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# Pollinating insects of some economically important plants of Kolhapur region, India

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## ABSTRACT

The area of pollinator dependant crops is increasing disproportionately and crop pollinators are under threat of pesticides and other chemicals used in agriculture farming. Therefore, there is need to make the survey of pollinating insects from Kolhapur region of India since this area is agriculturally very sound which contain very rich biodiversity. A total of 30 species of pollinating insect belonging to the five orders *viz.* Hymenoptera, Lepidoptera, Diptera and Coleoptera have been reported. Maximum pollinating visits have been made by *Apis dorsata* and least by *Chrysotoxum sp.* on crop plants in the region. The order of dominant pollinator was Hymenptera> Lepidoptera> Diptera>Coleoptera>Thysanoptera.

**Keywords**- Pollinating insects, Economic plants, Kolhapur, India.

## INTRODUCTION

Kolhapur is situated between 15º to 17º North latitude and 73º to 74º East longitude with an average rain fall 1100 mm covered mainly by monsoon with temperature range 16-38ºC. Western Ghats, world's biodiversity hotspot is also located in Kolhapur region. Therefore, the region is recognised as biodiversity rich area for both plants and animals. Kolhapur region of India is also visualized as best agricultural zone. Thus, it is admixture of forestry and agriculture. For conservation, protection and utilization of biodiversity of economically important crop plants pollination through insect is effective source. The value of insect pollination for worldwide agriculture production is estimated at €153 billion, which represents 9.5% of the value of the world agricultural production used for human food in 2005 (Klein *et al*., 2007; Gallai *et al*., 2009). As estimated, 62% of all flowering plants may be suffering reduced generation from seed as a result of pollinator scarcity (Burd, 1994). The area cultivated with pollinator dependent crops has increased disproportionately over the last decades, suggesting that the need for pollination services will greatly increase the near future (Airen and Harder, 2009).

Review of literature indicates that Anand (1926), Faegri and van der Piji (1979), Thien (1980), Ananthakrishnan *et al*. (1981), Ananthakrishnan (1982), Ananthakrishnan and Gopinathan (1986), Kirk (1988), Allen *et al*. (1998), Hogendoorn *et al*. (2006), Slaa *et al*. (2006), Klein *et al*. (2007), Gallai *et al*. (2009), Aizen and Harder (2009), Basu *et al*. (2011), Sathe (2010), Sathe and Shinde (2006), Ghosh and Jana (2013), Sushil *et al*. (2013), Jothimani *et al*. (2014), Duara (2014), Duara and Khalita (2014), Sunitadevi *et al*. (2014), Sharmah *et al*. (2015) worked on insect pollination.

## MATERIAL AND METHODS

Intensive field visits were made in Kolhapur region of India both from plain and forest ecosystems at weekly interval from 8.00 AM to 6.00 PM during the years 2013-2014 for noting pollination by insects on

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different flowering crop plants. All observations were taken during clear days and insects were identified by consulting appropriate literature cited in the references. A few of the listed plants along with pollinating insect were photographed in colour and incorporated in the text. The insects were collected with the help of insect net. After noting their characters they were released in the environment from which they were collected.

## RESULTS

Results recorded in table 1 and figs. 1 to 12 indicates that a total of 30 species of pollinating insects were prevalent in Kolhapur region of India. The dominant pollinating insects were belonging to five orders namely Hymenoptera, Lepidoptera, Diptera, Coleoptera and Thysanoptera.

Results recorded in Figitr-1, indicated that three genera *Apis, Megachile* and *Xylocopa* were potential pollinator for many economically important plants. The honey bee *A. dorsata* was major pollinator (9) followed by A. *cerana* (8), *A. mellifera* (7) and *Megachile brevis* (6). Other insect groups were more specified to their narrow range host preference. The dominant pollinating insects were belonging to Hymenoptera followed by Lepidoptera, Diptera, Coleoptera and Thysanoptera. Among the Hymenopterans, dominant pollinators were from the genus *Apis* followed by *Megachile* and *Xylocopa*. Coleoptera and Thysanoptera represented by two species of pollinators from the region.

In all 18 plants of economically important from the view horticulture, horticulture, floriculture, ornamentation, forest, medicinal and agriculture have been surveyed. *Tamarindus indica* appeared as most

**Table 1: Pollinating insects of Kolhapur region, India**

| Sr. No. | Insect Pollinators | Crop Plants | Flowering | |
|---|---|---|---|---|
| | | | Colour | Period |
| 1 | *Papillio demoleus* L.<br>*P. polytes stichius* (Hubn.) | *Citrus aurantifolia* Swingle (Horticultural plant) | White | Throughout year |
| 2 | *Tirumala limniace exoticus* (Gmelin)<br>*Danaus chrysippus chrysippus* (Linn.)<br>*Euploea core core* (Cramer)<br>*Corema sp.* | *Lantana camera* L. (Weed) | Purple | Throughout year |
| 3 | *Graphium agamemnon menides* (F. and F.) | *Nerium indicum* Mill. (Floricultural plant) | White | Throughout year |
| 4 | *Apis dorsata* Fab.<br>*Apis cerana* Fab.<br>*Apis mellifera* L.<br>*Menochilus sp.*<br>*Coccinella sp.* | *Carthamus tinctorius* L. (Oil seed Medical Plant) | Yellow/Red | February - April |
| 5 | *P. polytes stichius*<br>*Euploea sp*.<br>*Hypolimnas misippus* (Linn.) | *Hibiscus rosasinensis* L. (Floricultural and Medicinal plant) | Red | Throughout year |
| 6 | *A. dorsata*<br>*A. cerana*<br>*A. mellifera*<br>*A. florea* | *Linum usitatissimum* L. (oil seed, medicinal) | Blue | December – February |
| 7 | *A. dorsata* | *Solanum nigrum* L. (Vegetable) | White | February to July/ Throughout year |
| 8 | *Papillio sp*.<br>*Euploea core core*<br>*Melanitis ismene* | *Ricinus communis* L. (Medicinal and oil plant) | White | November to May |
| 9 | *A. dorsata*<br>*A. cerana*<br>*A. mellifera* | *Ocimum sanctum* L. (Medicinal plant) | Purplish-White | August-January |
| 10 | *A. dorsata*<br>*A. cerana*<br>*A. mellifera*<br>*A. florea*<br>*Papilio spp.* | *Moringa oleifera* Lam. (Vegetable and medicinal plant) | White | January to June |

| | | | | |
|---|---|---|---|---|
| | *Euploea sp*.<br>*Xylocopa letipes* Drury<br>*Megachile brevis* Say | | | |
| 11 | Thrips<br>*A. dorsata*<br>Tachinid fly | Marigold (Floricultural and Medicinal plant) | Yellow | September to June |
| 12 | *A. dorsata*<br>*A. cerana*<br>*A. mellifera*<br>*A. florea*<br>*Danaus chrysippus* (L.)<br>Thrips | *Allium cepa* L. (vegetable and Medicinal plants) | White | January to June |
| 13 | *X. letipes*<br>*Xylocopa pubescence* Spinola<br>*Megachile centuncularis* L.<br>*M. brevis*<br>*A. mellifera*<br>*A. florea* | *Cassia fistula* (Ornamental and Herbal plant) | Yellow | March to May |
| 14 | *Amegilla zonata* Linnaeus<br>*A. mellifera*<br>*A. florea*<br>*X. pubescence*<br>*M. brevis*<br>*Chrysotoxum sp.* | *Peltophorum pterocarpum* (Ornamental and Forest plant) | Yellow | April to June |
| 15 | *X. letipes*<br>*X. pubescence*<br>*M. centuncularis*<br>*M. brevis* | *Cassia marginata* (Ornamental and Forest plant) | Pink | April to June |
| 16 | *X. letipes*<br>*M. centuncularis*<br>*M. brevis*<br>*A. mellifera*<br>*A. florea*<br>*A. zonata*<br>*Ceratina hieroglyphica* Smith<br>*Nomia iridescens* Smith<br>*Nomia sp.*<br>Syrphid fly | *Tamarindus indica* (Horticultural plant) | Reddish Brown | April to June |
| 17 | *X. letipes*<br>*X. pubescence*<br>*M. centuncularis*<br>*M. brevis*<br>*A. florea*<br>*A. zonata*<br>*Nomia sp.* | *Lagerstromia speciosa* (Ornamental and Herbal plant) | Pink | April to June |
| 18 | *M. centuncularis*<br>*M. brevis* | *Delonix regia* (Ornamental plant) | Red | April to June |

favourable for pollinators visit and *Nerium indicum* least (Figure-2). The services of pollinators were extremely important for increasing yield of crop plants.

## DISCUSSION

According to Duara and Kalita (2014) butterflies were the main pollinators of *Lxora coccinea* in Nambor Wildlife sanctuary, Assam. The families Papillionidae (6 species), Pieridae (3 species) and Nymphalidae (2 species) were mainly found as insect visitors to *L. coccinea*. They further noted that the flowering season of the plant was mainly summer and butterflies derived most of the heat from the summer. Butterflies visited plants more afternoon than morning and flower colour had also influence on the number of visitors. Duara (2014) individually reported the highest number of butterflies of family Papillionidae associated with *L. coccinea*. He further noted increased in the fruit number on plants and fruits per bunch.

**Figure- 1. Plant visits by pollinators from Kolhapur region.**

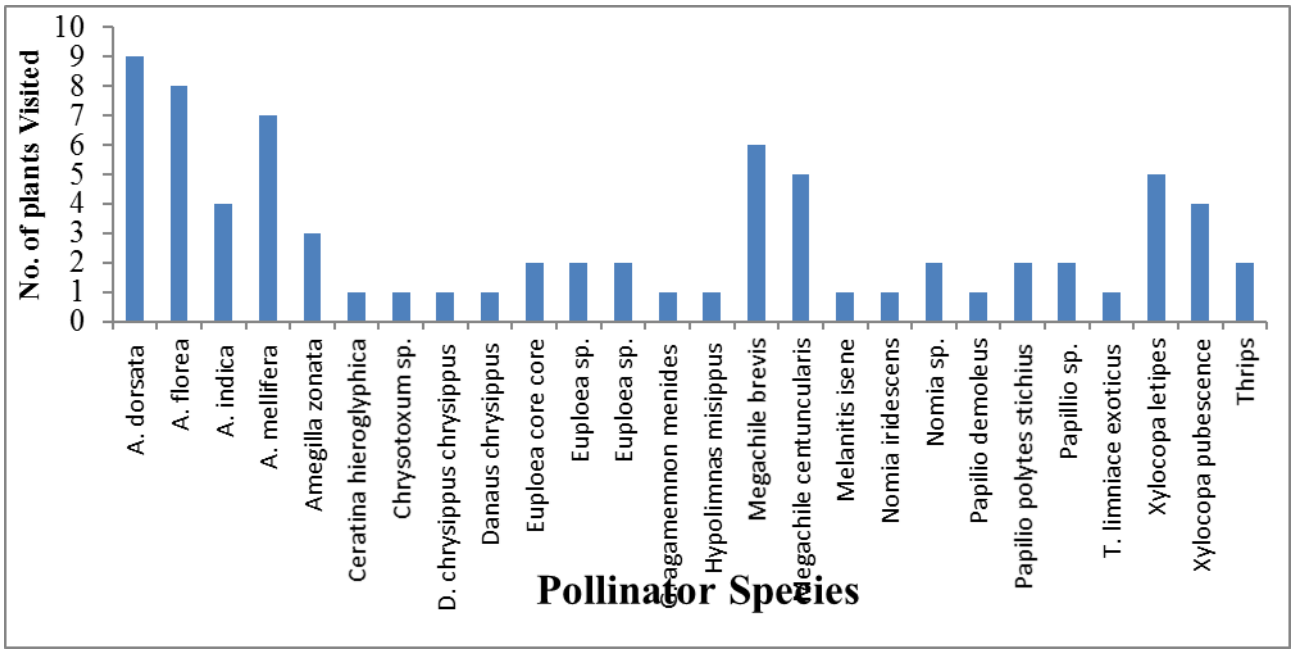
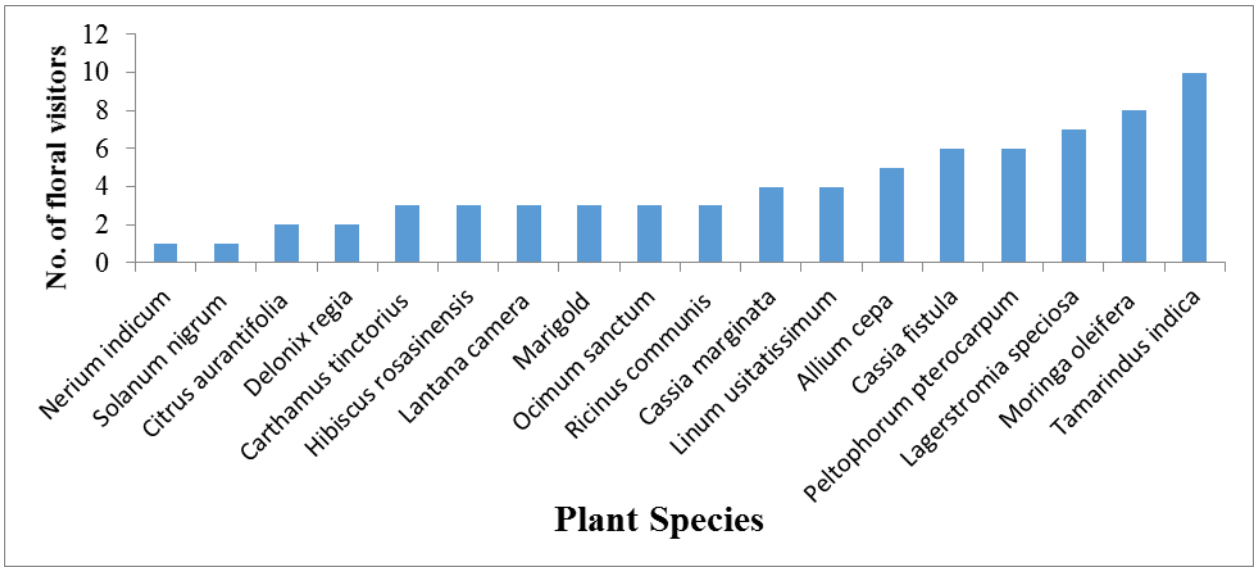



**Figure-2. Pollinators visit to flowering plant from Kolhapur region.**




Jothimani *et al*. (2014) studied the role of butterflies as pollinator in Maruthamalai hills of Southern western Ghats. They collected 27 species of butterflies as flower visitors on 36 plant species. Among the life habits, the herbs were the dominant species (19) over shrubs (7), trees (6) and undershrubs (4). Out of 27 species of the butterflies Nymphalids were 7, Pierids 5, Lycaenids 5 and Papillionids 3 indicating the dominance of Nymphalidae family.

Bees visited plants for their food, nectar and pollen. This floral fidelity of bees was due to their preference for nectar having sugar content and pollens with higher nutritive values. Honey bees were best known for their honey production but the principal economic role of honeybees in nature was to pollinate hundreds and hundreds of flowering plants and ensure seed set in quantity and quality (Shamah *et al*., 2015).

Sharmah *et al*. (2015) explained the importance of pollination in improving food security and livelihoods through enhancing productivity of horticultural crops such as fruits and vegetables.

**Figure-3. *A. dorsata* on *P. pterocarpum* flower**

**Figure-4. *A.zonata* on *T. indica* flower.**

**Figure-5. *A. zonata* on *L. speciosa* flower.**

**Figure-6. *M. brevis* on *C. fistula* flower**

**Figure-7. *M. brevis* on *D. regia* flower**

**Figure-8. *X. pubescence* on *C. fistula* flower**

**Figure-9. *C. hieroglyphica* on *T. indica* flower**

**Figure-10. *Nomia* sp. on *L. speciosa* flower**

**Figure-11. *Chrysotoxum* sp. on *P. peltophorum* flower**

**Figure-12. Syrphid fly on *T. indica* flower**

They reported that pollinator scarcity was the main factor responsible for inadequate pollination and the dramatic decline in pollinator populations was a crucial issue in crop productivity in India.

According to Morse and Colderone (2000) the value of honey bee pollination to crop production in US is $14.6 billion and the value of honeybee pollination has been estimated at CAN $ 1.2 billion in Canadian agriculture (Winston and Scott, 1984).

Sharmah *et al*. (2015) recognized four indigenous species of honey bees in India as *A. cerana*, *A. dorsata*, *A. florea*, and *A. andreniformes*. The Indian hive bee *A. cerana* and rock bee *A. dorsata* were the most abundant and predominant pollinators in India for cross pollination of crops including vegetables, which constituted 46% and 42% respectively of the total pollinators' population.

Sunita Devi *et al*. (2014) and Omkar et al (2014) studied the diversity and abundance of insect pollinators on *A. cepa* in field experiment at CCS Haryana Agriculture University, Hisar during 2009-10 to correlate their incidence in relation to the biotic environmental factors. Hymenopterans were found to be the most abundant (60%) followed by Lepidoptera, Diptera and Coleoptera. Variation in abundance was noted over time and space. *A. dorsata* was dominant pollinator of *A. cepa* followed by *A. mellifera*, *A. cerana* and *A. florea.* The visits of pollinators were low at the time of commencement and cessation of flowering but remained high during mid-flowering period.

The surveys of pollinator mechanism (Armstrong, 1979) and Desai et al (2015) illustrated that the identification of pollinators was usually not quantitative. The pollinators of a flower were commonly identified by a combination of observing the most frequent flower visitors and matching the floral characteristics, such as size, shape, colour and scent, with those derived in a pollination syndrome (Faegri and van der Piji, 1979). If these two methods identified the same group of animals and these animals were well known for pollinating other plants, then the result was usually accepted without resorting to quantitative measurement. Thrips pollinate a wide variety of plants belonging to at least 8 families namely Araceae, Asteraceae, Brassicaceae, Convolvulaceae, Dipterocarpaceae, Ericaceae, Euphorbiaceae, Leguminaceae, Orchidaceae, Palmaeceae, Verbenaceae and Winteraceae. The asymmetric single mandible of thrips mouthparts was an adaptation to feeding on pollen and that leaf feeder (Kirk, 1988 and Pawara et al, 2014). Thrips mouthparts were very appropriate for feeding on both pollen and leaf cells. Some flower thrips appeared to be more active in flowers at night. Medium sized, white to yellow sweet scented flowers with compact floral structures and small pollen grains were adaptive feature of flowers for thrips pollination. The aim of the pest management and use of pollinators in agroindustry is to increase the yield of crops (Sathe, 2001, 2010; Patil et al, 2014; Sathe and Shinde, 2006; Sathe *et al*., 2015). Therefore, the present work will add great relevance as baseline for increase of productivity in crop plants of the region in near future.

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## Conflict of Interests:

The authors declare that there is no conflict of interests regarding the publication of this paper.

## References

1. Aizen, M. A. and L. D. Harder. 2009. The global stock of domesticated honey bee is growing slower than agricultural demand for pollination. *Current Biol*.; 19(11), 915-918.
2. Allen –Wardell, G.; Bernhardt, P.; Bitner, *et al*. 1998. The potential consequences of pollinator declines on the conservation of biodiversity and stability of food crop yields. *Conservation Biology*; 12 (11), 8-17.
3. Ananthkrishnan, T. N. 1982. Thrips and pollination biology. *Current Science*; 51(4), 168-172.
4. Ananthkrishnan, T. N. and Gopinathan. 1986. Insect pollinator-plant interactions, In: Dynamics of insect-plant interaction (Ed.) T. N. Ananthakrishnan, ERI, Loyola college, Madras. pp- 85-101.
5. Annand, P. N. 1926. Thysanoptera and the Pollination of Flowers. *The American Naturalist;* 60(667), 177-182
6. Antram, C. B. 2002. Butterflies of India. A mittal publication New Delhi.
7. Armstrong, J. A. 1979. Biotic pollination mechanism in the Australian flora-A review. *N. Z. J. Bot.*, 17, 467-508.
8. Burd, M. 1994. Bateman's principle and plant reproduction: the role of pollen limitation in fruit and seed set. *Bot. Rev*.; 60, 81-109.
9. Desai A.S., Khamkar A.G and T.V. Sathe. 2015. Ecology and Ethology of Crane fly Tipula paludosa Meigen (Tipulidae: Diptera) from Kolhapur region, India. Biolife. 3(1):21-25
10. Duara, P. 2014. Effectiveness and importance of butterflies as pollinator to the flowers of *Lxora coccinea*. *Int. Nat. J. Res. Studies Biosci*., 2(11), 71-74.

11. Duara, P. and J. Kalita. 2014. Butterfly as pollinating insects of flowering plants. *Global Journal of Science Frontier Reseach:C Biological Science*, 4(1), 1-4.
12. Faegri, K. and L. Vander Piji. 1979. The principles of pollination ecology. Pergamon press, Oxford, 3rd ed.
13. Gallai, N.; Salles, J. M. and B. E. Vaissiere. 2009. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological Economics*, 68(3), 810-821.
14. Ghosh, A. K. and D. Jana. 2013. Butterfly-philic plants in agro-forestry of West Bengal. *Geobios*; 40, 220-222.
15. Hogendoorn, K., Cross, C. L. Sedgley, M. and M. A. Keller. 2006. Increased tomato yield through pollination by native Australian *Amegilla chlorocynea* (Hymenoptera: Anthophoridae). *J. Econ. Ent.*; 99(3), 828-833.
16. Jothimani, K.; Ramchandran, V. S. and A. Rajendran. 2014. Role of butterflies as pollinator in Marathamalai Hills of South western Ghats. *Academic Journal of Entomology*, 7(1), 7-16.
17. Kirk, W. D.J. 1988. Thrips and pollination biology, In: Dynamics of insect plant- interaction (Ed.) T. N. Ananthakrishnan and A. Raman. pp. 129-136.
18. Klein, A.M., Vaissiere, B. E., J. H. Cane et al. 2007. Importance of pollinators in changing landscapes for world crops. *Proc. Royal. Soc*. (B), 274(1608), 303-313.
19. Kunte, K. 2000. Butterflies of peninsular India. Universities press (Hydrabad) and Indian Academy of Sciences (Bengaluru).
20. Morse, R. A. and N. W. Calderone. 2000. The value of honey bee as pollinator of US crops in 2000, Report- Cornell University, Ithaca, New York.
21. Omkar V. Yadav and S. R. Yankanchi. 2014. Preliminary study of herpetofaunal diversity in Radhanagari wildlife sanctuary (WLS), Kolhapur, Maharashtra, India. Biolife. 2(4):1154-1159
22. Patil, S. R., Patil, S. S., & Sathe, T. V. (2014). Preliminary Analysis of Diversity Status with Reference to Pisces from major wetlands of Aajara tahsil of Kolhapur district, Maharashtra, India. Biolife. *3*(1),12-15.
23. Pawara R. H, Patel N.G, Pawara J.V, Gavit, P.J and Ishi S.S. 2014. Beetles of Jalgaon district of Maharashtra, India. Biolife. 2(3):970-973
24. Sathe, T. V. 2001. Agrochemicals and pest management. Daya Publishing House, New Delhi, pp. 1-217.
25. Sathe, T. V. 2006. Fundamentals of bee keeping. Daya Publ. House, New Delhi, pp 1-120.
26. Sathe, T. V. and K. P. Shinde. 2006. Diversity of butterflies from Western Ghats (Kolhapur district). *J. Nat. Con*., 18(1), 181-184.
27. Sathe, T. V., Anna Gophane and Nilam Shendage. 2015. Colour attractivity and occurrence of some cell sap sucking pests on crop plants*. Biolife*, 3(2), 540-546.
28. Sharmah, D. Amrita, Khound, S. Rahman and P. Rajkumari. 2015. Significance of honey bee as a pollinator in improving horticultural crop productivity in N.E. region of India: A review. *Asian Journal of Natural and Applied Sciences*, 4(1), 62-67.
29. Slaa, E. J., L. A.S. Chaves, K. S. Malagodi-Braga and F. E. Hofstede. 2006. Stingless bees in applied pollination: practice and perspectives. *Apidologie,* 37(2), 293-315.
30. Sunita Devi, Rachana Gulati, Kanika Tehri and Asha. 2014. Diversity and abundance of insect pollinators on *Allium sepa* L. *Journal of Entomology and Zoology Studies*, 2(6), 34-38.
31. Sushil, S. N., Stanley, J., N. K. Hedau and J. C. Bhatt. 2013. Enhancing seed production of trees Brassica vegitables by honey bee pollination in North-Western Himalayas of India. *Universal Journal of Agricultural Research*, 1(3), 49-53.
32. Thien, L. B. 1980. Pattern of pollination in the primitive angiosperms. *Biotropica*, 12(1), 1-13.
33. Winston, M. L. and C. D. Scott. 1984. The value of bee pollination to Canadian agriculture. *Canadian Beekeeping*, 11, 134.
34. Wynter-Blyth, M. A. 1957. Butterflies of Indian region. Bombay Natural History Society, Mumbai.