Conclusions And Scope For Further Research
GENERAL CONCLUSIONS AND SCOPE FOR FURTHER RESEARCH

Order Trichoptera is economically one of the most important insect order. Inspite of this a very little information is available in India. Whatever scattered works are available those are all by the foreign workers who either got the material from the various Indian museums on loan basis or collected it during different expeditions. So all those works are neither uniform, nor thorough and systematic. This group remained neglected at the hands of the Indian naturalists because of difficulty in procuring the material and translating (most of the concerned literature on Indian Trichoptera is in the languages other than English). According to Schmid (1984), who made an outstanding contribution to the systematic of Indian caddisflies there are more than 4000 species of this group awaiting their discovery in India. So far only 1000 species are on record from Indian subcontinent. According to Morse (2003) India records the highest density of species per unit area i.e. 1.6 species per kilohectare. The basic problems concerning what occurs in India (how many genera, species) and where they are found (distribution) are still lying unsolved. Literature reflects that previous workers instead of smoothening the past works and synthesizing that with new, worked with a target of describing new taxa from here and there, and thus there are numerous lacunae and gaps in the previous works. From many angles the existing knowledge on this group is so much fragmentary, inadequate and incomplete that all the previous works lack keys at the generic and the species level. Even the available descriptions are not complete. The works of the previous researchers need improvement through additional collections, redescriptions and updating the taxonomic status of different taxa. The present research endeavour was undertaken with a view to achieve these objectives and streamline the works concerning this order and particularly the Plenitentoria group which includes 8 families from this region. During the
course of study, the first year was full of difficulties as the present author was a beginner on this group. The major problem was to procure the literature as our Indian libraries are not fully equipped with important books and journals. So I contacted several persons who were globally working on this insect order. I was fortunate enough that I got a major help from Dr. J. C. Morse (Clemson University, U.S.A) who is an authority on this order and was kind enough to send me all the literature through email or sometimes in the form of hard copies. Based on the available information, workable dichotomous keys at the subfamily, generic and the species level of Plenitentoria group have been constructed which collectively form an outstanding and worth-mentioning feature of my present studies. To update the taxonomic status of this group, an intensive and extensive faunistic survey have been undertaken to cover the different localities of Himalayan ranges between an altitude of 400 m amsl in Tamin (Arunachal Pradesh) to 4000 m amsl in Apparwat (Jammu & Kashmir) since 2008-2011 in pre and post monsoon seasons in North-East and North-West Himalayas. No collection was made in the winter months i.e. November to February as the insects undergo hibernation due to winter. Keeping in view the time devoted and the field area covered, the results were quite encouraging and satisfactory.

The perusal of the relevant literature shows that by and large collections were made from a few and selected places, thus leaving a large scope for exploring unexplored localities in order to collect more material and discover new species and first records. In the present context, the taxonomic study of 77 species based on my personal collections from Indian Himalaya during the last four years would definitely lay a sound foundation for the more extensive and thorough studies on the Indian Plenitentoria group and thus, would provide a base for the future workers. 25 species of Lepidostoma Rambur and 1 Species of Paraphylopteryx Ulmer of the family Lepidostomatidae are new to science. Also 2 species of the genus Lepidostoma Rambur constitute first record from India. These were earlier reported from Nepal and Bhutan respectively. 2
species of the genus *Pseudostenophylax* Martynov and one species of the *Limnophilus* Leach belonging to the family Limnephilidae are new to science. 1 species of the genus *Pseudostenophylax* Martynov is recorded first time from India, which was earlier reported from Pakistan. 1 species of the genus *Astratodina* Mosely is recorded first time from India earlier recorded from Pakistan. 2 species of the genus *Goera* Stephens belonging to the family Goeridae are new to science. 2 species of the genus *Eubasilissa* Martynov belonging to the family Phryganeidae are new to Science. Female of *Eubasilissa asiatica* Betten belonging to family Phryganeidae is described and illustrated first time. A detailed account of each species has been prepared which includes: bibliographic references, synonymy (if any), morphological description of genitalia along with other body features, material depository, material examined, complete collection data, distribution and diagnostic combinations this has certainly updated the existing status of this group.

The structure of genitalia was found to be of great taxonomic significance and provides essential characters for the diagnosis of the species. Inspite of good assemblage of data, the old descriptions of the genitalia need updating. In the present studies, the details of the shapes of the genital segments and their appendages and characters from the phallic apparatus have been taken into account for separating closely related species. According to Schmid (1984) a specimen which is mutilated and is deprived of its genitalia, usually does not lends itself to determination. Accordingly, examination of various morphological characters pertaining to ocelli, head, antenna, maxillary palp, labial palp, thoracic warts, legs and wings was carried out at various levels.

Descriptions of the female genitalia are very rare in the literature as male genitalia are highly developed and are sufficient to distinguish the species. However, an attempt has been made to study and associate the females with the males on the basis of some common morphological characters. The distributional patterns including altitude, collection localities etc. were taken as
supportive evidence for the association of the counterparts. However, due to limitation of time and the literature only few females could be studied. In the end, exact collection localities and distributional maps for all the species included in this work have been provided with a view to remove anomalies in the earlier works. The taxonomic treatment given to the collected material has been fully justified in the present study.

Conclusions based on field surveys reveal that optimum range for collection of Plenitentoria group is between 1200-4000 m amsl. Most of the species remain confined in this zone and the group is practically non-existent below 1200 m. Genera like Apatania, Astratodina, Limnephilus, Pseudostenophylax flourish at an altitude above 2800 m. Though most of the species in Plenitentoria group are active during night but some of the individuals in the families Lepidostomatidae and Limnephilidae are also diurnal. Trichoptera adults start emerging quite early (March-May) in North eastern states of Himalaya and somewhat late (May-June) in North western ranges. Adult life span is about 35-40 days. Since they are available for about six months (April-September), so it is understood that they are multivoltine in nature.

It is further suggested that this work may be extended to the remote high altitude areas of entire India, which may be thoroughly screened, so that the actual position of these insects can be brought to light. It is very likely that species so far recorded only from the neighbouring countries (Pakistan, Afghanistan, Bhutan, Nepal, Tibet and Myanmar) may be found within the Indian faunistic limits as well. So while making the complete survey of these insects, Uttarakhand, Sikkim, Arunachal Pradesh and south Indian hills must be taken into consideration with special attention to Nilgiri and Kodakanal hills. Also molecular phylogeny of Indian trichopteran can be an interesting aspect to study. Larval studies on this group will be interested aspect of future study, as trichopteran larvae are used in bio-monitoring surveys and thus serve as good indicator species of
pollution and climate change. It is earnestly hoped that the present studies will 
form a sound base for future workers in the field of caddisfly taxonomy. In the 
end, it can be said that this work was just a beginning and there is much to do 
in the field of Indian caddisfly taxonomy.