INFLUENCE OF CLIMATE CHANGE ON RUBBER HONEY PRODUCTION

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Apiculture and commercial honey production in Kerala mainly depend on the rubber plantations. Rubber, *Hevea brasiliensis* Muell Arg. yields both latex and honey (nectar). The latex is produced by the laticeferous cells in the bark and nectar exuded from the extra-floral nectaries at the junction of the trifoliate leaf petiole. The leaves of rubber tree shed during December-January. Generally the shedding of older leaves commences in the Northern parts of Kerala during December and extends up to January in Southern parts. After this, refoliation starts almost within one or two weeks depending on the weather conditions. The occurrence of rainfall during these period results in the infection of tender leaves *Oidium* causing leaf shedding, affecting seriously the nectar secretion. The young leaves at half maturity (light green colour) secrete nectar through extra-floral nectaries situated at the junction of the petiole. The honey flow begins in Northern districts of Kerala during January- February months and it extends up to February-March in Southern districts. A study was conducted by AICRP on Honey bees and Pollinators at Vellayani centre to correlate the influence of untimely rainfall and honey yield in rubber. Weather conditions influenced the secretion of nectar from the extra floral nectaries. Rain washes away or diluted the nectar from the leaves resulting in severe economic loss to the beekeepers. The increased relative humidity during the refoliation period due to untimely rainfall paved way for the incidence of powdery mildew (*Oidium heveae* Steinm) on tender leaves. The leaves showed powdery/ashy coating, curling, crinkling and edges of leaves rolled inwards resulting in leaf fall within a week. The average honey yield and data on summer rain for the last five years showed that the untimely rainfall in 2008 honey flow season negatively affected honey yield. The secretion of extra floral nectaries and in turn the production of honey from the rubber plant are related to the prevailing weather and climate change especially too much rains during the nectar secreting season will be harmful for honey production.

Keywords: Climate, Honey production, Nectar, Powdery mildew, Refoliation.

Honey bees (Genus: *Apis*), belong to the super family Apoidea in the order Hymenoptera, occurring in almost all parts of the world except the polar region with its possible centre of origin in South and South East Asia (250 genera in 9 families). These bees are either solitary or lead a social life but all individuals share some common characteristics. Nearly all bees feed on pollen and nectar and they tend the young ones in the cells with food. They represent only a small fraction of approximately 20,000 known species of bees. The commercial beekeeping is being practiced in exploiting

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the floral diversity and potential for beekeeping since many decades. The coconut palm (*Cocos nucifera)* is the richest source of pollen to bees and rubber (*Hevea brasiliensis*) is the abundant source of nectar. Apiculture and commercial honey production in Kerala mainly depend on the rubber plantations (Thankamma and George, 1968). Rubber tree yields both latex and honey (nectar). The latex is produced by the laticeferous cells in the bark and nectar is exuded from the extra-floral nectaries (Jayarathnam, 1970; Narayanan, 1980) at the junction of the trifoliate leaf petiole (Fig. 1). The leaves of rubber tree shed during December-January. Generally the shedding of older leaves commences in the Northern parts of Kerala during December and extends up to January in the Southern parts. After this, refoliation starts almost within one or two weeks depending on the weather conditions. The untimely rainfall during refoliation results in the drastic reduction in honey yield. Hence an experiment was conducted by AICRP on Honey bees and Pollinators, Vellayani centre, Kerala Agricultural University to assess the role of climate change/ rainfall in honey production in rubber plantations.

Fig. 1. Nectar on leaf petiole

The rubber estate at Uzhamalakkal, Nedumangadu in Trivandrum district of Kerala was selected for the experiment. Ten healthy disease free Indian bee (*Apis cerana indica*) colonies, each having six frame bee strength were kept in the rubber estate during the honey flow season, *i.e.* January to May, for five years from 2006 to 2010. The monthly rainfall data and honey production in the bee colonies during the experimental period were recorded.

During 2006 there was no rainfall from January to April and 188.6 mm rainfall was recorded during May. In 2007, the monthly rainfall ranged from 0.6 mm to 162.8 mm in the experimental area (Table 1) during

Fig. 2. Early symptoms of *Oidium*

Fig. 3. *Oidium* infected leaves

Table 1: **Rainfall during different months (mm) from 2006 to 2010 in Trivandrum**

Year	JAN	FEB	MAR	APRL	MAY
2006	0.0	0.0	0.0	0.0	188.6
2007	0.6	2.2	0.0	162.8	102.9
2008	0.0	38.8	8.91	74.8	153.2
2009	0.0	0.0	12.60	39.90	305.6
2010	11.07	0.0	0.0	61.00	0.0

(Source: Meteorological data, College of Agriculture, Vellayani)

different months except March. There was no rainfall in January 2008, while, during the months from February to May 2008, 38.8 mm, 8.9 mm, 74.8 mm and 153.2 mm rainfall were recorded, respectively. No rainfall was recorded during January and February 2009 while during March, April and May respectively, 12.6 mm, 39.9 mm and 305.6 mm rainfall were recorded.

During January and April 2010, the rainfall recorded was 110.70 mm and 61.00 mm, respectively and no rainfall was recorded during February, March and May 2010.

The three extra-floral nectaries at the junction of the petiole of young leaves at half maturity (light green colour) generally exude nectar. Weather conditions affected the production of nectar from the extra floral nectaries. Rain washed away or diluted the nectar from the leaves. The increased relative humidity during the sprouting of new flushes due to intermittent and untimely rainfall caused the incidence of powdery mildew (*Oidium heveae* Steinm) on tender leaves (Bolle Jones and Hilton, 1956; Edathil *et al*., 2000). The leaves showed powdery/ ashy coating, curling, crinkling and edges of leaves rolled inwards (Fig. 2 & 3) resulting in leaf fall within a period of one week (Rangaswami, 1975).

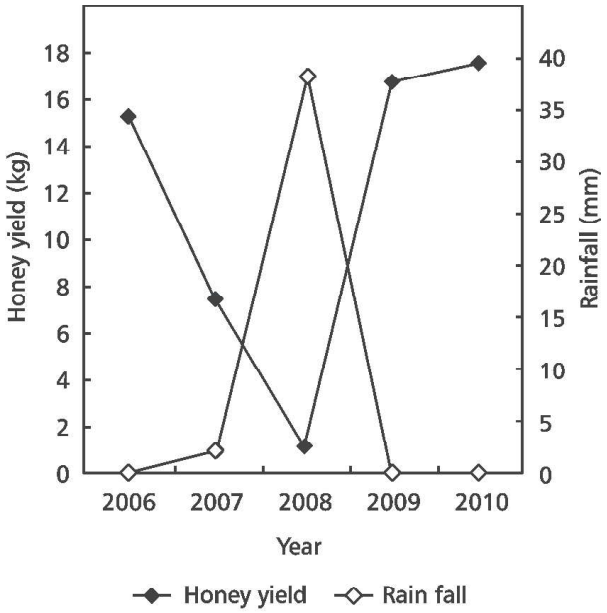

Fig. 4. Influence of rainfall on average honey yield in the month of February from 2006 to 2010

The average honey yield and data on summer rains for the five years (2006-10) showed that untimely rainfall influenced the secretion of nectar from the extra floral nectaries which was more reflected in the 2008 honey flow season yielding less honey. The secretion of extra floral nectaries and in turn the production of honey from the rubber plant is directly related to the rainfall pattern in the honey season. Average honey yield from the experimental colonies are represented in Fig. 4. February is the peak period for development of nectaries in the leaves, wherein the rainfall adversely affected the honey production since the new leaves were infected with the powdery mildew, by *O. heveae* resulting in the damage to nectaries and subsequent leaf fall. During 2006, 2009 and 2010 there was no rainfall during February and the honey yield per colony recorded were 15.3 kg, 16.8 kg and 17.6 kg respectively, in contrast to the honey produced (1.18 kg) in 2008 when the rain fall was 38.8 mm.

The secretion of nectar from the extra floral nectaries in rubber is related to honey production. The occurrence of rainfall during the sprouting of new flushes causing the powdery mildew disease by *O. heveae* resulted in unnatural leaf shedding, destruction of nectaries and significant reduction in honey yield. The observations from 2006 to 2010 during the honey flow season (January to May) showed that the honey yield per colony was high when the rain fall was the least during February as compared to the yield when there was heavy or intermittent rainfall during February. It revealed that there is a direct correlation between rain fall during February and honey yield. The incidence of rain in rubber plantations during February 2008 adversely affected the production of honey resulting in severe economic loss to beekeepers. Changes in summer rains many effect honey production in Kerala.

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