

3. Viscosity is low during prophase, metaphase and early anaphase of the mitotic cycle; it rises during late anaphase and telophase, and drops again during the fusion of the karyomeres.

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Zoology. — *The first illustrations of stick-lac and their probable origin.*

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VON GERNET (1) draws attention to the fact that the work of the Dutch Herbalist, C. CLUSIUS, contains illustrations of stick-lac, which are the earliest to be found in the literature. Through the kindness of the Librarian of the Royal Dutch Library, at the Hague, I was fortunate enough to borrow a copy of this work, entitled "Aromatum et Simplicium", being a Latin translation of GARCIA DA HORTA's Portugese book, "Colloquios dos Simplicis e Drogas", printed at Goa, in 1563. Sir GEORGE WATT (2) says, in this connection, that GARCIA, "as physician to the Portugese Governor of India visited that country in 1534. His volume of Colloquies was published at Goa in 1563 and was the second book printed in India".

Mrs GARLAND JANE of the Lisbon Branch of the Historical Society kindly sent me a photostatic copy of the article where GARCIA deals with lac. She did me the additional favour of kindly translating into English the entire article on lac so that I could compare GARCIA'S text with that of CLUSIUS. The last named author gives three pictures of stick-lac whereas none is found in the Portugese original. CLUSIUS printed his translation at Antwerp, the first edition appearing in 1567, only four years after GARCIA'S book had appeared at Goa. This is a remarkably short period considering the facilities of communication as they existed then. The question is being raised as to the origin of the three illustrations offered by CLUSIUS but absent in GARCIA'S original.

Had there been only one species of the lac insect the problem would have been simple, for only one biological source could have represented these pictures. In fact this would still be the official opinion in India today. However, even as early as 1780, SWAGERMAN (3) found at least three sorts of lac. He differentiated them, according to their geographical source. From Siam was the reddest of all, from the Coromandel coast was intermediate, while from Bengal, as it was understood then, was the palest and yellow in colour. In 1786, Dr CHAMBERS, F.R.S. (4), also mentions three localities which export lac; "Stick lac is brought from Malabar, Bengal and Pegu", — the text has been condensed. Now the localities mentioned by SWAGERMAN and by CHAMBERS coincide with each other in so far as the species of lac insect found in Siam and in Pegu is *Lakshadia chinensis*, on the Coromandel coast and in Malabar it is *Lakshadia communis*, while in Bengal, as it was understood then, it is *Lakshadia nagoliensis*, an insect which

L. communis kept at the British Museum and certainly on *Butea frondosa*. The encrustation of lac is so papery that it has been damaged in handling. I have previously (12) illustrated how stick-lac from *L. communis*, merely on storing, can show cracks due to the quality of secretion being so very poor. Just as there are poor breeds of milk cattle in *L. communis* we have a lac insect which occupies a similar position among insects of its class.

GARCIA mentions that Goa produces little lac as the soil there is not suited for its production. This would be a typical reply, even today, from a forest officer who has to deal with *L. communis*, be it in Goa or anywhere in South India where it occurs wild. CARTER (11) in 1861 found this species in Bombay, which is north of Goa and so did I in 1916 in the same city. Samples sent to me from Travancore also indicated the presence there of *L. communis*. I am therefore certain that the insect found in Goa is *L. communis*. Why lac from this biological source is scanty is due to its inherent constitutional defect and not to any fault of the soil. The insect all of a sudden gives to such a preponderance of males in a generation that the colony becomes extinct and the species is able to continue only when the male larvae become bisexual and this happens with difficulty. These rare hermaphrodites, unlike normal cells, which are round, have been called crown shaped cells on account of their shape. The crown shaped cells are mostly found with *L. communis* which also shows the greatest variation in sex ratios. Now Fig. 1 from CLUSIUS shows the presence of such a crown shaped cell. This would confirm the original specimen was derived from Goa.

Fig. 5 gives a picture of a crown shaped cell, marked, K, at the lower end of the twig, towards the left; it is seen isolated and hence a conspicuous object by itself. The generation of larvae that emerged from this mother cell has formed the encrustation on the upper portion of the twig. The encrustation is not fully developed. It was collected during September in Bangalore on *Ficus mysorensis* while it would have taken another four weeks for it to be fully formed. The encrustation seen in Fig. 1 likewise seems rather immature, comparable with Fig. 5 here. Perhaps for this reason the crown shaped cell, in Fig. 1, is relatively conspicuous.

Fig. 6 shows an ideal full grown encrustation of *L. communis* derived from one crown shaped cell marked, K. It was growing at Bangalore, on *Pithecolobium saman* and was collected early in November. Imagine such a photograph being transferred onto wood and the picture reproduced as wood engraving. This has to be remembered in appreciating the presence of crown shaped cell in Fig. 1 which is a wood cut.

In Fig. 1 the crown shaped cell is seen projecting from the main mass of encrustation. In a previous article (13) on the probable occurrence of sex reversal, in Fig. 3 there, I have shown a crown shaped cell still more conspicuous. In the communication on sex ratio variability (14) in Fig. 2 there,



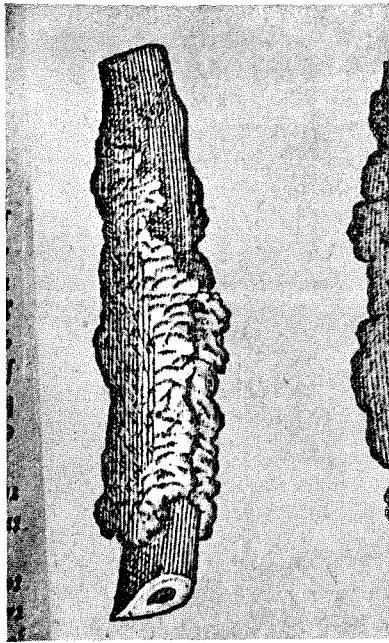


Fig. 1.

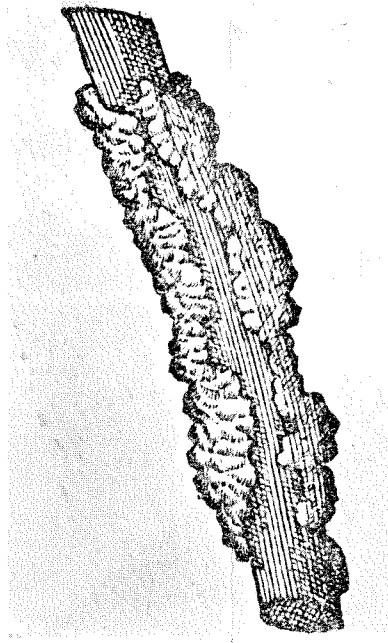


Fig. 2.

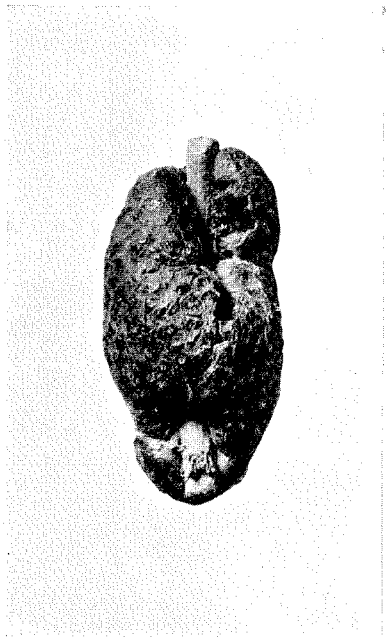


Fig. 3.

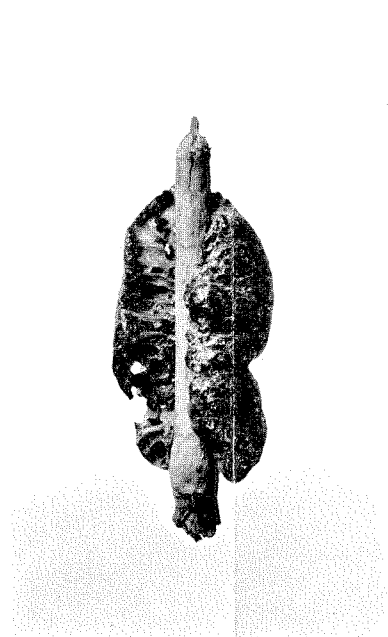


Fig. 4.

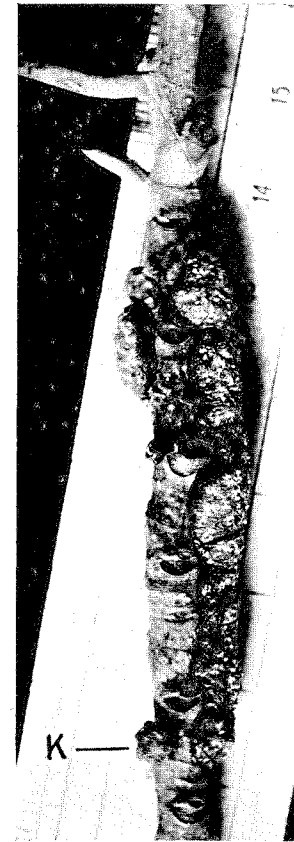


Fig. 5.



Fig. 7.



Fig. 6.

EXPLANATION OF FIGURES.

Fig. 1. Stick lac illustrated by CLUSIUS in 1567. At the extreme basal end, to the left, there is a crown shaped cell, seen in profile and as silhouette. It is further shown in Fig. 7. It belongs to *Lakshadia communis*.

Fig. 2. Stick lac as illustrated by CLUSIUS; the picture here is seen a little enlarged. Here and in Fig. 1 resin secretion from the sides does not fuse due to the insect being a poor producer of a resin. It represents *L. communis*.

Fig. 3. A chunk of lac from *L. communis*, typical of this insect, with secretion from the sides not fusing together. Original is in British Museum. The host plant is *Butea frondosa*.

Fig. 4. A chunk of lac from *L. communis*, on *Butea frondosa*, in the British Museum, showing a papery secretion of lac, fragile and broken.

Fig. 5. A living colony of immature insects of *L. communis* on *Ficus mysorensis*. At the basal end, a crown shaped cell, *K*, represents the mother of the entire generation. Magnification 11 : 10.

Fig. 6. An encrustation of *L. communis*, from a single crown shaped cell, *K*, on *Pithecolobium saman*, full grown. Magnification 11 : 10.

Fig. 7. The crown shaped cell incorporated in Fig. 1 is seen by itself.

it is seen in profile, comparable with Fig. 1 here. In both these illustrations the crown shaped cell occupies the lowest portion of the colony, a position typical for it. In Fig. 1 the crown shaped cell is seen not merely in profile but also as silhouette. Fig. 7 shows the crown shaped cell of Fig. 1 by itself. It is comparable with Fig. 2 C of the previous communication (14). The object has been to interpret what is found rather than complain what has been omitted which should have been the task of contemporary critics.

Summary.

CLUSIUS in 1567 gives three illustrations of stick lac. They are printed from wood engravings. Probably the drawings were made by GARCIA in India whose book CLUSIUS translated. GARCIA'S work was printed in 1563 at Goa where the press was not advanced to enable the illustrations to appear. GARCIA probably passed on these drawings to CLUSIUS.

The insect species represented in these illustrations is probably *L. communis*, a common lac insect found all over south India, including Goa. It has some special features which the illustrations in CLUSIUS bear out. It secretes a very poor layer of lac. The insect produces crown shaped cells which are hermaphrodites, being male larvae which have become females. Fig. 1 from CLUSIUS shows a crown shaped cell attached to it.

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