STUDIES ON THE OCCURRENCE OF THAI SACBROOD VIRAL DISEASE IN RUBBER PLANTATIONS-BASED INDIAN HONEY BEE COLONIES (*APIS CERANA INDICA* F.) AND ITS IMPACT ON THE DEVASTATION OF COLONIES.

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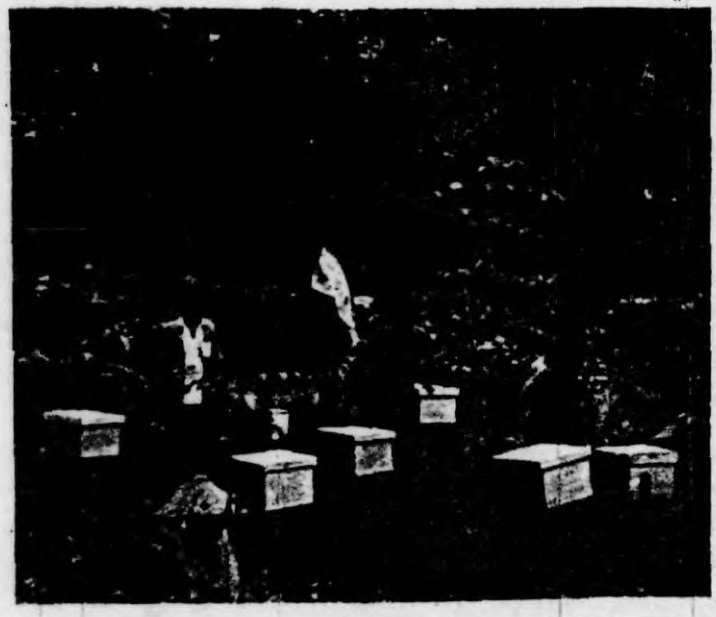
Abstract

Rubber plantations are best suited for commercial beekeeping which account for 42 - 47% of the total honey produced in India. Losses of colonies of *Apis cerana indica* due to severe outbreak of Thai sacbrood viral (TSBV) disease caused an alarming situation recently in rubber plantation based apiaries in Kerala, Tamil Nadu and Karnataka states. Continuous death of brood in propupal but unsealed stage followed by complete desertation of infected colonies was reported by the beekeepers in the rubber growing areas during November and December, 1991. The causative agent was identified as Thai sacbrood virus. Studies on the occurrence and devastation of TSBV disease revealed that 76.71% colonies of *Apis cerana indica* were lost due to the disease. In Kerala state, Kozhikode, Thiruvananthapuram and Kottayam districts accounted for 95.36%, 94.27% and 93.65% loss of bee colonies respectively. In Tamil Nadu, Kanya Kumari district accounted for 90.04% loss of bee colonies. In Karnataka state, D.K. district accounted for 40.32% loss of colonies. In rubber plantations, where migratory beekeeping is commonly practised, potential danger of spread of this brood disease, therefore, connot



be ignored. However, studies are in progress at RRII to identify and establish Indian honey bee colonies which are unaffected by the disease.

Key words: *Apis cerana indica*, Thai sacbrood viral disease, devastation of bee colonies.

1. Introduction

Beekeeping is one of the oldest agro-industries of India. It is a branch of agriculture dealing with the seasonal and off-seasonal management of honey bee colonies. The importance of honey is amply highlighted in the literature on Indian Ayurveda and Islamic culture. With the standardisation of management practices for *Apis cerana indica* F., beekeeping in rubber plantations had been currently emerging as a fast developing cottage industry in the southern states like Kerala and Tamil Nadu occupying nearly 98% of the total area under rubber cultivation in the country which accounted for 42-47% of the total honey produced in India (see table 1). Jayarathanam (1970), Suryanarayana (1980) and Nehru *et al* (1985; 1989) emphasized the importance of rubber plant (*Hevea brasiliensis* Muell Arg.) as a major nectar source for commercial beekeeping. The honey flow period of rubber plants ranges from January to mid April and during the period honey bees collect large quantities of nectar from the extra floral nectary glands at the distal end of petioles where the leaflets join (Nehru, 1985). Availability of perennial sources of nectar and pollen is the most important limiting factor in the survival, abundance and distribution of honey bees especially during the

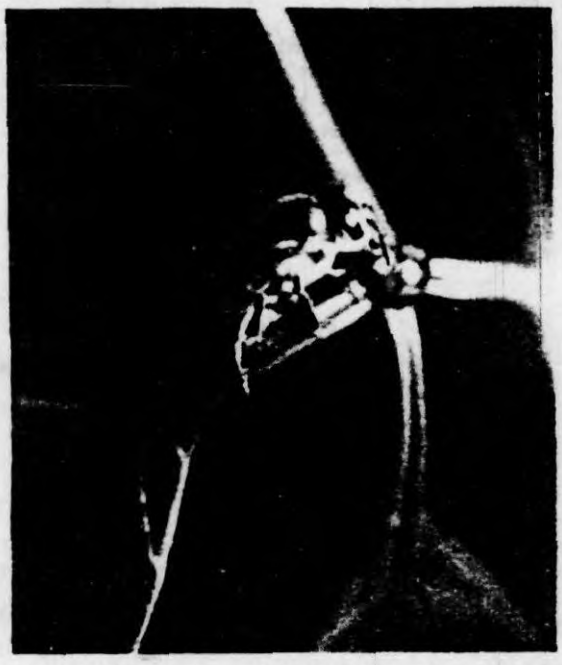


Table 1. Total Production of Honey in India and the share of Rubber Honey

Year	Total honey production in India (tonnes)*	Estimated share of rubber honey (tonnes) (%)
1982-83	5700	2700 (47%)
1983-84	4400	1848 (42%)
1984-85	5500	2315 (42%)
1985-86	6200	2600 (42%)
1986-87	6500	2750 (42%)
1987-88	5800	2494 (42%)
1988-89	5600	2352 (42%)
1989-90	— +	— +
1990-91	— +	— +
1991-92	7917	1963 (25%)
1992-93	— +	— +
1993-94	1375	550 (40%)

* Source of Indian Production of honey: KVIC, Bombay & RRII.

\+ Data not available.

prolonged dearth period ranging from April to December in the rubber plantation-based apiaries. It is in this context that an attempt was made to confirm the pollen and nectar potential of four bee forage plants in and around the rubber plantations of the Rubber Research Institute of India (RRII) in Kerala that were successfully established and proved to be best suited for off-seasonal bee-management during the dearth (Nehru, 1983; Nehru *et al* 1984; 1985; 1989). With the alternative bee forage, and proper bee management, the colony yield from the Indian boney bee was 19 kg honey/colony/year. Twenty hives can be well maintained in a rubber plantation having 400 mature trees (Nehru *et al* 1989). Thus, rubber plantations are best suited for large scale commercial beekeeping.

Indian honey bees were by and large free from any disease till 1978 when a dreaded disease called Thai sacbrood virus disease appeared in an epidemic form. It was first reported from Thailand in 1976 on *Apis cerana indica* colonies. Its occurrence in north eastern states was recorded first in Nagaland in 1978 and Meghalaya in 1979 and it caused 90-100% mortality of *Apis cerana indica* colonies in those areas (Shah and Shah 1987). By 1983, the outbreaks in Thailand and north-eastern India had generally disappeared, but the disease continued to spread and cause heavy losses in other areas of Bihar, Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Kashmir, Sikkim and Nepal by 1984. As a result, *Apis cerana indica* based beekeeping industry was completely ravaged. It took 13 years for TSBV disease to reach southern states, particularly Kerala State, first appearing during November and Devember, 1991. Subsequently, in rubber plantations, where migratory beekeeping is commonly practised, potential danger of spread of this disease, therefore, became most serious. Losses of colonies of *Apis cerana indica* due to severe outbreak of TSBV disease caused an alarming situation recently in rubber plantation-based apiaries in Kerala, Tamil Nadu and Karnataka States. Continuous death of brood and large scale desertion of infected colonies was reported by beekeepers in the rubber growing areas, during November and December, 1991. Urgent measures were taken to identify the disease which was earlier mis-identified as European Foul Brood (EFB) disease. The disease

was identified as TSBV disease by CBRT & I, Pune and same was later reconfirmed by Kerala Agricultural University. Following is a brief communication on the occurrence and devastation of TSBV disease in rubber plantation-based Indian honey bee colonies.

2. Materials and Methods

An on-the-spot region-wise survey for the incidence of TSBV disease was conducted in 1992-94 by RRII in collaboration with the Department of Rubber Production, Rubber Board, India with a view to evaluate the intensity of incidence of TSBV disease in rubber growing regions of Kerala, Tamil Nadu and Karnataka States. A large number of infected apiaries were examined and samples were collected for pathological investigations. Typical symptoms based for TSBV disease survey were : (1) Large scale death of brood and dead brood found in propupal but unsealed stage, (2) Dwindling of colony strength, (3) The tip of head produced tongue like up-turned projection, (4) Appearance of sac-like forms on the dead pupae or late larvae, containing lemon green liquid, (5) In advanced stages, the bees are unable to remove these sacs which later fall into the bottom board, or remain in the cells, decay, and change to dark colour, (6) The symptoms resemble those of sacbrood disease except that the cappings on brood cells infected with TSBV disease are not sunken and most infected *Apis cerana indica* colonies abscond, and (7) Formation of sacs and death of even sealed pupae as a peculiarity of TSBV disease.

3. Results and discussion

The results reveal that the typical symptoms based for TSBV disease survey were confirmed in laboratory-cum-field studies. The TSBV in Indian honey bees affect the larvae or the pupae. The infection takes place early in the feeding stage of larvae which die a little later. The symptoms readily resemble those of sacbrood disease reported from the United States and Canada (White 1913) except that the cappings on brood cells infected with TSBV are not sunken, and most infected colonies abscond (Shah and Shah 1987). After removing the remaining portion of the cappings, the dead larvae and pupae are seen lying on the bottom cells with head portion extending upwards. In the advanced stage, the larvae changed their colour from yellow to brown and finally the tip of the head becomes black. The outer skin of the larvae becomes thick and tough and with the help of a pair of forceps or pointed match stick, the larvae could easily be lifted out of the cell, like a sac of water. The bees seem to pull out the dead larvae and throw them out of the hive but in advanced stages, they are unable to remove these sacs which later fall into the bottom board or remain

in cells, decay and change to dark colour. Within the colony, the disease probably spreads through the house cleaning activity of young adult bees which transfer the infection of young larvae through feeding. Our survey clearly reveals that the migration of partly or fully infected swarms, drifting, robbery, exchange of brood combs, prevailing of unhygienic conditions, continuous use of unsterilised hive tools are the major causative factors responsible for the spread of the disease from one colony to another. In all rubber growing regions surveyed, the infection seemed to spread instantly throughout 1992-94, from one rubber estate to other neighbouring estates wherever migratory beekeeping was practised.

The results on the region-wise occurrence of TSBV disease and loss of Indian honey bee colonies are shown in table 2. In Kerala state, Kozhikode, Thiruvananthapuram and Kottayam districts were particularly noted for large-scale migratory beekeeping and these districts recorded 95.36%, 94.27% and 93.65% loss of bee colonies respectively. In Tamil Nadu, Kanya Kumari district, where migratory beekeeping was commonly practised, accounted for 90.04% loss. In Karnataka state, Sullia and Puttur regions under D.K. district, where migratory beekeeping was practised on a much reduced scale, recorded only 40.32% loss of bee colonies. Thus, introduction of large scale migratory beekeeping system in rubber plant-ations was confirmed to be the major causative factor for colossal loss of bee colonies following the outbreak of TSBV disease.

Table 2. Incidence of Thai Sac-brood viral disease (TSBVD) in Kerala, Karnataka and Tamil Nadu states during 1992.

State/ District	Total no. of hives	Total no. of diseased hives	% of loss hives
Kerala State			
Kannur	6420	3964	61.74
Kozhikode	5820	5550	95.36
Malapuram	395	162	41.01
Thrissur	435	280	64.37
Ernakulam	1805	1530	84.76
Idukki	965	865	89.64
Kottayam	13064	12234	93.65
Pathanamthitta	2577	2286	88.71
Thiruvananthapuram	5058	4768	94.27
Karnataka State			
D.K. District (Sullia & Puttur)	12400	5000	40.32
Tamil Nadu State			
Kanyakumari	4500	4052	90.04

4. Control

TSBV disease connot be controlled by chemotherapeutic means. Hirsch and Kaplan (1987) gave an account of possible treatments for human viral diseases, including the use of specially produced interferon and the development of amino nucleoside compounds that limit multiplication by viruses. The process of testing and developing such compounds and legally registering them for use will take much time, and the applicability of these compounds to bee viruses is still unknown.

In this context, studies are in progress at RRII to identify and establish colonies of *Apis cerana indica*, which are unaffected by the disease.

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Year	Honey production in India (tons)	Production of rubber honey (tons)	Shate of-rubber honey
1981-82	5600	2300	41%
1985-86	6200	2600	42%
1995-96	NA	1000	NA
1996-97	11,425	1500	13.12%
1998-99	12,000	1750	14.60%

Source : KVIC, Mumbai and Rubber Research Institute of India, Kottayam