SUMMARY AND CONCLUSION
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The architecture of the flowers are of great significance in relation to pollination mechanism through its uniqueness and specific features. Some flowers are pollinated by several flower-visitors while some depends on particular flower visitors. Floral phenology are also very much adapted to various pollination syndromes.

Floral biology including pollination of flowering plants is important for formation of fruit and seed set which is crucial for various conservation process. It is also important to understand pollination and breeding systems that regulate the genetic structure of populations. Floral rewards like nectar and pollen are the major attractants in angiosperm flowers. A pollinator is an agent that transfers pollen grains from anthers to the stigma of the flowers. Lack of pollinators makes pollen transfer difficult. So, the relationship between the flower and visitor is one of the most significant part of plant sexual reproduction as well as pollen dispersal and pollination. Successful pollination not only depends on the availability of pollinator but also depends upon the pollen load and its viability, stigma forms and its receptivity.

Information on floral biology in relation to pollination provides a better understanding of dynamic interaction among plants and animals interaction in the crop fields.

From the present investigation on floral morphology and phenology as well as pollination mechanism in relation to fruit set of selected economically important crop plants reveals the following:

- Some of the investigated plants like *Benincasa hispida*, *Borrasus flabellifer*, *Cocos nucifera*, *Lagenaria siceraria*, *Luffa acutangula*, *Momordica charantia*, *Trichosanthes cucumerina* shows unisexual flower, while the flowers of *Capsicum annuum*, *Cicer arietinum*, *Lathyrus sativus*, *Nigella sativa*, *Sesamum indicum*, *Trifolium campestre*, *Trigonella foenum-graecum* and *Vigna mungo* are bisexual. All the Cucurbitians along with *Borassus flabellifer* and *Cocos nucifera* have the unisexual flowers which required pollen vector for pollination. On the other hand the stigmatic movement of *Nigella sativa*, close association of anther and stigma of *Capsicum annuum* and *Sesamum indicum* promote self pollination, but insects also play important role in pollination which promote cross pollination.
  Though morphological adaptations like enclosed stamens and stigma by petals, anther dehiscence before flower opening promote self-pollination in the Leguminous plant, but insects also play vital role as pollinator.

- In *Vigna mungo* presence of peristigmatic hairs surrounding the stigma prevents auto deposition of pollen which favours the cross pollination as a consequence require agents for effective pollination.

- Poral dehiscence and absence of nectar are common features of Solanaceae but present observation revealed longitudinal anther dehiscence and presence of nectar in *Capsicum annuum*. 

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Pollination success depends on pollen production and pollen production capacity by an individual plant is under genetic and physiological control. Highest pollen production per flower was observed in *Nigella sativa* (1,08,284) while lowest number of pollen grains per flower was observed in *Momordica charantia* (7,500). So pollen production vary from species to species.

Some of the investigated taxa produced sticky pollen grains with complex surface ornamentation which help to attach to the different body parts of the flower-visitors and dispersed, while in case of *Borassus flabellifer* and *Cocos nucifera* the pollen grains are small, light, smooth walled, powdery which float in the air and easily dispersed through air as a result atmospheric pollen frequency is high, which result a considerable amount of fruit set in netting condition. Thus, the study of pollen morphology on the basis of apertural characters, surface pattern, exine ornamentation, size and shape of pollen grains are important criteria in pollen dispersal and pollination as well as pollen-stigma interaction. The present study also throw light that flower visitors during forage disturbed floral parts which also help in dislodging of pollen from the floral parts and contribute in the atmospheric pollen dispersal.

Successful fruit set and high crop yield depend on viable pollen grains. In case of *in vitro* pollen germination, sucrose and boric acid individually showed good results but sucrose supplemented with boric acid enhanced pollen germination and pollen tube development. Salts of calcium, magnesium and potassium also showed positive role in pollen germination as well as tube growth.

Stigma receptivity is a critical stage in the maturation of the flower that may greatly influence the success of pollination at different stages in the life cycle of the flower and the receptive surface of stigma contains extracellular proteins either as a pellicle in the dry stigmas or as a component of the exudate in the wet stigmas. So pollen pistil interaction is of cardinal importance in the biology of sexual reproduction and seed formation which have a direct relevance to breeding programmes.

The present investigation showed the intense presence of esterase and peroxidase on stigmas during its high receptive period and it might be considered that intense presence of esterase and peroxidase are important associated factors for stigma receptivity. The presence of esterase and peroxidase become more in particular time after anthesis when stigma become more receptive. From the present investigation it can be concluded that there is a correlation with the intense presence of esterase and peroxidase with peak receptive period of stigmas of all selected plant taxa and suggests contribution of esterase and peroxidase towards stigma receptivity.

Pollen: ovule ratio reflects the breeding system. The crop plants which have low pollen-ovule ratio is generally self-pollinated, whereas cross-pollinated plants show generally high pollen-ovule ratio. The flowers of Cucurbitaceae show low pollen ovule ratio, but they showed out crossing nature in breeding experiment due to unisexuality. *Sesamum indicum* also have low pollen ovule ratio but it also have out
crossing nature. Flowers of *Borassus flabelifer* and *Cocos nucifera* showed high pollen: ovule ratio indicating the xenogamous nature due to unisexuality, while in *Nigella sativa* pollen-ovule ratio reflects the facultative xenogamy but self-pollination also occur due to stigmatic movement. As in bud condition, stigmatic head extended beyond the anther level, the flower is primarily outcrossing in nature but stigmatic movement downwards to the anther may also assure the reproductive successes by selfing.

- Different groups of insects along with birds, squirrels were found to visit flowers for forage and act as pollinators in the investigated plant taxa.

- Floral morphology and the results showed the selfing nature of Fabaceae but the floral morphology and the floral rewards are very much suited for bees and Thrips which help in out crossing.

- Previously, bees (Abu-Hammour and Wittmann, 2011; Mukherjee et al., 2013) were observed as flower visitors in *Nigella sativa*, but in the present investigation on floral biology especially the movement of the essential organs i.e stigma towards the effective pollination was observed in details. Besides *Apis dorsata*, *Apis cerana indica*, *Amegilla sp.*, *Borbo sp.*, *Eristalinus* sp. etc. were also observed as flower visitors which help in pollen dispersal as well as in pollination.

- It was reported by the earlier workers that *Capsicum annuum* was pollinated by *Trigona* spp. but in the present investigation different members of Hymenoptera (*Apis cerana indica* *Apis dorsata*, *Anthophora* sp., *Halictus* sp., *Vespa* sp., *Xylocopa* sp. and Ant (Formicidae) ) and Lepidoptera (*Borbo* sp., *Cepora* sp., *Danaus* sp., *Hypolimnus* sp.) were also observed to visit flowers for their forage which help in pollen dispersal and pollination.

- The flowers of *Luffa acutangula* and *Trichosanthes cucumerina* open at dusk while in *Benincasa hispida* open during dawn and the flowers of these plants are visited by hawkmoth (*Macroglossum* sp.) primarily and then by bees which play vital role in pollination.

- Present investigation shows that bees (*Apis* sp., *Xylocopa* sp., *Amegilla* sp.) are the dominant pollinator groups and play a vital role in plant-pollinator interactions, which are crucial in conservation biology as well as in sustains of ecosystem.

- Pollination success rate can be increased within the potential of the plant by exposing the open flowers to large number of manageable pollinators with their nesting requirements. Flower-visitors interaction is dependent on environmental factors like temperature, relative humidity which also influence the activity of pollinators and pollen dispersal. In *Borassus flabelifer* and *Cocos nucifera* pollen grains are smooth.
walled, light weight, powdery which are adapted for anemophilus nature. In case of unisexual Cucurbitaceous flowers stigma remain receptive up to long day for the deposition of large amount of pollen grains to effect the pollination.

- Besides flower-visitors, air also plays a vital role in pollen dispersal and pollination of the investigated plant taxa. Atmospheric pollen frequency was observed as highest (34.00% at 12:30pm) in case of *Borassus flabellifer* and lowest (1.54% at 11:00am) in *Trifolium campestre* during peak flowering time. Biological rhythm of anthesis, anther dehiscence and mode of pollen dispersal differ from each other which reflect the aerial pollen concentration. Their role in successful fruit formation was confirmed after getting fruit set in netted flowers or inflorescence.

- From the present investigation on floral biology and phenology as well as pollination mechanism in relation to successful fruit and seed formation of economically important crop plants, it can be concluded that species based difference on flower morphology, anthesis, pollen productivity, pollen morphology, pollen-ovule ratio, *in vitro* pollen germination, morphology and receptivity of stigmas, *in vivo* pollen behavior were reflected the adaptability of flowering plants for their sustainable occurrence under the critical environmental condition. Pollination success rate may be enhanced within the potential of the plant by exposing the open flowers to large number of manageable pollinators with their nesting requirements. Thus, present study provides a broad picture of the magnitude and importance and applications of the study of floral biology as well as plant reproductive biology.