



Terminology for the Orchid pollination in North- East India

S. K. Chaturvedi* and Bhaskar Buragohain**

*23-19/1, C.Y. Chintamani Road, Allahabad-211002, India

**Department of Botany, Mariani College, Mariani, Assam, India

*Corresponding author e-mail: sunchat1@rediffmail.com

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ABSTRACT

Anthecological studies on some wild orchids, viz., *Aerides odorata*, *A. rosea*, *Calanthe sylvatica*, *Coelogyne nitida*, *C. corymbosa*, *Dendrobium devonianum*, *D. primulinum*, *D. densiflorum*, *D. fimbriatum*, *D. jenkinsii*, *D. chrysotoxum* and *D. moschatum*, *Flickingeria fugax*, *Paphiopedilum insigne*, *Phaius tankervilleae*, *Pholidota articulata* and *Rhynchostylis retusa* of Assam and Nagaland states of North- east India have been made during last 15 years i.e. 2005 to 2020. The present paper is the compilation of previously reported terminology for the pollination of various orchids through the different body parts of the insects, viz. fore -head and thorax and a new report of pollination through the mouth-parts of these insect visitors called “Probonotribic pollination.”

Keywords : Terminology, Orchid pollination, North- East India, Anthecology, Frontotribic, Probonotribic, and Thoraxinotribic,

Among orchids, unlike other angiosperms, except asclepads, the reproductive organs become more specialized and known as “Gynostemium”. The gynostemium of orchids is compound reproductive structure which possesses male and female reproductive organs adjacent to each other but separated by a membrane like structure called “Rostellum”. Therefore, for carrying out the successful fertilization the pollinaria have to be inserted into the receptive surfaces of the stigmas which are present sub-apically on the column of the flowers. The orchids, therefore, offer different types of attractants like nectar and odour so as to attract insect visitors on their flowers and in turn get the pollinaria transferred on the receptive surfaces of stigma. The term “Nototribic” and “Sternotribic” have been assigned for the transfer of Pollen grains from anthers to stigma of flower/s through the dorsal and ventral surfaces of insect visitors respectively. Chaturvedi (2010) and Bhaskar and Chaturvedi (2020) have coined the terms “Frontotribic” and “Thoraxinotribic” for the pollination, of *Aerides odorata* and *Thunia alba*, through the fore-head and the thorax of the insect visitors respectively. The present paper reports a new terminology as “Probonotribic pollination” for the transfer of pollinaria from anthers to stigma through the mouth-parts of insects in two orchids viz., *Calanthe sylvatica* and *Pholidota articulata*. Therefore, the present communication is a consolidated compilation of the terminology for orchid pollination reported by Chaturvedi (2010) and Buragohain and Chaturvedi (2020) for the pollination of orchids viz., *A.odorata* and *Thunia alba* of North –east India. Hence, the paper deals with the compilation of terminology for orchid pollination viz., Frontotribic, Probonotribic (new report) and Thoraxinotribic

for the investigated orchids, viz., *Aerides odorata*, *A. rosea*, *Calanthe sylvatica*, *Coelogyne nitida*, *C. corymbosa*, *Dendrobium devonianum*, *D. primulinum*, *D. densiflorum*, *D. fimbriatum*, *D. jenkinsii*, *D. chrysotoxum* and *D. moschatum*, *Flickingeria fugax*, *Paphiopedilum insigne*, *Phaius tankervilleae*, *Pholidota articulata* and *Rhynchostylis retusa* .

MATERIALS AND METHODS

Anthecological studies were made at Mokokchung district of Nagaland State and Mariani city of Jorhat district of Assam state of North - East India (GPS position Mokokchung district 26°39'39"N and 94°19'22 E and Mariani city 26°38'61.3"N and 94°17'88.9"E). The observations were made from March to June and September to November during 2005 to 2020. Field photographs of insect's foraging on flowers and the attachment of pollinaria on their body parts were taken with the help of Canon digital Camera ESO 550 D. The insect visitors have been identified with the help of photographs available on the DVD Data- Rom entitled “Brisbane Insects and Spiders, Version 1.2, purchased from Peter Chew of Australia. The identification of insects was authenticated by sending the specimen to the In- charge, regional office of Zoological Survey of India, Shillong (Meghalaya) and the Director, Zoological Survey of India, Kolkata.

OBSERVATIONS AND RESULTS

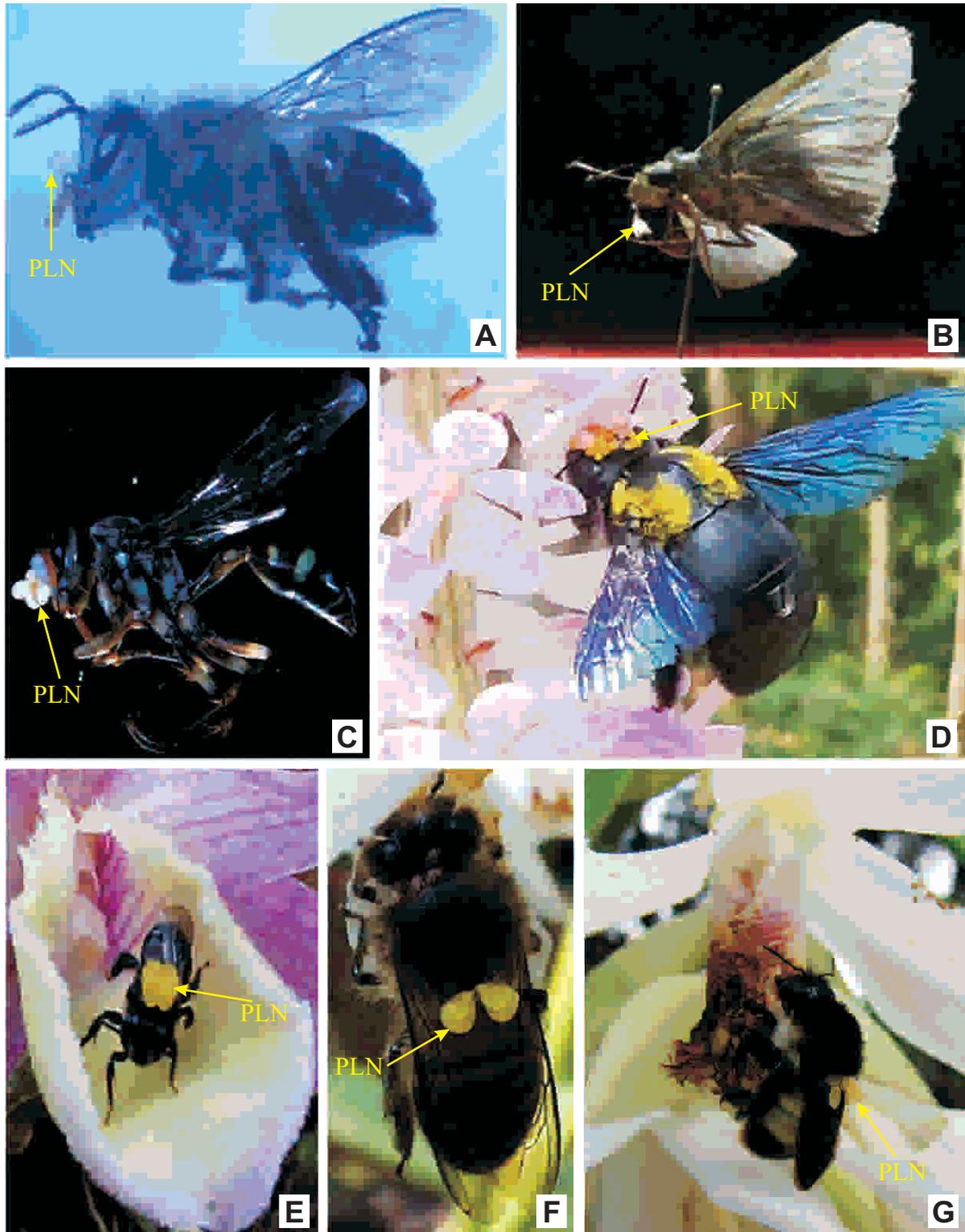
Anthecological studies on the indigenous orchids of Assam and Nagaland revealed that most of the taxa are visited and foraged for nectar by the insects belong to order Diptera, Hymenoptera and Lepidoptera only. During the act of probing

for the nectar the insect visitors either enter inside the flowers i.e. in between the lip and the column of the flower and insert their mouth – parts at the base of the lip so as to lick- up the nectar secreted by the nectary or the spur of the flowers of various orchids viz., *Aerides odorata*, *A. rosea*, *Calanthe sylvatica*, *Coelogyne nitida*, *C. corymbosa*, *Flickingeria fugax*, *Pholidota articulata* and *Rhynchostylis retusa*. The flowers of different species of genus *Dendrobium*, viz., *D. devonianum*, *D. primulinum*, *D. densiflorum*, *D. fimbriatum*, *D. jenkinsii*, *D. chrysotoxum* and *D. moschatum*, and other genera viz., *Paphiopedilum insigne* and *Phaius tankervilleae* attract insects through the odour emitted by the hairs present on the labellum or inside the modified labellum called “synsepalum” of *P. insigne*. These flowers do not offer any reward (Nectar) to the insect visitors and exhibit deceptive pollination mechanisms. During the process of nectar probing inside the flower either the fore-head or proboscis or thorax of the insects come in contact with the viscidium of pollinarium which are attached on the apical portion of the column and get stick to them. As soon as these insects retract their body out of the lip, the pollinaria too come out of the anthers either along with the anther cap or without it. But in the flowers with lip spurs, viz. *Aerides odorata*, *A. rosea* and *Calanthe sylvatica*, the visitor bees, moths and butterflies do not enter the flowers, instead, these visitors perch on the lip and suck nectar by inserting their proboscis inside the spurs. In doing so these insects try to insert their proboscises deep inside the spur so as to lick up more nectar and exert a pressure on the apical portion of column e.g. as in *Aerides odorata*, *A. rosea* and *Pholidota articulata* so that the viscidium of the pollinaria present at the apical portion of the column come in contact with the fore-head of the insect foragers i.e. *Bombus* sp. and *Xylocopa* sp. in

genus *Aerides*. However, in case of *P. articulata* the honey bees of *Apis indica* insert their proboscis at the base of column so as to lick up the nectar and these bees while retracting themselves out of the flowers their proboscis come in contact with the viscidium of the pollinarium which get stick to it. The wasps of genus *Parapolybia varia*, also forage these flowers and in doing so their fore-head come in contact with the viscidium of the pollinarium which get stick to it. When such insects retract out of the flowers the pollinaria which are attached to the fore-head of the wasps also come out of the anthers. Therefore, the flowers of *P. articulata* exhibit promiscuous pollination through the honey bees of *Apis indica* and the wasps *Parapolybia varia*. The flowers of *Coelogyne nitida*, *C. corymbosa*, *Flickingeria fugax*, *Phaius tankervilleae* and *Rhynchostylis retusa*, exhibit thoraxinotribic pollination as the pollinaria of all these taxa become attached on the thoraxes of their insect visitor/pollinators (Table-1 and Fig. 1A-G). In Mokokchung town the black isolated bees of genus *Lasioglossum* have been found as the only visitors and pollinators of all the species of genus *Dendrobium* viz., *D. chrysotoxum*, *D. densiflorum*, *D. devonianum*, *D. fimbriatum*, *D. jenkinsii*, *D. moschatum* and *D. primulinum*. In all the investigated species of genus *Dendrobium*, the pollinaria become attached to the thoraxes of the visitor insects and get inserted into the stigmatic groove. Such type of pollinaria transfer through the thoraxes of insects has been termed as “Thoraxinotribic pollination”. However, In *Paphiopedilum insigne* (lady’s slipper orchid) the Syrphid flies of genus *Syrphus* have been found as the only pollinators (Chaturvedi, 2008). These flies also exhibit “Thoraxinotribic pollination”.

Table–1, Showing different terminologies used for the pollination of investigated orchids in Assam and Nagaland states of North- east India

Sl. No.	Proposed Terminology	Names of Orchid genera	Parts of the insect with Pollinaria attached	Name of the insect visitors/ pollinators
1.	Probonotribic	1. <i>Calanthe sylvatica</i>	Mouth- parts	<i>Pelopidas methias</i>
		2. <i>Pholidota articulata</i>	Mouth-parts	<i>Apis indica</i> (Indian honey bee)
2.	Frontotribic	1. <i>Aerides odorata</i> ,	Fore- head	<i>Bombus</i> sp.
		2. <i>A. rosea</i>	Fore- head	<i>Xylocopa</i> sp.
		3. <i>Rhynchostylis retusa</i>	Fore- head	<i>Xylocopa aestuens</i>
		4. <i>Flickingeria fugax</i>	Fore- head	<i>Lasioglossum</i> sp.
		5. <i>Pholidota articulata</i>	Fore- head	<i>Parapolybia varia</i>
3.	Thoraxinotribic	1. <i>Dendrobium</i> (Six species)	Thorax	<i>Lasioglossum</i> sp.
		2. <i>Phaius tankervilleae</i>	Thorax	<i>Xylocopa</i> sp.
		3. <i>Paphiopedilum insigne</i>	Thorax	<i>Syrphus</i> sp.
		4. <i>Coelogyne nitida</i>	Thorax	<i>Apis indica</i>
		5. <i>C. corymbosa</i>	Thorax	<i>Apis indica</i>



Figs. 1 A-G: Insect visitors of orchids showing pollinaria attachment on different parts of their body. A. *Apis indica* with pollinaria attached to the mouth-parts (Probonotriby) ; B. *Pelopidas mathias* (Butterfly) with pollinaria attached on the Proboscis (Probonotriby); C. A Wasp *Parapolebia varia* with pollinaria attached on the fore-head (Frontotriby); D. Carpenter bee *Xylocopa aestuens* with a lump of pollinaria attached on the fore-head (Frontotriby); E. Black solitary bee *Lasioglossum* sp. with pollinaria attached on the thorax (Thoraxinotriby); F. *Apis indica* with pollinaria attached on the posterior part of Thorax (Thoraxinotriby) ; G. *Bombus* sp. with pollinaria attached on the posterior part of the thorax (Thoraxinotriby). PLN- Pollinaria

CONCLUSIONS

Anthecological studies on the Orchids of Assam and Mokokchung revealed that most of them are visited and pollinated by the insects of different class viz., Diptera, Hymenoptera and Lepidoptera. Chaturvedi (2010) and Buragohain and Chaturvedi (2020) have already given the terminology for the attachment of pollinaria on the fore-head and thoraxes of these insect visitors as “Frontotribic” and “Thoraxinotribic” in *Aerides odorata* and *Thunia alba* respectively. The thoraxinotribic pollination has also been observed in all the seven investigated species of genus *Dendrobium*, viz., *D. chrysotoxum*, *D. densiflorum*, *D. devonianum*, *D. fimbriatum*, *D. jenkinsii*, *D. moschatum* and *D. primulinum*. whereas, two species of genus *Aerides*, viz., *A. odorata* and *A. rosea* exhibit attachment of pollinaria on the fore-head of the foragers and called frontotribic pollination as reported by Chaturvedi (2010). The flowers of *Aerides odorata*, *A. rosea*, *Pholidota articulata* and *Rhynchostylis retusa* exhibit “Promiscuous pollination” as they attract more than one type of insect pollinators. In *Paphiopedilum insigne* the pollinators are attracted towards the flowers by urine like odour which is produced by the multicellular hairs present on the inner cuticle of the synsepalum and once the insects are trapped inside the synsepalum, they cannot get out of it. Therefore, these flies search an exit through the column and perform the process of pollination through their thoraxes which come in contact with anther and the well exposed stigma. Since, the flowers do not offer any nutrition or reward to the visitor insects, it has been considered as deceitful pollination or “Sapromyophily”. Although, the abdomenotribic and tarsenotribic pollination has not been found in the investigated species of orchids, yet, there

are reports of pollinaria attachment and transfer into the receptive stigmatic surfaces through the abdomen of the insects in various species of genus *Ophrys* and termed as “Pseudocopulation” (Correvon and Pouyanne 1916 and Tyteca *et al.* 2006).

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