first to practice a primitive form of irrigation agriculture along the middle Tigris River and its tributaries. The connection is most clearly seen at Tell el-'Oueili near Larsa, excavated by the French in the 1980s, where eight levels yielded pre-Ubaid pottery resembling Samarran ware.

Culture

There is considerable evidence concerning Sumerian music. Lyres and flutes were played, among the best-known examples being the Lyres of Ur. Inscriptions describing the reforms of king Urukagina of Lagash (c. 2350 BC) say that he abolished the former custom of polyandry in his country, prescribing that a woman who took multiple husbands be stoned with rocks upon which her crime had been written. Sumerian culture was male-dominated and stratified. The Code of Ur-Nammu, the oldest such codification yet discovered, dating to the Ur III, reveals a glimpse at societal structure in late Sumerian law. Beneath the lu-gal ("great man" or king), all members of society belonged to one of two basic strata: The "lu" or free person, and the slave (male, arad; female geme).

The son of a lu was called a dumu-nita until he married. A woman (munus) went from being a daughter (dumu-mi), to a wife (dam), then if she outlived her husband, a widow (numasu) and she could then remarry another man who was from the same tribe. Marriages were usually arranged by the parents of the bride and groom; engagements were usually completed through the approval of contracts recorded on clay tablets. These marriages became legal as soon as the groom delivered a bridal gift to his bride's father. One Sumerian proverb describes the ideal, happy marriage through the mouth of a husband who boasts that his wife has borne him eight sons and is still eager to have sex. The Sumerians generally seem to have discouraged premarital sex.[65] Neither Sumerian nor Akkadian had a word exactly corresponding to the English word 'virginity'.

Language and Writing

The most important archaeological discoveries in Sumer are a large number of clay tablets written in cuneiform script. Sumerian writing is considered to be a great milestone in the development of humanity's ability to not only create historical records but also in creating pieces of literature, both in the form of poetic epics and stories as well as prayers and laws.

Although pictures-that is, hieroglyphs-were used first, cuneiform and then ideograms (where symbols were made to represent ideas) soon followed. Triangular or wedge-shaped reeds were used to write on moist clay. A large body of hundreds of thousands of texts in the Sumerian language have survived, including personal and business letters, receipts, lexical lists, laws, hymns, prayers, stories, and daily records. Full libraries of clay tablets have been found. Monumental inscriptions and texts on different objects, like statues or bricks, are also very common. Many texts survive in multiple copies because they were repeatedly transcribed by scribes in training. Sumerian continued to be the language of religion and law in Mesopotamia long after Semitic speakers had become dominant.

Religion

The Sumerians credited their divinities for all matters pertaining to them and exhibited humility in the face of cosmic forces, such as death and divine wrath. Sumerian religion seems to have been founded upon two separate cosmogenic myths. The first saw creation as the result of a series of hieroigamoi or sacred marriages, involving the reconciliation of opposites, postulated as a coming together of male and female divine beings, the gods. This pattern continued to influence regional Mesopotamian myths. Thus, in the later Akkadian Enuma Elish, creation was seen as the union of fresh and salt water, between male Abzu, and female Tiamat. The products of that union, Lahm and Lahmu, "the muddy ones", were titles given to the gate keepers of the E-Abzu temple of Enki in Eridu, the first Sumerian city. Another important Sumerian hierosgamos was that between Ki, here known as Ninhursag or "Lady of the Mountains", and Enki of Eridu, the god of fresh water which brought forth greenery and pasture. At an early stage, following the dawn of recorded history, Nippur, in central Mesopotamia, replaced Eridu in the south as the primary temple city, whose priests exercised political hegemony on the other city-states. Nippur retained this status throughout the Sumerian period.

Deities

Sumerians believed in an anthropomorphic polytheism, or the belief in many gods in human form. There was no common set of gods; each city-state had its own patrons, temples, and priest-kings. Nonetheless, these were not exclusive; the gods of one city were often acknowledged elsewhere. Sumerian speakers were among the earliest people to record their beliefs in writing, and were a major inspiration in later Mesopotamian mythology, religion, and astrology. Sumerian gods were often associated with different cities, and their religious importance often waxed and waned with those cities' political power. The gods were said to have created human beings from clay for the purpose of serving them. The temples organized the mass labour projects needed for irrigation agriculture. Citizens had a labor duty to the temple, though they could avoid it by a payment of silver.

Cosmology

Sumerians believed that the universe consisted of a flat disk enclosed by a dome. The Sumerian afterlife involved a descent into a gloomy netherworld to spend eternity in a wretched existence as a Gidim (ghost).

Temple and Temple Organisation

Ziggurats (Sumerian temples) each had an individual name and consisted of a forecourt, with a central pond for purification. The temple itself had a central nave with aisles along either side. Flanking the aisles would be rooms for the priests. At one end would stand the podium and a mudbrick table for animal and vegetable sacrifices. Granaries and storehouses were usually located near the temples. After a time, the Sumerians began to place the temples on top of multi-layered square constructions built as a series of rising terraces, giving rise to the Ziggurat style.

Funerary Practices

It was believed that when people died, they would be confined to a gloomy world of Ereshkigal, whose realm was guarded by gateways with various monsters designed to prevent people entering or leaving. The dead were buried outside the city walls in graveyards where a small mound covered the corpse, along with offerings to monsters and a small amount of food. Those

who could afford it sought burial at Dilmun. Human sacrifice was found in the death pits at the Ur royal cemetery where Queen Puabi was accompanied in death by her servants.

Agriculture and Hunting

The Sumerians adopted an agricultural lifestyle perhaps as early as c. 5000–4500 BC. The region demonstrated a number of core agricultural techniques, including organized irrigation, large-scale intensive cultivation of land, monocropping involving the use of plough agriculture, and the use of an agricultural specialized labour force under bureaucratic control. The necessity to manage temple accounts with this organization led to the development of writing (c. 3500 BC).

In the early Sumerian Uruk period, the primitive pictograms suggest that sheep, goats, cattle, and pigs were domesticated. They used oxen as their primary beasts of burden and donkeys or equids as their primary transport animal and "woollen clothing as well as rugs were made from the wool or hair of the animals. By the side of the house was an enclosed garden planted with trees and other plants; wheat and probably other cereals were sown in the fields, and the shaduf was already employed for the purpose of irrigation. Plants were also grown in pots or vases."

The Sumerians were one of the first known beer-drinking societies. Cereals were plentiful and were the key ingredient in their early brew. They brewed multiple kinds of beer consisting of wheat, barley, and mixed grain beers. Beer brewing was very important to the Sumerians. It was referenced in the Epic of Gilgamesh when Enkidu was introduced to the food and beer of Gilgamesh's people: "Drink the beer, as is the custom of the land... He drank the beer-seven jugs! and became expansive and sang with joy!"

The Sumerians practiced similar irrigation techniques as those used in Egypt. American anthropologist Robert McCormick Adams says that irrigation development was associated with urbanization, and that 89% of the population lived in the cities. They grew barley, chickpeas, lentils, wheat, dates, onions, garlic, lettuce, leeks and mustard. Sumerians caught many fish and hunted fowl and gazelle.

Sumerian agriculture depended heavily on irrigation. The irrigation was accomplished by the use of shaduf, canals, channels, dykes, weirs, and reservoirs. The frequent violent floods of the Tigris, and less so, of the

Euphrates, meant that canals required frequent repair and continual removal of silt, and survey markers and boundary stones needed to be continually replaced. The government required individuals to work on the canals in a corvée, although the rich were able to exempt themselves.

As is known from the "Sumerian Farmer's Almanac", after the flood season and after the Spring equinox and the Akitu or New Year Festival, using the canals, farmers would flood their fields and then drain the water. Next they made oxen stomp the ground and kill weeds. They then dragged the fields with pickaxes. After drying, they plowed, harrowed, and raked the ground three times, and pulverized it with a mattock, before planting seed. Unfortunately, the high evaporation rate resulted in a gradual increase in the salinity of the fields. By the Ur III period, farmers had switched from wheat to the more salt-tolerant barley as their principal crop.

Art

The Sumerians were great creators, nothing proving this more than their art. Sumerian artifacts show great detail and ornamentation, with fine semi-precious stones imported from other lands, such as lapis lazuli, marble, and diorite, and precious metals like hammered gold, incorporated into the design. Since stone was rare it was reserved for sculpture. The most widespread material in Sumer was clay, as a result many Sumerian objects are made of clay. Metals such as gold, silver, copper, and bronze, along with shells and gemstones, were used for the finest sculpture and inlays. Small stones of all kinds, including more precious stones such as lapis lazuli, alabaster, and serpentine, were used for cylinder seals.
Some of the most famous masterpieces are the Lyres of Ur, which are considered to be the world's oldest surviving stringed instruments. They have been discovered by Leonard Woolley when the Royal Cemetery of Ur has been excavated between from 1922 and 1934.

Architecture

The Tigris-Euphrates plain lacked minerals and trees. Sumerian structures were made of plano-convex mudbrick, not fixed with mortar or cement. Mud-brick buildings eventually deteriorate, so they were periodically destroyed, leveled, and rebuilt on the same spot. This constant rebuilding gradually raised the level of cities, which thus came to be elevated above the

surrounding plain. The resultant hills, known as tells, are found throughout the ancient Near East.

According to Archibald Sayce, the primitive pictograms of the early Sumerian (i.e. Uruk) era suggest that "Stone was scarce, but was already cut into blocks and seals. Brick was the ordinary building material, and with it cities, forts, temples and houses were constructed. The city was provided with towers and stood on an artificial platform; the house also had a tower-like appearance. It was provided with a door which turned on a hinge, and could be opened with a sort of key; the city gate was on a larger scale, and seems to have been double. The foundation stones-or rather bricks-of a house were consecrated by certain objects that were deposited under them."

The most impressive and famous of Sumerian buildings are the ziggurats, large layered platforms that supported temples. Sumerian cylinder seals also depict houses built from reeds not unlike those built by the Marsh Arabs of Southern Iraq until as recently as 400 CE. The Sumerians also developed the arch, which enabled them to develop a strong type of dome. They built this by constructing and linking several arches. Sumerian temples and palaces made use of more advanced materials and techniques, such as buttresses, recesses, half columns, and clay nails.

Economy and Trade

Discoveries of obsidian from far-away locations in Anatolia and lapis lazuli from Badakhshan in northeastern Afghanistan, beads from Dilmun (modern Bahrain), and several seals inscribed with the Indus Valley script suggest a remarkably wide-ranging network of ancient trade centered on the Persian Gulf. For example, Imports to Ur came from many parts of the world. In particular, the metals of all types had to be imported.

The Epic of Gilgamesh refers to trade with far lands for goods, such as wood, that were scarce in Mesopotamia. In particular, cedar from Lebanon was prized. The finding of resin in the tomb of Queen Puabi at Ur, indicates it was traded from as far away as Mozambique.

The Sumerians used slaves, although they were not a major part of the economy. Slave women worked as weavers, pressers, millers, and porters.

Sumerian potters decorated pots with cedar oil paints. The potters used a bow drill to produce the fire needed for baking the pottery. Sumerian

masons and jewelers knew and made use of alabaster (calcite), ivory, iron, gold, silver, carnelian, and lapis lazuli.

Trade with the Indus Valley

Evidence for imports from the Indus to Ur can be found from around 2350 BC. Various objects made with shell species that are characteristic of the Indus coast, particularly Trubinella Pyrum and Fasciolaria Trapezium, have been found in the archaeological sites of Mesopotamia dating from around 2500–2000 BC. Carnelian beads from the Indus were found in the Sumerian tombs of Ur, the Royal Cemetery at Ur, dating to 2600–2450. In particular, carnelian beads with an etched design in white were probably imported from the Indus Valley, and made according to a technique of acid-etching developed by the Harappans. Lapis lazuli was imported in great quantity by Egypt, and already used in many tombs of the Naqada II period (c. 3200 BC). Lapis lazuli probably originated in northern Afghanistan, as no other sources are known, and had to be transported across the Iranian plateau to Mesopotamia, and then Egypt.

Several Indus seals with Harappan script have also been found in Mesopotamia, particularly in Ur, Babylon and Kish. Gudea, the ruler of the Neo-Summerian Empire at Lagash, is recorded as having imported "translucent carnelian" from Meluhha, generally thought to be the Indus Valley area. Various inscriptions also mention the presence of Meluhhatraders and interpreters in Mesopotamia. About twenty seals have been found from the Akkadian and Ur III sites, that have connections with Harappa and often use Harappan symbols or writing.

The Indus Valley Civilization only flourished in its most developed form between 2400 and 1800 BC, but at the time of these exchanges, it was a much larger entity than the Mesopotamian civilization, covering an area of 1.2 million square meters with thousands of settlements, compared to an area of only about 65.000 square meters for the occupied area of Mesopotamia, while the largest cities were comparable in size at about 30–40,000 inhabitants.

Military

The constant wars among the Sumerian city-states for 2000 years helped to develop the military technology and techniques of Sumer to a high level. The first war recorded in any detail was between Lagash and Umma in c.

2450 BC on a stele called the Stele of the Vultures. It shows the king of Lagash leading a Sumerian army consisting mostly of infantry. The infantry carried spears, wore copper helmets, and carried rectangular shields. The spearmen are shown arranged in what resembles the phalanx formation, which requires training and discipline; this implies that the Sumerians may have made use of professional soldiers.

The Sumerian military used carts harnessed to onagers. These early chariots functioned less effectively in combat than did later designs, and some have suggested that these chariots served primarily as transports, though the crew carried battle-axes and lances. The Sumerian chariot comprised a four or two-wheeled device manned by a crew of two and harnessed to four onagers. The cart was composed of a woven basket and the wheels had a solid three-piece design. Sumerian cities were surrounded by defensive walls. The Sumerians engaged in siege warfare between their cities, but the mudbrick walls were able to deter some foes.

Legacy

Evidence of wheeled vehicles appeared in the mid-4th millennium BC, near-simultaneously in Mesopotamia, the Northern Caucasus (Maykop culture) and Central Europe. The wheel initially took the form of the potter's wheel. The new concept led to wheeled vehicles and mill wheels. The Sumerians' cuneiform script is the oldest (or second oldest after the Egyptian hieroglyphs) which has been deciphered (the status of even older inscriptions such as the Jiahu symbols and Tartaria tablets is controversial). The Sumerians were among the first astronomers, mapping the stars into sets of constellations, many of which survived in the zodiac and were also recognized by the ancient Greeks. They were also aware of the five planets that are easily visible to the naked eye.

They invented and developed arithmetic by using several different number systems including a mixed radix system with an alternating base 10 and base 6. This sexagesimal system became the standard number system in Sumer and Babylonia. They may have invented military formations and introduced the basic divisions between infantry, cavalry, and archers. They developed the first known codified legal and administrative systems, complete with courts, jails, and government records. The first true city-states arose in Sumer, roughly contemporaneously with similar entities in what are now Syria and Lebanon. Several centuries after the invention of cuneiform, the use of writing expanded beyond debt/payment certificates and inventory lists to be applied for the first

time, about 2600 BC, to messages and mail delivery, history, legend, mathematics, astronomical records, and other pursuits. Conjointly with the spread of writing, the first formal schools were established, usually under the auspices of a city-state's primary temple.

Conclusion

The Sumerian city-states rose to power during the prehistoric Ubaid and Uruk periods. Sumerian written history reaches back to the 27th century BC and before, but the historical record remains obscure until the Early Dynastic III period, c. 23rd century BC, when a now deciphered syllabary writing system was developed, which has allowed archaeologists to read contemporary records and inscriptions. The Akkadian Empire was the first state that successfully united larger parts of Mesopotamia in the 23rd century BC. After the Gutian period, the Ur III kingdom similarly united parts of northern and southern Mesopotamia. It ended in the face of Amorite incursions at the beginning of the second millennium BC. The Amorite "dynasty of Isin" persisted until c. 1700 BC, when Mesopotamia was united under Babylonian rule. The Sumerians were eventually absorbed into the Akkadian (Assyro-Babylonian) population.

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Prelude to the Hidden History of Kumari Kandam

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Prehistoric studies in India, in its strict sense, had its beginning in 1863. Robert Bruce Foote had discovered the first Palaeolithic implements from Pallavaram in Madras in 1916. Since then hundreds of prehistoric sites have been discovered from various parts of India. Even though Indian archaeologists have achieved tremendous progress in unraveling the rich prehistoric cultural heritage of our country till recently certain regions were rather neglected in such studies. Kumari Kandam was one such region which did not figure till 1974 in the prehistoric studies due to the non-discovery of any Palaeolithic evidences from the region. It is, however, satisfying to note that some of the earlier archaeological discoveries in India include certain finds from Kumari Kandam such as the Megalithic burials, ancient pottery, the Neolithic tool, a few quartz flakes along with a fragment of Neolithic Celt besides the Stone Age carvings, Urn burials, Rock-cut cave tombs, Rock-cut caves, and a few Mesolithic implements. Besides these discoveries no remarkable progress had been made in the prehistoric studies of Kumari Kandam till 1974, and the region remained a lacuna in the prehistoric map of India.

Keywords: Revolutionary, Clutches, Elaborate and Hidden History.

Kumari Kandam has its prehistoric studies since 1974 and till then the region was considered as sterile in the case of Palaeolithic habitation. The non-discovery of any Stone Age evidences from this region was mainly due to the blind acceptance of certain hypotheses put forward by Robert Bruce Foote as far back in 1863. According to him the inhospitable environmental situations like heavy rainfall, impenetrable forests, dissected terrain, absence of quartzite,

etc. might have affected the region less attractive comparing the other regions in India. These opinions, rather untested hypothesis, hindered the Indian Archaeologists from surveying this coastal belt along with Lemuria Continent. Such a situation has been changed since 1974 due to the discoveries of several prehistoric cultural evidences of both the Pleistocene and Holocene periods.

There was a lull in the prehistoric research in South India, especially in Kumari District for over a century and the monotone was broken when Dr. Immanuel had discovered the first Palaeolithic implements from Athencode in 2010. This was the first Palaeolithic discovery from Kumari and since then several Stone Age sites have been discovered from Tamil Nadu. Studies conducted by his team since 1974 have laid a strong foundation for further Archaeological research in Kumari Kandam.

Explorations in various parts of Kumari District since 1974 have resulted in the discoveries of ten Palaeolithic sites – Citharal, Athencode, Thengapatinam, Kapukkadu, Kadiappatinam, Kurumbanai, and Eranial. These sites are located in the river basins of Palayaru and Puthanaru flowing in the taluks of Kalkulam and Villavancode in Kanyakumari District. In attempting to look back upon our own history in 20th century, the first essential would appear to be the marking of a few of the more salient features of Kumari Kandam. This will give us perspective; and whatever imperfection there may be in detail, it will make the whole presentable. If, at this distance, we take a retrospect, the history of India of the Lemurians would appear, like our own Himalayas at a great distance, all smooth but for a few peaks of commanding height. 'Happy is the nation whose annals are a blank' and if we can derive comfort from this seeming blankness, we shall perhaps be in a delusion. I shall attempt, therefore, to present in outline the outstanding features of Lemuria with a view to clothing these later on to make them as presentable looking as we may.

One of the greatest efforts of the explosion of knowledge in twentieth century is the revolutionary development towards the approach in research on social science. Serious studies in the Tamil tradition through folklore and writings as the lost continent of Kumari had its beginning only a few decades ago. However, the progress achieved in recent decades is remarkable and could unravel the hitherto unknown culture of the region. These study-results are strong enough to unlock the Lumeria continent out of the clutches of the legends and literatures and above all from the untested hypothesis put forward by Robert Bruce Foote as far back in 1863. The word "inhospitable environment" of R. B. Foote which encompasses several negative aspects unsuitable for human habitation are not seen anywhere in the lost continent

even in the present context irrespective of cruel interference of modern human habitation.

There is lot of references in Kalittokai and Silappathikaram etc. to submerged land areas to the south of Kanyakumari. They are only an attestation of the actual submersion of the continental shelf millennia age. Kalittokai 104, Cilappathikaram, Katukankathai and Ilampuranar (C – 10th century AD) the earliest commentators on Tholkappiyam mentioned the loss of land due to submersion by sea of lands to the south of Kanyakumari. The post – 10th century commentators like the commentator of Iraiyanar Akapporul and Adiyarkkunallur elaborate this further, with possibly some hyperbole. Among the scholars who have discussed the implications of this Tamil flood legend were S. Somasundara Bharathi (1913), V. J. Tambi Pillai (1913), Maraimalaiyadigal (1930), A. S. VaidyanathaIyer (1929), J. Periyanayagam (1940), Father Heras (1954), V. T. Chellam (1984) and S. Padmanabhan (2021). They think the legend of Manu's flood in Satapatha Brahmana and that even the Sumerian flood legend is ultimately derived from this original Tamil flood legend.

In the last decades of the 19th century, historians and others posited a large continent Lemuria in the Indian Ocean which later subsided. Now it is axiomatic with Scientists that no large land mass of continental proportions ever subsided. The current theory of Continental drift and Plate Tectonics however admits that at the end of the last ice age (circa 10000 BP) the continental shelf (extending under the sea upto two or three hundred miles from the present sea shore) got flooded by sea. Suring the heyday of the hypothesized Lemurian continent theory, some Tamil scholars began to refer to the submerged land area, south of Kumari, as the Lemurian continent. But even then cautious scholars like S. Somasundara Bharathi, MayilaiSeeni Venkataswami and Tamil Nadu historian Mainani V. T. Chellam were careful to indicate that the land submerged south of Kumari could have been of a modest area. Ks. Appadurai and Dr. S. Padmanabhan also was careful to use the term 'Kadalkonda Thennadu'.

Harping on the momenclature Lemuria, Sumathi Ramaswamy has, in her Fabulous Geographies, Catastrophic Histories: The Loss of Lemuria poked fun at the expense of Tamil ideologues. No doubt the nomenclature Lemuria was untenable after the 1950's. But she has forgotten that many books have been realistic enough to say that the Kadal Konda Tennadu mentioned in Kalithokai, Cilappatikaram and by later commentators could have been of modest proportions. "Nadu" need not mean a country; there are 2 or 3 nadus in one taluk; and the submerged 49 nadus need not have been of continental

proportions. Ramanathan in 1998 and 2003 has shown how the Tamil traditions of submerged areas to the south of Kumari can be validated in the light of contemporary ideas of submersion of Continental shelf about 10000 BC.

But the latest tirade of this author is in tune with her earlier "Remains of the race: Archaeology, nationalism and the yearning for civilization in the Indus Valley" in which she conveniently bypassed the views of Kamil V. Zvelebil, AskoParpola and others and poured scorn on the heads of Dravidianist scholars by baseless allegations of misrepresentation, misappropriation and enormous abuse of archaeological and historical knowledge.

Scientific studies in the region clearly proved more or less a similar environment of today without any drastic climatic change since the early Quaternary. Ecology of Lemuria is one of the richest unlike any other regions in the country. Therefore, the appearance of the earliest human species in this universe remains a bone of contention which requires more scientific study with the help of all other auxiliary sciences. It seems that the land of Lemuria might be the place where the earliest human species first appeared on this earth. The land of Lumeria situated between Madagascar and South India remained the cradle of human civilization where the man originated and developed to the stature of Lemurians and Jambavans.3 The land bridge between India and Africa might have reached up to Antarctica. It was like an Indo-African continent which remained the homeland of Proto-Dravidians. It represented a period long before the prehistoric period even earlier to the Palaeolithic Age. These places, especially the submerged areas should undergo archaeological excavations. The human beings inhabited in these areas were the earliest people in this Universe.

The original inhabitants of the Lemurian continent migrated to other parts of world and established civilizations on the banks of river Indus, Euphrates, Tigris, Nile, Yanglse, etc. The geographical and ecological factors changed the native colour and behaviour of the people at different regions of their settlement. As a result, the primitive people who migrated to other parts of the world lost their identity with the people of the land, Lumerians and further they adjusted calamities like earthquake and floods the erstwhile land known as Jampudeep, the island of Jampus and Kumari Kandam lost their identity and parcelled itself into several territorial segments.

There is an old, persistent Tamil tradition about a land that existed south of India called Kumari Kandam, a belief that is linked to the lost land of Lemuria, a figment of Western imagination. Accounts of the lost continent

vary, but the common theme is that a large area went under the ocean as a result of geological cataclysms, a theory that geologists of today do not subscribe to the common ancestor's native home of the Tamils and the aborigines of Africa, Australia and other Pacific islands. The ancestors must have been in the lost Lemuria or Kumara continent.

There are a number of traditions and stories on flood and northward or north-westward migration of people from Indian Ocean or its nearby regions. The story of Gilgamish in Mesappotamia, story of Manu in Bhagavathapurana and story of Oenness in Ediru recorded past memories of flood and northward migration of people. Traditions recorded in Sangam literature tell a northward migration from Lemuria continent.4 The Sangam works of Kalithokai and Kurunthokai mentioned the last continent of Kumari. The River Pathuruli in Kumari continent is also mentioned in Purananuru. The ancient literary works Aindiram and Tholkappiyam which were released in the first and second Tamil Sangams respectively held in the lost continent of Kumari.

The discovery of the first Palaeolithic from Pallavaram in 1863 by Robert Bruce Foote and his subsequent work in different parts of Tamil Nadu, Karnataka, Andhra and Gujarat had brought to light the rich Prehistoric evidence of India.6 He discovered various types of stone age tools from different parts of Tamil Nadu. He proved that the last Ice Age had a profound influence on the prehistory of humankind. So in prehistoric studies of coastal areas, it is crucial to understand the consequence of changes in the sea level. About 14,500 years ago, the sea level was lower by 100 metres. With subsequent global warming and melting of large masses of ice, the level started rising, in stages.7 As the sea level rose, the low-lying lands in the coastal region and the exposed continental shelves were inundated.

Lemuria is the name of a continent purported to have been in the Indian and Pacific Oceans. The lost continent derives its name from the primate lemur belonging to the group prosimians. Lemurs now inhabit Madagascar island, the surrounding smaller islands and Comoros island. The term lemur comes from the Latin word "lemurs", meaning spirits of the night, a reference to many species of lemur that are nocturnal and so have large reflective eyes. Their distribution once extended from Pakistan to Malaya. The English geologist Philip Sclater (1864) coined the term Lemuria in his article 'The Mammals of Madagascar'. Trying to explain the presence of fossil lemurs in Madagascar, he proposed that the Indian Ocean, Island and India had once been part of a larger continent, Lemuria.8 His theory was put forward before the concepts of continental drift and plate tectonics provided the explanations

for the similarity and distribution of formations and fossils in different strata and continents.

During the 19th century, scientists frequently postulated the presence of submerged land masses in order to account for the present distribution of species. As Lemuria gained some acceptance within the scientific community, it began to appear in the works of scholars such as Ernst Heinrich Haeckel (1834-1919), a German biologist who promoted the work of Charles Darwin in Germany. Haeckel suggested that there was a land bridge that remained above water long enough to facilitate the migration of prosimians from Africa into India and the Malay peninsula.

According to the teachings of the Theosophical Society, human beings evolved through seven successive root races, each of which populated and occupied different continents. Lemuria was occupied by the third root race called Lemurians, who were primitive beings.9 Subsequently, the more advanced inhabitants of Atlantis, called Atlanteans, replaced them. Aryans, the descendants of Atlanteans, were the fifth root race and were considered the pinnacle of evolution.In 1931, Harvey Spencer Lewis, the founder of the mystical society called the Rosicrucians, wrote on the evolution of Lemurians in his book 'Lemuria: the Lost Continent of the Pacific'. Maps of the lost land were produced by taking the idea from the palaeo continent of Gondwana, which existed long before the advent of humanity.

K. Appadurai, in his book 'Kumari Kandam' Allathu Kadal Konda Thennadu (Kumari Continent or the Submerged Southern Land, 1941) begins to permeate historic knowledge of Lemuria. The term Lemuria found its way into certain Tamil textbooks and was given the Tamil name Kumari Kandam, or continent of Kumari. Names from Tamil classics were given to the mountain ranges, rivers, places and areas. For example, the puranic geography of an axial mountain called Meru as the centre of Jambudvipa (Sanskrit) or Navalan Theevu (Tamil) was accepted, and, later on, these names were attributed to certain parts of Lemuria, giving it acceptability among Tamil readers. In the 1920s, with Tamil revivalism and the efforts to counter the Aryan and associated Sanskrit dominance, the concept of Lemuria was wedded to the notion of the lost land referred to in Tamil literature.

There are a few references in Tamil Sangam classics to a landmass that was swallowed up by the sea. Historians consider the first three centuries A.D. as the Sangam period. The reference to the tradition about three Tamil Sangams (assemblies or academies) is noted in Iraiyanar Kalviyalurai, attributed to Nakeerar. According to this commentary, the Pandya kings

patronised Tamil poets in their capital, where the Sangam was located. According to tradition, the MudalSangam (first assembly), was located in Thenmadurai. When the sea swallowed Thenmadurai, the capital was shifted to Kapatapuram and the second or Idai Sangam was established. The IdaiSangam functioned until a deluge destroyed Kapatapuram. After the deluge, the Pandyas shifted their capital to the present-day Madurai where the last or KadaiSangam was established.10

Some of the important references from Tamil Sangam classics are as follows: 1) in Purananuru 9, verses 10-11 are interpreted as a reference to a Pandya king who ruled a part of the lost land where the river Pahruli flowed. 2) in Silapathigaram (KaduKaanKaathai) (11:17-22) is a reference to a Pandya king who won over kingdoms in Imayam (the Himalayas) and Gangai (the Ganga) to compensate for his land lost to the deluge. Tamil scholars such as DevaneyaPaavaanar consider the deluge under reference to be the one that destroyed Thenmadurai. 3) According to AdiyarkuNallar, poem 104:1-4 from MullaiKalithogai indicates that the Pandya king resettled the survivors of the deluge in certain Chera and Chola territories. It is portrayed by certain Tamil writers that the series of deluges destroyed the Tamil civilisation and the survivors spread out and civilised other parts of the world.

The Tamil tradition about a lost land was committed to writing after the 10th century by commentators like Nakeerar in his commentary on Iraiyanar Akapporulurai. Nachinarkiniyar and Adiyarku Nallar followed him. Those who wrote the commentaries exaggerated the extent of land that was submerged by the deluges referred to in Silapathigaram and Kalithogai. According to the commentators, there were 49 countries (nadu) in the lost land of Kumari and the distance between the river Kumari and the river Pahruli that flowed in the lost land was 700 katham, which according to one calculation is about 770 km.

The crucial question is whether the land referred to as Kumari was as large as a continent? The advocates of Kumari Kandam interpreted the term nadu to mean country. In Tamil Nadu and Kerala many small towns and villages have in their names the term nadu, which basically referred to a settlement, as opposed to kadu, or forest. In the above Tamil references there is no mention of the term kandam, referring to land the size of a continent.

According to Pingala Nikandu, a lexicon of ancient words, kandam means country. In the words of the historian N. Subrahmanian (1996), It is possible that a small area of land (to the extent of a present-day district) was lost by sea erosion and Pahruli and Kumari were parts of that territory and that the king shifted this capital to some other place. But in all probability that

event occurred only in the 5th or 4th century B.C. Such erosions on a limited scale were not unknown to the southern and eastern seaboards of Tamil Nadu. If the fiction is removed from the fact, the entire romantic superstructure called the theory of the KumariKandam will stand exposed, as non-history.11

If the oral traditions and the subsequent writings exaggerated the size of the submerged land called Kumari, what was the background to the lost land referred to in Sangam literature?Dramatic geological events were attributed to catastrophes like earthquakes and volcanic eruptions. Eventually, the understanding of phenomena such as plate tectonics, continental drift and sea floor spreading dismissed the catastrophe theories. The speculation about land bridges and lost continents faded into obscurity elsewhere in the world but not quite so in Tamil Nadu. Since the early part of the last century major strides have been made in the geological and geophysical understanding of the earth. For instance, in 1912 Alfred Wegener, a German meteorologist, explained the concept of continental drift; in 1924, the British geologist Arthur Holmes explained that the convection current in the mantle could cause continents to drift; in 1962, the American Geologist Harry Hess pointed out that continental drift could be explained by sea-floor spreading; in 1966, the concept of sea-floor spreading was established by independent oceanographic data involving microfossils, sediments of the sea floor, measure of heat flow from the earth's interior and palaeo-magnetic and seismic studies.

Since the first oceanic sounding in 1840, the study of oceans, including their chemistry, biology, geology and physics, has advanced in the last century. Improved coring devices have enlarged our knowledge of the oceans, and deep ocean floors have been mapped by echo-soundings and ultra-sonic signals. In the 1940s, seismic methods were also used to study the ocean floor. Evidence of former glaciations on a wide scale became overwhelmingly conclusive in the last century. During the past two million years, there have been five major glacial advances and five glacial retreats as the globe began to warm. The last of such periods is the present period known as Holocene. The last Ice Age caused the fragmented distribution of Homo sapiens, and the enormous environmental changes that took place with global warming had a profound influence on the prehistory of humankind.

Extensive studies were done to understand global warming during the interglacial periods; sediments were subjected to meticulous analyses to establish the age and palaeo-geographical conditions in many parts of the world. For instance, about 18,000 years ago, during the time of the last Ice Age, ice sheets in the poles spread much wider and the sea level was more than 100 metres lower than it is today, exposing a large area of land along the

continental shelf. Then Siberia was connected to Alaska and along this land bridge, the peopling of the Americas and migration of animals happened over a long period. At this time, the landmass of present-day Papua New Guinea, Australia and Tasmania were joined together as were the British Isles with Europe. After the last Ice Age, the level of the Indian Ocean, like the rest of the oceans, fell. Sri Lanka was connected to the Indian peninsula by a landmass, which now lies under the Gulf of Mannar. In the following 8,000 years, global warming continued and large masses of ice and glaciers melted, raising sea levels in stages and inundating low-lying lands.12 The portion of the continental shelf of the south Indian peninsula and the land that connected it to Sri Lanka also went under water as the sea level rose.

Records of sea-level fluctuations and related climatic changes are preserved in the layered sediments of the seabed. These can be studied through data such as faunal contents and nature of sediments. Rajiv Nigam and N.H. Hashimi of the National Institute of Oceanography (NIO), Goa, have done extensive work on sea-level rise by analysing sediments for microfossils such as pollen and foraminifera to determine palaeo-climate and by dating corals from the continental shelf in the west coast of peninsular India. The team studied marine sediments to generate proxy climate records through which changes in palaeo sea levels could be deciphered.

Nigam and P.J. Henriques, also of the NIO, have developed a regional model for palaeo depth determination on the basis of percentage of foraminifera in surface sediments of the Arabian Sea. The significant results of the study on palaeo sea levels are that the sea level was lower by 100 m about 14,500 years ago and by 60 m about 10,000 years ago and that during the last 10,000 years there had been three major episodes of sea-level fluctuation. These sea-level changes had affected human settlements and peopling of the coastal areas and had left their signatures on archaeological events.

Once the status of the periodic sea-level rise was established, it was easy to decipher the configuration of the coastline, giving allowance wherever applicable to tectonic activities and deposition of silt at the confluence of rivers. The Naval Hydrographic Office, Dehra Dun, has produced hydrographic charts (INT 717071-1986 to the scale 1:10,000,000 and INT 7007706-1973 of scale 1:3,500,000) pertaining to Cape Comorin-Gulf of Mannar, where it surveyed the depth of the sea floor with echo-sounders, which measure the sea floor contours with great accuracy.

It is possible to demarcate the land lost to the sea in the south of India from postglacial inundation maps that indicate the significant changes in the

coastline. The author has prepared inundation maps on the basis of bathymetric contours and the sea-level curve for the central west coast to work out the configuration of the coastline south of India since the last Ice Age. This study shows that about 14,500 years ago the sea level was lower by approximately 100 m than the present sea level. The land between the present coast and the bathymetric contour of 100 m roughly was the land that was exposed during that time.

In other words, hypothetically, if a 100 m column of sea water were to be removed, the land that went under water would be exposed. At that time the present Gulf of Mannar was a landmass of 36,000 sq. km connecting Sri Lanka with peninsular India and the coast was wider by about 80 km to the east, south and west of present-day Cape Comorin exposing a triangular mass of 6,500 sq. km adjoining the Cape. The coastline was 25-35 km wider than the present near Cuddalore and about 25 km wider near Colombo.

The increased rate of global warming between 12,000 and 10,000 years ago saw the sea level rise almost 50 m, inundating low-lying lands and covering a major part of the exposed continental shelf. About 10,000 years ago, the sea level was about 50 m lower than the present sea level. At that time, the land extended about 25 km south of the Cape and the coast was about 40 km broader than the present coastline along the east and the west, which exposed about 1,000 sq km of land near Cape Comorin. Rameswaram and Mannar were joined by land and the land that extended in the present-day Gulf of Mannar was a 2,500-sq km stretch marked by sedimentary formations and coral reefs.

S.C. Jayakaran prepared the map on the basis of bathymetric contours and the sea-level curve for the central west coast to work out the configuration of the coastline south of India since the last Ice Age. It shows that about 14,500 years ago the sea level was lower by about 100 m than the present. The land between the coast now and the bathymetric contour of 100 m was the land that was exposed then.

As the research of Rajiv Nigam indicated, sea levels continued to rise and reached the present level around 6,000 years ago. This is about the time Sri Lanka evolved as an island. Between 4,000 and 3,500 years ago, heavy rains, in addition to melting of snow, also contributed to the sea level rise. It rose by a couple of metres and fell to the present level about 2,000 years ago.As the sea levels rose, resulting in periodic flooding and deluges, prehistoric settlements that were located in the low-lying coastal lands and the exposed continental shelf were inundated. The people who lived in the coastal area of the Indian peninsula and Sri Lanka and who escaped the deluges

perpetuated the oral tradition of a lost land. It is considered that it is the development that gave rise to the land of Kumari Kandam. It has its prehistoric studies since 1947 and till then the region was considered as sterile in the case of Palaeolithic habitation. The study has proved beyond doubt that region had been inhabited by the early man.

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Myth and Facts: Lemuria A Review of Literature

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For most people, continents are Earth's seven main large landmasses. But geoscientists have a different take on this. They look at the type of rock a feature is made of, rather than how much of its surface is above sea level. In the past few years, it is seen an increase in the discovery of lost continents. Most of these have been plateaus or mountains made of continental crust hidden from our view, below sea level. One example is Lemuria continent or the Kumarikkandam, the world's eighth continent that extends underwater in Indian Ocean. Several smaller lost continents, called micro continents, have also recently been discovered submerged in the eastern and western Indian Ocean. In Tamil mythology, Kumari Kandam is a mythical continent, believed to be lost with an ancient Tamil civilization, supposedly located south of present-day India in the Indian Ocean. Alternative names and spellings include Kumarikkandam and Kumari Nadu. This research tries to explore the myths and facts about Lemuria continent or the Kumarikkandam through various literatures.

Keywords: Lemuria Continent, Kumarikkandam, Lemur and Indian Ocean.

A new study in the British journal Nature Communications recognizes additional samples of the volcanic rock zircon of up to 3 billion years old, providing additional evidence to support the underwater continent's discovery. A comparatively young island, Mauritius is only a few million years' old–rocks that much older would have to belong to a continent. In the most recent study, researchers found the zircon in solid rock, not just in the beach sand, addressing a criticism of the initial study asserting that the mineral could have washed ashore from another, existing continent.

A group of scientists from Norway, Germany, South Africa and the U. K. have discovered a submerged continent in the Indian Ocean. In deep oceans the thickness of Earth's crust, which forms the upper layer of the planet and protects us from the extremely hot magma underneath it, is about seven km. But underneath Mauritius and leading to Seychelles, which is more than 1,000 km away, there were large chunks of the crust that were as thick as 30 km. it shall not be certain about the origins of the zircons but when combined with the evidence of thicker crusts in such big parts of the ocean floor, it can be quite certain that a small continent existed underneath Mauritius.. There are a number of popular myths about submerged continents

Figure: 1 Geographical Map of Kumarikandam

For instance, in the 19th century Lemuria, a large submerged continent in the Indian Ocean, was considered to extend from Antarctica to Kanyakumari. But it's claimed existence did not stand the test of science. The Earth's crust consists of seven or eight major "plates", which but slowly is constantly moving relative to each other. Figure: 1 shows the geographical Map of Kumarikandam submerged under the Indian Ocean.

Over millions of years these have shaped how the world looks today. Some 140 million years ago, the Indian subcontinent split from a supercontinent called Gondwana, which also consisted of modern Africa, Australia, Antarctica and South America. It eventually collided with the Eurasian plate some 50 million years ago, raising the Himalayas in the process. Scientists predict that it was in between leaving Gondwana and colliding with the Eurasian plate that this continent Mauritia may have existed as an archipelago, a cluster of islands, squeezed in between Madagascar and the Indian subcontinent.

Lemuria

Lemuria is the name of a hypothetical "lost land" variously located in the Indian and Pacific Oceans [8]. Accounts of Lemuria differ, but all share a common belief that a continent existed in ancient times and sank beneath the ocean as a result of a geological, often cataclysmic change, such as pole shift. Lemuria is the name of a mythical continent purported to have been in the Indian and Pacific Oceans.

The Lemuria Myth

There is an old, persistent Tamil tradition about a land that existed south of India called Kumarikkandam (continent), a belief that is linked to the myth of the lost land of Lemuria, a figment of Western imagination. Accounts of the lost continent vary, but the common theme is that a large area went under the ocean as a result of geological cataclysms, a theory that geologists of today do not subscribe. The last Ice Age had a profound influence on the prehistory of humankind. So in prehistoric studies of coastal areas, it is crucial to understand the consequence of changes in the sea level [1]. About 14,500 years ago, the sea level was lower by 100 metres. With subsequent global warming and melting of large masses of ice, the level started rising, in stages.

Figure 2: The Lemurian as conceived by W. Scott Elliot, a staunch theosophist who published, in 1904, 'the lost Lemuria'

Figure 2 shows a Lemurian and how it permeated the Tamil tradition through folklore and writings as the lost continent of Kumari. As the sea level

rose, the low-lying lands in the coastal region and the exposed continental shelves were inundated. This phenomenon gave rise to the stories and legends of deluges that permeated the African, Amerindian and Australian aboriginal folklore and Greek, Roman and Hebrew legends, and the Indian puranas, which referred to pralayas. The coastal areas south of India that were submerged in ancient times evidently gave rise to the Tamil myth of the lost continent of Kumarikkandam, while myths of the lost continents of Atlantis and Lemuria were generated in the Western world.

Lemuria is the name of a mythical continent purported to have been in the Indian and Pacific Oceans. The lost continent derives its name from the primate lemur belonging to the group prosimians [11]. "The probable primeval home or 'Paradise' is here assumed to be *Lemuria*, a tropical continent at present lying below the level of the Indian Ocean.

Lemurs

Lemurs now inhabit Madagascar Island, the surrounding smaller islands and Comoros Island. The term lemur comes from the Latin word lemures, meaning spirits of the night, a reference to many species of lemur that are nocturnal and so have large reflective eyes. Their distribution once extended from Pakistan to Malaya. The English geologist Philip Sclater (1864) coined the term Lemuria in his article The Mammals of Madagascar'. Trying to explain the presence of fossil lemurs in Madagascar, he proposed that the Indian Ocean Island and India had once been part of a larger continent, Lemuria. His theory was put forward before the concepts of continental drift and plate tectonics provided the explanations for the similarity and distribution of formations and fossils in different strata and continents.

During the 19th century, scientists frequently postulated the presence of submerged land masses in order to account for the present distribution of species. As Lemuria gained some acceptance within the scientific community, it began to appear in the works of scholars such as Ernst Heinrich Haeckel (1834-1919), a German biologist who promoted the work of Charles Darwin in Germany. Haeckel suggested that there was a land bridge that remained above water long enough to facilitate the migration of prosimians from Africa into India and the Malay Peninsula. While explaining the evolution of man, there is a subtle but conscious attempt in the book to establish the superiority of the Aryan race. Later, some members of the Theosophical Society published essays, presented in the garb of scientific writings, on Lemuria and Atlantis. Thus the myth of Lemuria was perpetuated.

According to the teachings of the Theosophical Society, human beings evolved through seven successive root races, each of which populated and occupied different continents. Lemuria was occupied by the third root race called Lemurians, who were primitive beings. Subsequently, the more advanced inhabitants of Atlantis, called Atlanteans, replaced them. Aryans, the descendants of Atlanteans, were the fifth root race and were considered the pinnacle of evolution. Figure [3] shows a ring-tailed lemur. Also Figure [4] shows a ring-tailed lemur now belong to Madagascar. They are native only to the island of *Madagascar.* Most existing *lemurs*are small, have a pointed snout, large eyes, and a long tail. They chiefly live in trees. In fact, over 75% of the island's fauna and flora is found nowhere else. *Lemurs* evolved separately from other primates on the Indian Ocean island of *Madagascar.*

Lost Land of Tamils

The narratives about Lemuria found their way into colonial India about the time when folklore began to permeate historic knowledge as though they were fact. The writings of WisharCerve and the maps of Scott Elliot were brought into Tamil writings [3] by K. Appadurai, in his book Kumarikkandamor been called as Kadal Konda Then Nadu (Kumari Continent or the Submerged Southern Land, 1941). The term Lemuria found its way into certain Tamil

textbooks and was given the Tamil name Kumarikkandam [5][6], or continent of Kumari. Names from Tamil classics were given to the mountain ranges, rivers, places and areas. For example, the puranic geography of an axial mountain called Meru as the centre of Jambudvipa (Sanskrit) or NavalanTheevu (Tamil) was accepted, and, later on, these names were attributed to certain parts of Lemuria, giving it acceptability among Tamil readers. In the 1920s, with Tamil revivalism and the efforts to counter the Aryan and associated Sanskrit dominance, the concept of Lemuria were wedded to the notion of the lost land referred to in Tamil literature [9].

Some of the important references from Tamil Sangam classics are as follows: 1) in Purananuru 9, verses 10-11 are interpreted as a reference to a Pandya king who ruled a part of the lost land where the river Pahruli flowed. 2) in Silapathigaram (KaduKaanKaathai) (11:17-22) is a reference to a Pandya king who won over kingdoms in Imayam (the Himalayas) and Gangai (the Ganga) to compensate for his land lost to the deluge. Tamil scholars such as DevaneyaPaavaanar consider the deluge under reference to be the one that destroyed Thenmadurai. 3) According to AdiyarkuNallar, poem 104:1-4 from MullaiKalithogai indicates that the Pandya king resettled the survivors of the deluge in certain Chera and Chola territories. It is portrayed by certain Tamil writers that the series of deluges destroyed the Tamil civilisation and the survivors spread out and civilised other parts of the world.

The Tamil tradition about a lost land was committed to writing after the 10th century by commentators like Nakeerar in his commentary on IraiyanarAkapporulurai. Nachinarkiniyar and AdiyarkuNallar followed him. Those who wrote the commentaries exaggerated the extent of land that was submerged by the deluges referred to in Silapathigaram and Kalithogai. According to the commentators, there were 49 countries (Nadu) in the lost land of Kumari and the distance between the river Kumari and the river Pahruli that flowed in the lost land was 700 katham, which according to one calculation is about 770 km.

The crucial question is whether the land referred to as Kumari was as large as a continent? The advocates of Kumarikkandam interpreted the term Nadu to mean country. In Tamil Nadu and Kerala many small towns and villages have in their names the term 'Nadu', which basically referred to a settlement, as opposed to 'kadu', or forest. In the above Tamil references there is no mention of the term Kandam, referring to land the size of a continent. If the oral traditions and the subsequent writings exaggerated the size of the submerged land called Kumari, what was the background to the lost land referred to in Sangam literature?

The present formations of India, Arabia, Africa, Antarctica, South America and Australia started breaking up due to natural upheavals and moving to different parts of the earth at the rate of 15,000 years per mile on an average and found their places in the Asian Continent. The movement of the earth mass, called Navalam Theevu in Tamil, caused the formation of the present continent of India [12].

There was a general belief that both Lemuria and Kumarikkandam were one and the same. However, it has been established by Frank Joseph, Secretary for Ancient American Association, in his book "The Lost Civilization of Lemuria", the existence of a land called Lemuria, one of the world's oldest civilizations, about 2.5 lakh years ago, in Indonesia. Hence, Lemuria and Kumarik kandam, which existed in southern part of India, are different lands. Mr. Joseph has also established that the Mohenjodaro letters of Eastern Islands are nearly 1,00,000 years old. He has critically examined the views of various findings by the researchers and established the source of Mohenjodaro letters as well as the ancient civilization of Moo and has written that due to natural calamities, the island of Moo was destroyed about 2.5 lakh years ago.

From Kumarikkandam, South of Tamil Nadu, about 15,000 years ago people moved to Africa and became Sumerians and those who moved from Africa to Arabia later became Jews. From Kumarikkandam, South of Tamil Nadu due to tsunami, people moved to Bengal and became Cholas and those who moved to Sind and Punjab became Cheras.

In Sillapathikaram, it was mentioned that one "EzhuthangaNadu" (7x7 =49 countries) existed. So, Southern Tamil Nadu and KumariKandam are different regions. Those who have moved to Southern Tamil Nadu were called Pandiyas and they spread over Ceylon and Tirunelvelli.For decades, scientists offered wild theories about the fabled lost continent of Lemuria in the Indian Ocean. Then, in 2013, scientists actually found some evidence.

Conclusion

In this work a detailed research has been made to believe with a strong evidence that all aware that the origin of the Tamil people and their culture is shrouded in deep mystery. Though there are many traditions narrated in early literature, "Kumarikkandam", the land that lay to the south of India and, which later submerged in the Indian Ocean, has been a matter of conjecture for a study by the researchers. Herewith this work concludes with a

request to all the great Tamil scholars, eminent astronomers and mathematical experts to join together in this noble research to establish the glory of Tamil language and Tamil race to the whole world. After this look at the "lost continent" of Lemuria, uncover the mysteries of the legendary lost cities and sunken cities of the ancient world.

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