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RESEARCH ARTICLE

MELISSOPALYNOLOGICAL STUDY OF NADIA DISTRICT, WEST BENGAL, INDIA

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ABSTRACT

The present paper deals with melissopalynological analysis of honey samples collected from seventeen blocks of Nadia district, West Bengal, India. It showed the dominance of *Parthenium* sp. pollen in the pollen spectra of honey samples. The weed emerged as prominent pollen type in the spectra of seven 'unifloral' honey samples belonging to the blocks of Karimpur-I, Karimpur-II, Nabadwip, Krishnaganj, Hanskhali, Santipur and Ranaghat-I and contributed second highest percentage as individual pollen type in ten 'multifloral' honeys belonging to the blocks of Tehatta-I, Tehatta-II, Kaliganj, Nakashipara, Chapra, Krishnagar-I, Krishnagar-II, Ranaghat-II, Chakdah and Haringhata. This result affirms about the preference of bees to the weed as their forage. As most of the crop plants are cross pollinated, the role of the pollinators in crop yield is well documented and bees are considered to be the best performer in relation to the pollination service. In the context of the characteristic behavior of 'floral fidelity' of the bees, the findings of the present paper creates concern as presence of the weed *Parthenium* sp. in the vicinity of the crop field may distract the bees and pose potential hindrance to ensure pollination service to the local crops flowering synchronously.

INTRODUCTION

Pollen forms an important part of food of the honey bees and the analyses of pollen loads collected by bees provide a vivid knowledge of bee forage. As most of the crop plants are cross pollinated, the role of pollinators with regard to crop yield is emphasized. Honey bees are rated as best pollinating agents and their important trait is of 'floral fidelity', as bees pay visit to the preferred species as long as it flowers. A number of local naturalized flora including weeds flower simultaneously in a given locality along with cultivated crops and attract bees for their nectar and pollen and if any of these plant species other than the target crop achieve success to get preference of the bees, there will be great loss in crop yield due to insufficient pollination. Hjelmroos and Lobreau-Callen (1994) gave an idea about the ecological relationship of pollen and bees in the context of melissopalynology. Pendleton (2006) described on melissopalynological methods involving centrifugation should include data for calculating Relative Centrifugal Force (RCF) or should express data in units of RCF or gravities (g). Sajwani *et. al.* (2007) investigated on the melissopalynological studies from Oman and showed the frequency of various pollen morphotypes. Lazarova and Yurukova (2010) reported on the botanical origin and inorganic content of bee honey in northeast Bulgaria (Shumen region). Atanassova *et al.* (2012) revealed interesting finding on pollen and inorganic characteristics of Bulgarian unifloral honeys. Dimou *et al.* (2013) studied on the melissopalynological analysis from Greece. The present investigation has been done in order to search the dominant weed species through melissopalynological analyses in crop field hindering the crop yield in seventeen blocks of Nadia district, West Bengal, India.

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MATERIALS AND METHODS

The honey samples from seventeen blocks (Karimpur-I, Karimpur-II, Tehatta-I, Tehatta-II, Kaliganj, Nakashipara, Chapra, Krishnagar-I, Krishnagar-II, Nabadwip, Krishnaganj, Hanskhali, Santipur, Ranaghat-I, Ranaghat-II, Chakdah and Haringhata) of Nadia district, West Bengal, India were collected during January to April, 2010. The geographical boundary of Nadia district comprises Bangladesh in the East, Bardhaman and Hugli district on the West, Murshidabad district on the North and North West and North 24 Parganas towards South and South East. Nadia is situated between 22°53″ and 24°11″ North latitude and 88°09″ and 88°48″ East longitude and about 390027 Sq Kms. in area and approximately 46 ft. above the mean sea level. The Tropic of Cancer divides the district in two parts. Among the seventeen samples, twelve are squeezed honeys and the rest five are apiary honeys. For qualitative microscopic studies of the pollen contents, five ml. of honey sample were dissolved in twenty ml. of warm water and the solution was repeatedly centrifuged with water and was finally treated with five ml. of glacial acetic acid. This was then followed through acetolysis (Erdtman, 1952) and finally the sediment was mounted in glycerin jelly on several micro slides depending upon the quantity of the sediment. Qualitative pollen

analysis was performed according to the method recommended by the International Commission of Bee Botany (ICBB, 1970). The pollen types were identified with the help of reference slides made from ground flora. Honey samples containing more than 45% of a single type of pollen are considered as 'unifloral' and those with several types of pollen types in considerable percentages are termed as 'multifloral'. According to ICBB (1970) frequency classes were determined as - predominant pollen type (>45%); secondary pollen types (16-45%); important minor pollen types (3-15%) and minor pollen type (<3%).

RESULT

A total of twenty five different pollen types belonging to nineteen different families were identified from seventeen honey samples where the maximum number of pollen morphotypes identified from a single sample is nine and the minimum number is four. Melissopalynological screening of different pollen types and their relative frequencies are presented in Figs. 1-17. Out of the twelve squeezed honey samples seven are 'unifloral' honeys having *Parthenium* sp. as predominant pollen. The highest percentage (69%) of *Parthenium* sp. (Asteraceae) pollen was found in the 'unifloral' sample from Ranaghat-I, where a total of eight pollen types were identified.

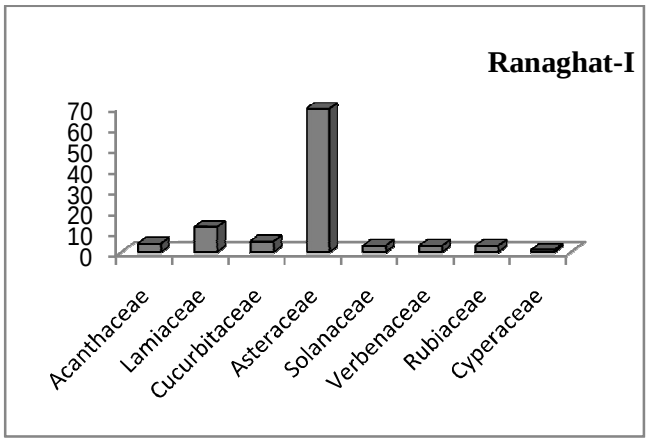

Fig. 1. Pollen frequency (%) in honey sample of Ranaghat-I Block

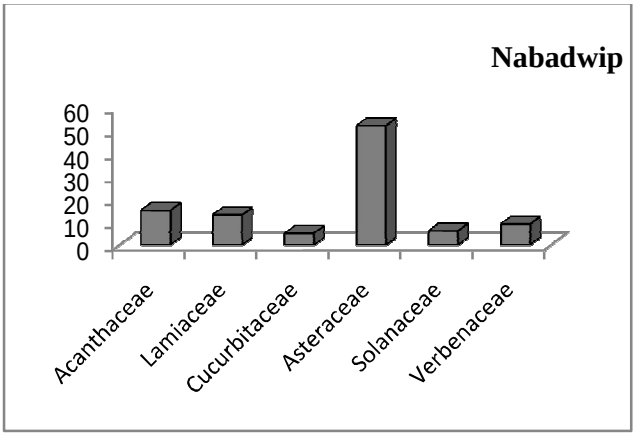

Fig. 2. Pollen frequency (%) in honey sample of Nabadwip Block

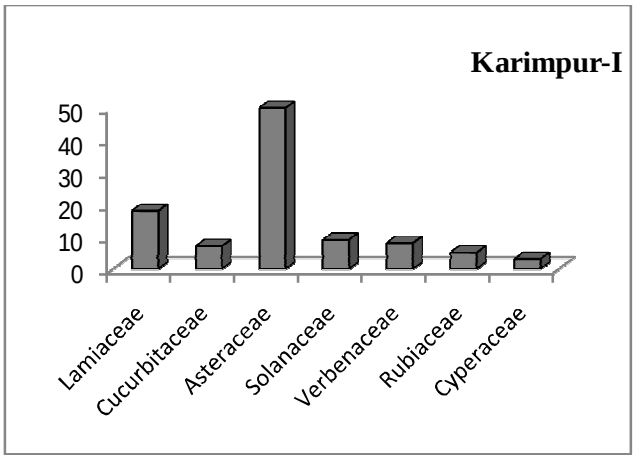

Fig. 3. Pollen frequency (%) in honey sample of Karimpur-I Block

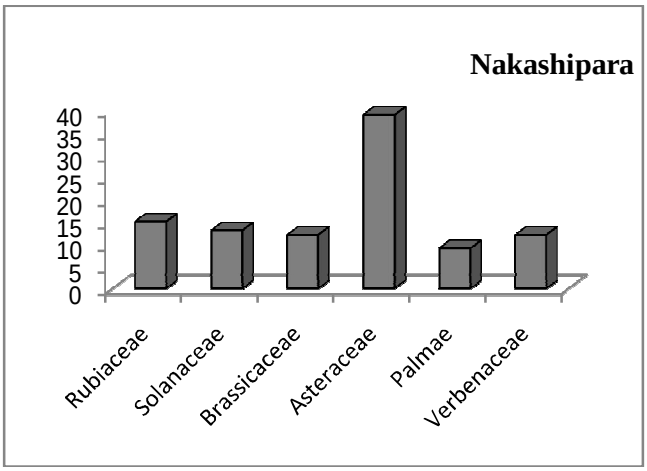

Fig. 4. Pollen frequency (%) in honey sample of Nakashipara Block

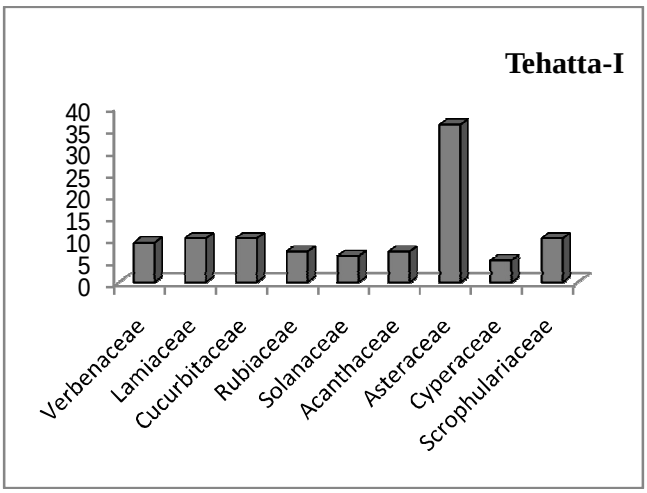

Fig. 5. Pollen frequency (%) in honey sample of Tehatta-I Block

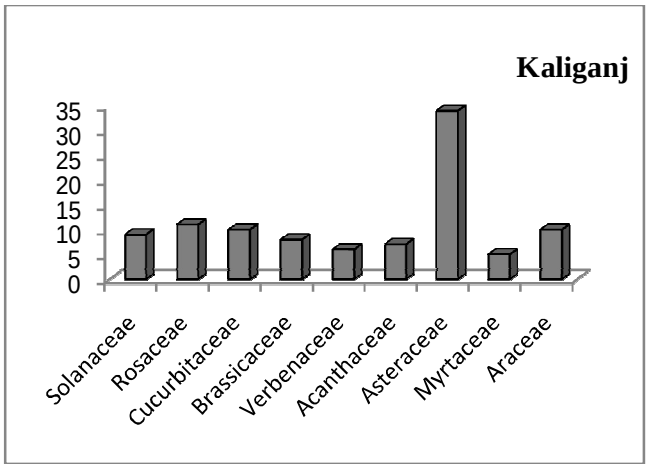

Fig. 6. Pollen frequency (%) in honey sample of Kaliganj Block

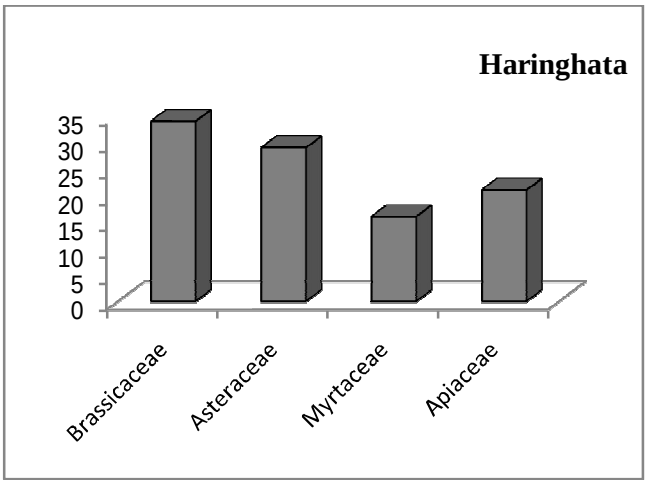

Fig. 7. Pollen frequency (%) in honey sample of Haringhata Block

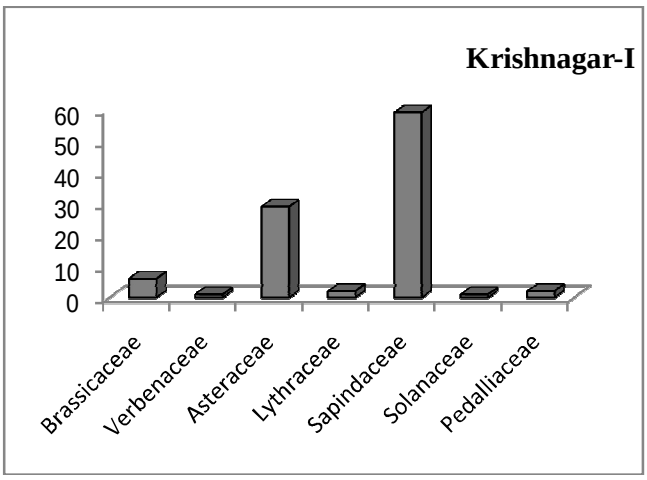

Fig. 8. Pollen frequency (%) in honey sample of Krishnagar-I Block

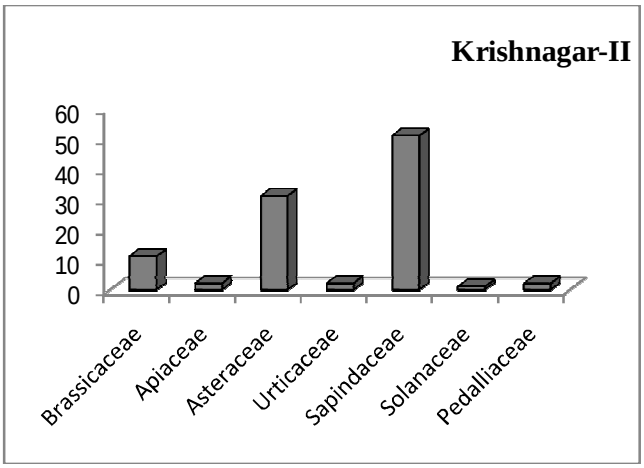

Fig. 9. Pollen frequency (%) in honey sample of Krishnagar-II Block

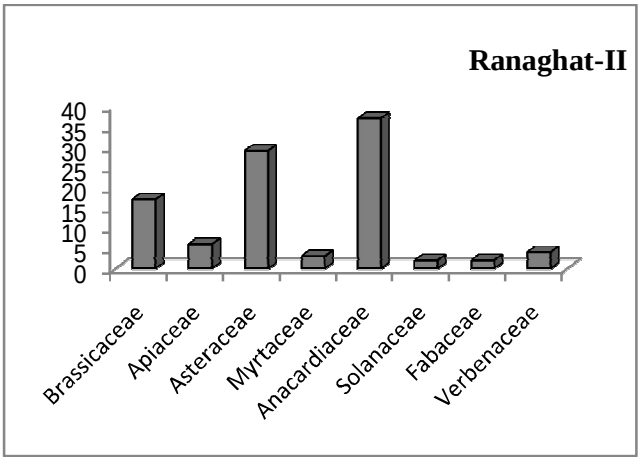

Fig. 10. Pollen frequency (%) in honey sample of Ranaghat-II Block

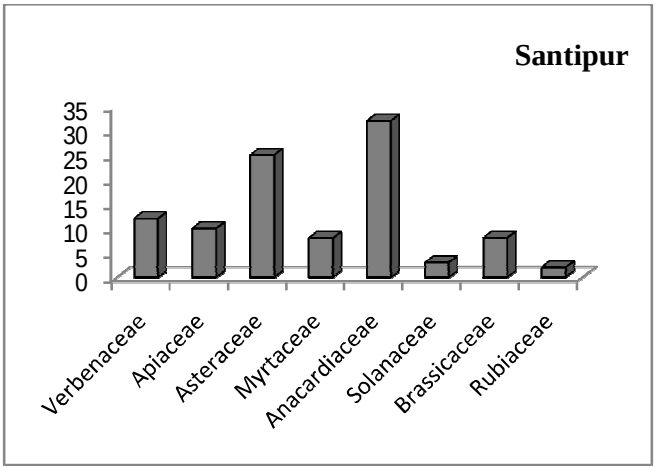

Fig. 11. Pollen frequency (%) in honey sample of Santipur Block

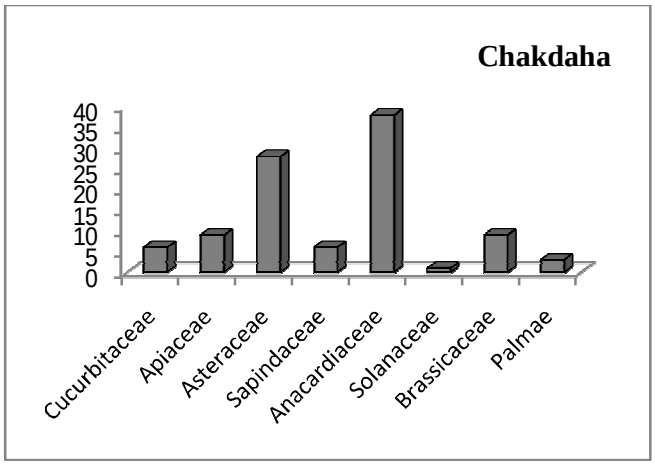

Fig. 12. Pollen frequency (%) in honey sample of Chakdaha Block

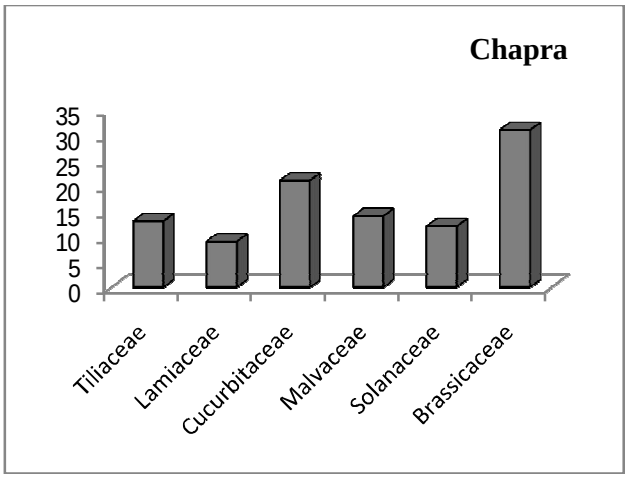

Fig. 15. Pollen frequency (%) in honey sample of Chapra Block

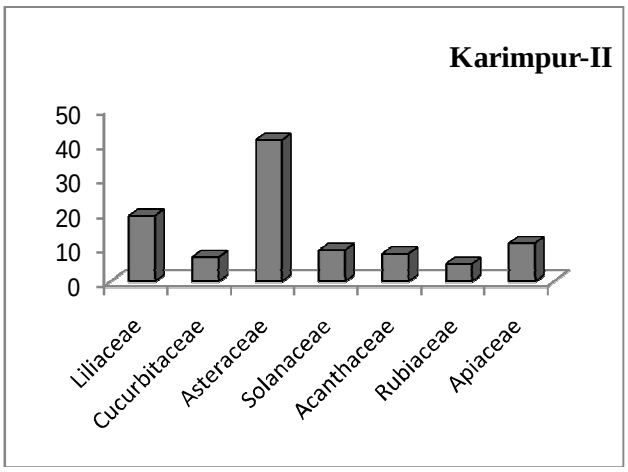

Fig. 13. Pollen frequency (%) in honey sample of Karimpur-II Block

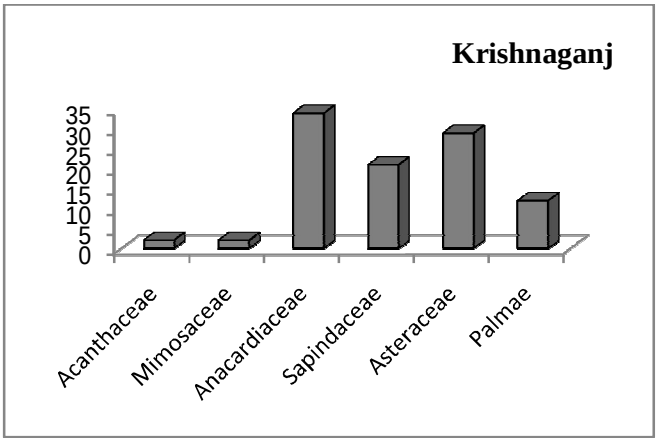

Fig. 16. Pollen frequency (%) in honey sample of Krishnaganj Block

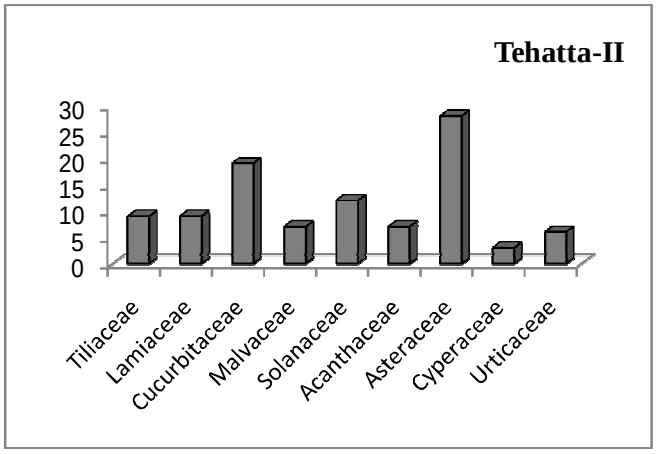

Fig. 14. Pollen frequency (%) in honey sample of Tehatta-II Block

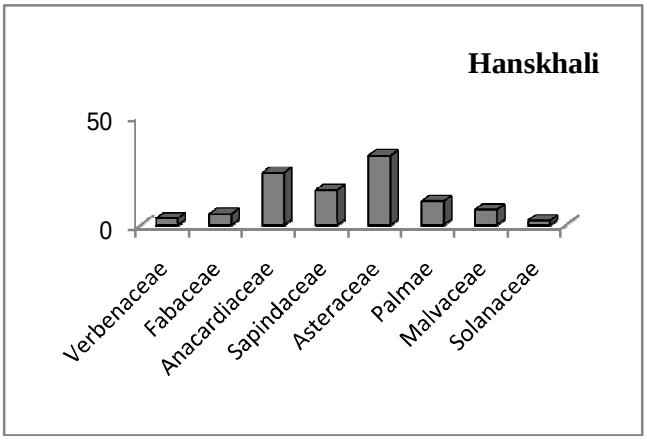

Fig. 17. Pollen frequency (%) in honey sample of Hanskhali Block

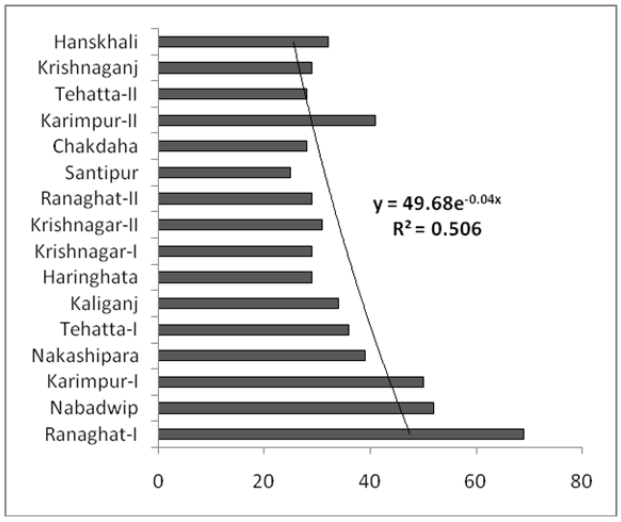

Fig. 18. Correlation between the pollen frequencies of *Parthenium* sp. in different blocks of Nadia

The sample from Nabadwip contained 52% of *Parthenium* sp. pollen, with a total of six pollen types and that from Karimpur-I contained 50% of the *Parthenium* sp pollen where also altogether seven pollen types were identified. Among the mulifloral honeys from Nadia district, the highest percentage (39%) of *Parthenium* sp. pollen was confirmed in the sample from Nakashipara, where *Parthenium* sp. was found to be the prevalent contributor among the total six types identified. *Parthenium* sp. pollen was found to be the most significant pollen morphotype contributing 36% of pollen in the multifloral honey sample from Tehatta-I, where a total of nine pollen types were identified. The sample from Kaliganj also contained nine pollen types where *Parthenium* sp. pollen contributed 34% of the pollen contents. A total of four pollen types were identified from the multifloral honey sample from Haringhata, where the contribution of *Parthenium* sp. pollen was 29% of the total pollen contents determined. The five apiary honey samples included in this investigation were collected from five different apiaries situated in Krishnagar-I, Krishnagar-II, Ranaghat-II, Santipur and Chakdaha of the district Nadia. Samples collecting from Krishnagar-I and Krishnagar-II is 'unifloral' containing *Litchi chinensis* (Sapindaceae) as dominant pollen type (59% and 51% respectively), where the second highest contributor was *Parthenium* sp., contributing 29% and 31% respectively. Only seven types of pollen were found in these samples. The samples collecting from Ranaghat-II, Santipur and Chakdaha were 'multifloral' where a total of eight pollen types were identified of which *Parthenium* sp. (Asteraceae) was found to be second highest pollen contributor (29%, 25% and 28% respectively) and the pollen of *Mangifera* sp. (Anacardiaceae) was found to be the most prevalent type contributing 37%, 32% and 38% respectively. No pollen of *Parthenium* sp. (Asteraceae) was recorded from Chapra block and there remains a positive trend to increase the pollen frequency in Ranaghat-I block following the degree of prevalence among other blocks. Significant positive correlation ($y = 49.68e^{-0.04x}$ and $R^2 = 0.506$) exists between pollen frequencies in different eco-zones of the district (Fig.18).

DISCUSSION AND CONCLUSION

The abundance of each pollen type varied among the areas and the samples. *Parthenium* sp. is a common herbaceous weed belonging to the family Asteraceae growing all over India and flowering round the year. Analysis of the pollen contents of seventeen honey samples conducted, samples shows that according to frequency classes, *Parthenium* sp. pollen is found to be prevalent type in all samples except two where *Litchi chinensis* and *Mangifera indica* predominates respectively. During a comprehensive melittopalynological survey of Ranga Reddy district of Andhra Pradesh, Ramanujam and Kalpana (1992) found *Parthenium* sp. as prevalent contributor of pollen contents in several honey samples and pollen loads collected both in summer and winter season (Kalpana and Ramanujam, 1994). The same researchers recorded *Parthenium* sp. pollen as secondary and important minor pollen types in many other samples (Ramanujam and Kalpana, 1990-91; 1992 and Kalpana and Ramanujam, 1994). Prevalence of *Parthenium* sp. pollen had also been reported from Adikmet area of Hyderabad (Kalpana *et al.*, 1990) and East Godavary district of A.P. (Ramanujam *et al*., 1992). Although the honeys and pollen loads originating in different blocks of Nadia district containing the pollen of *Parthenium* sp. as predominant type which were collected mainly by the honey bees like *Apis florea* and *Apis dorsata* (Jay and Jay, 1984) but present study indicates that the *Parthenium* sp. is equally preferred by *Apis florae, Apis dorsata* and *Apis cerana indica* because significant amount of *Parthenium* sp. pollen was recorded during analysis of pollen loads collected during different times of the season from different eco-zones of the Nadia district and this finding is concomitant with the available literature (Free, 1968; Ford, 1971; Garg and Nair, 1994; Hjelmroos, and Lobreau-Callen, 1994; Garg, 1996; Pendleton, 2006; Sajwani *et al.*, 2007; Lazarova *et al.*, 2010; Atanassova *et al.*, 2012 and Maria *et. al.*, 2013). Thus, it becomes apparent that the weed *Parthenium* sp. is an important bee plant which can successfully attract different bee species for its pollen and nectar which is evident from the past records of other eco-zones of India and other countries and present report on Nadia district, West Bengal, India known through melissopalynological analyses. Pollen frequency is high in Ranaghat-I block due to its location towards close vicinity of railways and probably due to less allelopathic effect. In Chapra block no pollen record of *Parthenium* sp. was found due to its remote location from railways and roads as well as consciousness of local people to eradicate *Parthenium* weed. Consequently it is obvious that the negative impact of floral competition is sure to reduce pollination of a target crop if it is cultivated in vicinity where the abundance of *Parthenium* sp. becomes high. *Parthenium* sp., being potential hazard, reducing bee pollination had also been reported earlier i.e. presence of Dandelion attracting pollinators in fruit orchard (Free, 1968) and white clover competition with Kiwifruit (Ford, 1971; Jayand Jay, 1984). The practice is usually followed to reduce this hazardous floral competition in respect of pollination service in crop field is either mowing of said weed or application of potential herbicide. Similar procedure should be implemented in case of *Parthenium* sp. to abate drifting of bee pollinators from the target crops or mix crop culture should be followed in Nadia

district of West Bengal, India to minimize the acute problem and to increase the crop yield.

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