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SYSTEMATIC TRIALS OF CULTURING LAC INSECT, *KERRIA LACCA* (KERR) IN U.S.S.R., WITH A SHORT BIBLIOGRAPHY OF LAC INSECT AND ITS HOST PLANTS

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Abstract

Lac insect is not indigenous to USSR, but has been deliberately introduced there from time to time from India, Vietnam and China. Systematic trials have revealed that the summer crop could successfully be grown during the months of May to September under field conditions but not the winter crops which could only be raised under artificially created conditions in green houses/glass houses, maintaining temperatures ranging from 17-25°C and relative humidity between 60-98 per cent. Broodlac could be stored for 25-45 days at a temperature of 14 ± 2°C under weak lighting conditions without any adverse effects, so as to regulate inoculation in the field in case of a sudden fall in temperature during the month of May (Spring). Due to acclimation under artificially created conditions described above the duration of lac crops during winter got reduce from six to four and a half months and thus the times of crawler emergence for the winter generation shifted from April/May to February and that of the summer generation, from October to June.

Of the various lac hosts tried, species of *Ficus*, *Albizia* and *Amorpha* proved comparatively better. Trials with Indian strain of lac insects could not succeed, but the ones with the Chinese strain which got mixed up with the Vietnamese strain have succeeded.

During severe winters of USSR in nature the lac insects have perished completely, whereas mild winters have led to the production of sterile females with preponderance of males.

The results of the above trials reveal that lac can be cultivated in USSR but at an exhorbitant cost of approximately 250 Roubles (Rs. 3000/- approx.) per kilogram.

No worthwhile information on lac insect and its culture in USSR is so far available. According to Gupta (1962) broodlac was sent from India during the second world war, but what happened to it subsequently could not be known. From the visit of a Soviet delegation on lac to India soon after, it could, however, be known that experiments on lac culture were carried out on black sea region of Georgia, but the success had not been achieved. Fresh attempts were perhaps made by contacts with South China where eleven Soviet scientists took part in a survey for lac in Yunan in 1956.

The author had an opportunity of visiting USSR during May to August 1975 and the present article is based on the discussions held with Russian scientists of the "Shellac Experimental Station", at Sukumi and on literature in Russian consulted at the library of All Union Institute of Plant Protection, Leningrad.

Lac insect is not indigenous to USSR but has been deliberately introduced in the form of broodlac of the *rangeeni** strain from time to time from other countries namely, India, Vietnam and China. A resume of the trials made at various localities is given below :—

Leningrad

The trials were initiated during the summer of 1944 by importing broodlac from India and it is perhaps this, to which Gupta *(loc. cit.)* has referred to, but during winter all the insects died.

In 1955, work was again taken up by importing broodlac from China, as rightly

*Strain of the lac insect having two unequal generation in a year, maturing normally in June/July and October/November, and propagated on *palas* (*Butea monosperma*) and *ber* (*Ziziphus mauritiana*) etc.

presumed by Gupta *(loc. cit.)* but only under artificially created conditions in the green houses, where a temperature between 17-25°C and relative humidity ranging from 60 to 98 per cent, were maintained. Lac was inoculated on the host plants, namely, *Zizyphus jujuba*,* *Albizia julibrissin, Desmodium gyrans, Eugenia edulis, Ficus religiosa, Hovenia dulcis, Tilia caucasica* and *Dalbergia obtusifolia.*

Of the mentioned host plants, *Ficus religiosa*, however, proved best on which seven consecutive generations could be reared, and thus the possibility of rearing the lac insects successfully under the green house conditions was established.

Under green house conditions as well as in nature there were two generations, a winter one and a summer one. Due to continuous acclimation under green houses, however, the developmental got period reduced from six to four and half months approximately; and the times of crawler emergence changed accordingly. Those of the winter generation, crawlers emerged in February instead of April/May and of the summer generation, in June instead of October.

On the host plant, *H. dulcis*, about 1000 lac nymphs survived after the initial settlement, but only 5-7 per cent were females which reached maturity. Rests were all males (Buscheek, 1960). According to Hadzhibeyli (1972), however, on account of low thermal conditions of Soviet sub-tropics the lac insect has only one summer generation at the average daily temperature higher than 18°C from the end of May to October. During mild winter, low temperatures cause the development of males or sterile females whereas during severe winters the lac insects perish completely. Winter generation should, therefore, be reared only under artificially created conditions.

The stage when the lac crawlers are in the incubating chamber of the mother within the lac cover, is found to be the most resistant to low temperatures. Storage at this stage for 25-45 days at 14 ± 2°C under weak lighting conditions is possible and can be practised for the regulation of time/date of inoculation in case of a sudden fall of temperature in spring. The practice also results in shortening the duration of the lac insect crop in the green houses. The optimum temperature for embryonic development of lac crawlers in the female body is 20-26°C. The low temperatures in autumn result in production of cold resistant forms of lac insects and the crawlers emerging therefrom are active at comparatively low temperatures of 12-16°C, whereas in Indian conditions, crawlers become inactive below a temperature of 18-20°C (Glover *et al.*, 1932).

Tadjekistan

Attempts were made since 1960 to acclimatize the lac insect at black sea coast of Caucasia in Azerbaijan and Turkmenistan. Broodlac from *Cajanus cajan*, was inoculated on *Z. mauritiana, Ficus carica, A. julibrissin, Amorpha fruticosa* between 12th to 17th of June, 1969. Swarming of lac larvae occurred between 9-12 hours. Moulting occurred between mid July to beginning of August. Sex ratio varied on different host plants. On *A. julibrissin*, a ratio of 58 per cent females and 42 per cent males was recorded whereas on the rest of the host plants males dominated. Male emergence occurred between 10th to 20th of August. Copious lac secretion by females, however, took place after the fertilization by males. Comparatively better crops were obtained on *F. carica* and *A. julibrissin* and better lac secretion was also recorded on the latter host plant. On maturity in April the broodlac was inoculated on *F. carica* in the green houses of Botanical gardens. Emergence of lac crawlers continued up to mid November. Thus under the climatic conditions of Tadzekistan, a complete summer

*Name changed to *Ziziphus mauritiana*

generation of lac insects was obtained on a number of host plants in nature (Babaev, 1971).

Sukumi

Sukumi is situated in the Georgian Republic of USSR on the black sea shore and the Shellac Experimental Station is located only a few metres from the sea. Three glass-houses are attached to the station and each glass-house is in a 1000 square metre area. At the time of the visit each had the host plants, namely, *Ficus carica*, *Amorpha californica*, and *Albizia julibrissin*, maintained in bushy condition. Desired temperature was maintained in the glass houses by running hot water in steel pipes fitted on the walls of the glass houses and humidity by watering the plants.

Trials with the Indian Strain

Trials with the Indian strain were made by obtaining broodlac from the Director, Indian Lac Research Institute, during the year 1967 which reached in good condition. It fared well during summer when a successful crop was raised in nature, but it died out in winter under glass house conditions, due primarily to the activity of lac parasites. Broodlac was, therefore, again imported from India (Hoshiarpur) during the year 1969, but was received in *phunki* state and hence could not be further utilized. Requests had again been made to the Govt. of India for the supply of the nucleus culture from some colder parts of the country, say, Jammu & Kashmir, but so far this had not materialized.

Trials with Vietnam's Strain

From Vietnam 20 kg of broodlac was obtained during the year 1963 and thereafter it got mixed up with the Chinese strain on account of trials made on alternation of lac between the three promising host plants, namely, *F. carica*, *A. julibrissin* and *A. californica*. Alternations of *F. carica* × *F. carica*, gave comparatively better results. This strain was not attacked by the lac parasites under glass house conditions to the extent of the Indian strain, and has therefore, been able to sustain itself to-date.

Summer Crop Under Field Conditions

There are three experimental plots attached to the experimental station, one each at the localities, named, Eschera, Gulripshi and Varchi, situated respectively at a distance of about 25, 12 and 10 kms from Sukumi. Visits to Varchi and Eschera could be made but not to Gulripshi due to shortage of time.

Lac Crop Condition at Varchi

The three lac hosts mentioned above were raised in an area of 12½ hectares. Majority of *A. julibrissin* trees (some of which were being converted to bushy conditions by cutting the main stem about 0.5 metre from base) were however, dying out due to some unknown causes.

Forty trees each of *A. julibrissin* and *A. carica* were under inoculation with lac. Development of insects was quite satisfactory, but the settlement was patchy due perhaps to the lower rate of broodlac used, *i.e.*, @ 50 g/tree. Some bushes of *Moghania macrophylla*, had also been raised but had not been inoculated. Another 40 trees of *A. californica* were inoculated with broodlac which was irradicated with doses of 5, 10 and 15 Kilorads. The crop condition on the former two treatments was satisfactory whereas on the later, it was comparatively poor.

Lac Crop Condition at Eschera

The three hosts being experimented at Varchi, were under inoculation at this locality also. General health of trees and the crop conditions were comparatively better at this station than at Varchi. There was no mortality of the *A. julibrissin* trees. Discussions with the Director, Dr. N.A. Kachibaya and other staff members were held and it transpired that one of the drawbacks in the successful cultivation of lac was that the crop in glass houses matured in the early part of May, when the

broodlac has to be transported from the glass houses to the experimental field plots. At this time due to cold climatic conditions in nature the larval emergence sometimes stops in the field and this affects the crop adversely.

The cultivation of lac although successful, is highly uneconomical at present and the cost of production of lac, in the manner described above, has been worked out at 250 Roubles Rs. 3000/- approx) per kilogram which is no doubt extremely high.

The discussions held with Dr. Mrs. N.K. Loek, specialist in enemy insects of lac also deserves a special mention and a separate article embodying the details of the role played by biotic factors and the fauna associated with lac will follow in another communication.

Discussion

The results of trials reveal interesting features regarding the behaviour of an exotic insect species introduced into a remote geographical area, widely differing in climatic conditions. Family Tachardidae has a natural geographical range (Chamberlain, 1923), and the Soviet Union falls quite out of it. Unlike other chance introductions of insect species in various countries which have flourished in their new environments to reach pest status; the lac insect, even after having been deliberately introduced and carefully cultured, has behaved in a quite different manner. The factors responsible for its success or otherwise appear to be the host plant, abiotic and biotic The later no doubt limiting, would be dealt with separately whereas, of the former two, the one of host plant appears to be a non-limiting one, rather favourable for USSR. Lac insect, being a polyphagous species with host plants numbering over four hundred, recorded from a wide geographical range throughout the world, has thus the potentialities of adapting itself well to a good number of them. That the USSR abounds in some of the quite promising ones such as species of *Ficus* and *Albizia* and this has proved that these trees have sustained lac crop to maturity not only in different localities in a number of summer crops in nature, but also during winter crops in artificially created environmental conditions in green houses/glass houses Of the abiotic factors, however, severe colds of USSR appear to be an important limiting factor as during these periods lac insects have perished completely in nature but during comparatively milder winters, antibiosis in the form of heavy mortality, production of sterile females and preponderance of males has been reported, although for the later phenomenon host plant factor has also been partly responsible. Successful lac crops during winters under glass house/green house conditions have no doubt been obtained, but only at exhorbitant costs. Possibilities of evolving a cold resistant strain at which the Russian scientists are at present engaged may perhaps lead to further success but at the moment success of commercial value has not been achieved.

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