DISCUSSION
5.1. SURVEY

Butterflies along with moths are the most fascinating and diversified creatures of animal kingdom with cosmopolitan distribution. Among butterflies, the family Pieridae includes some of the most common butterflies that are present abundantly in the crop field, garden, forest land etc. and are easily recognizable from other butterfly species. Majority of this group prefer forest and agricultural fields where both larval food plants and nectar sources are abundant along with favourable climatic conditions (Thorsteinson, 1960). They generally react to the changing environment (Hayes, 1981) and migrate in search of suitable locality, which provides an indication of shifting of environmental parameters.

The incessent rain, high temperature and humidity favour the growth of dense tropical forests in Assam (Sharma, 1991), which plays a significant role in the diversity and distribution of butterfly species in this part of the country. The Kamrup district of Assam is unique for its diverse floral composition, wetlands and forest types that favour the growth of all types of insect fauna including the butterflies (Kakati, 2002). Several species of Pieridae butterfly cause harmful effect on agriculture crops and medicinal plants (Baruah, 1988) in this region.

Surveys are the major issues in forest resource management because they provide adequate data in the form of measurements and estimate of populations and population artifacts (Coulson and Witter, 1984). A thorough survey was conducted to estimate the diversity of Pieridae butterfly along with their larval and adult food plants in the entire South Kamrup area of Assam. The survey on Pieridae butterflies in different zones of South Kamrup area reveals that altogether 26 species of Pieridae butterflies are evenly distributed in the region. The most common habitats of these butterflies are agricultural
fields, wetlands and bushy forest areas that are prevalent in the region. The genus of Pierid butterflies encountered during the survey includes - Leptosia (one species), Catopsilia (three species), Delias (three species), Eurema (four species), Pieris (three species), Appias (five species), Colias (one species), Anaphaeis (one species), Pontia (two species), Ixias (one species), Hebomoia (one species) and Huphina (one species).

The above mentioned 26 Pieridae species are remarkably different from each other by their colour, size and wing venation pattern. However, some species resemble each other very closely and it is difficult to separate them unless a thorough study is made. The species like *Catopsilia florella* and *Catopsilia pyranthe* are very closely allied and difficult to distinguish in the field. In the present study, they were distinguished from each other following Bingham (1905-07). He stated that *C. florella* are found during December to April whereas *C. pyranthe* are mostly available during June to October. Similarly, *P. rapae* and *P. brassicae* are difficult to differentiate from each other. Evans (1932) stated these two species could be identified by their size. The body size of *P. brassicae* is larger (65–75 mm) than that of *P. rapae* (45–55 mm). In most species males and females are differentiated by colour, wing venation and size. The largest Pieridae species observed during the survey was the Great orange tip (*Hebomoia glaucippe glaucippe*) with a wing span of 70-100 mm and the smallest one was the Spotless grass yellow (*Eurema laeta laeta*) with 30-45 mm wing span. Out of the recorded 26 Pieridae butterflies, 9 species are commonly available, 7 species are less common and 10 species are rarely observed. Riverbanks and moist shady places are the most preferred habitat of those species. Dwarf flowering plants, agricultural fields and adequate water resources encourage them for various activities.

The distribution and abundance of these species has direct relation with the vegetational pattern of the study area as reported by Clark and Geier (1972). The
vegetational composition determines the population of butterfly species (Boggs & Watt, 1981). The availability of food resources for both larvae and adults controls the population structure (Penz and Arauya, 1991). In the reserve forest areas of Kamrup district, the natural vegetations in the hills are tropical semi-evergreen, while that of the plains are grassland and reeds (Kakati, 2002). The presence of large number of flowering plants with the larval food plants forms a suitable habitat for larval and adult populations (Kakati and Kalita, 2002c). Agricultural fields with cabbage, cauliflower, mustard, radish, sarson, pea etc. and seasonal flowers like nasturtium constitute the most suitable source of food (Devi, 1994). In the present investigation it has been observed that wet sandy soils constitute an important place for Pierid butterflies; as such areas are preferred by the male butterflies to absorb salts along with water from the soil. Seasonal flowering plants and abundance of butterflies has a good relationship as reported by Tripathi and Akhtar (1985) and Moore (1986). In the present survey 31 species of larval food plants were observed belonging to the following families — Capparaceae (species – ten), Cruciferae (sps – ten), Leguminosae (sps – five), Tropaeolaceae (sps – two), Resedaceae (sps – one), Fabaceae (sps – one), Papilionaceae (sps – one) and Rubiaceae (sps – one).

The food plants under capparaceae, cruciferae and leguminosae families are widely distributed in all parts of South Kamrup area, whereas other families are less common and found to be restricted in some specific pockets only. Thus it may be inferred that due to non-availability of these food plants some Pieridae species of the genus like Hebomoia, Delias, Eurema, Anaphaetis, Appias, Colias and Pontia were rarely encountered in the region during the survey.
5.2. BIOLOGICAL STUDY

5.2.1. Study of life cycle

Like all other insects, the life cycle of butterfly is completed through four stages—egg, larva or caterpillar, pupa covered by a chrysalis and adult. Habitat selection and proper food plant identification were one of the most important periods for the gravid female (Kakati and Kalita, 2002b). In the present study, gravid females of *Leptosia nina nina*, *Catopsilia pyranthe* and *Delias hyperate indica* were found to select egg-laying sites after repeatedly testing the leaves of their food-plants and laid eggs only on selected plants. This type of behaviour of egg laying indicates that they wanted to lay eggs on some specified food plants. The presence of water content in the tender leaves and shoots may be an important factor during the time of oviposition. Watanabe (1976) and Kakati (2002) suggested that the egg laying females of some Swallowtail butterflies (*Graphium doson axion*, *Chilasa clytia dissimilis*) also select the leaves of food plants considering the water content of leaves. Wiklund (1974), Berenhaum (1981) and Honda (1983) reported that during egg laying, chemo-receptors of the insect helps them to detect the real food plant. In the present study, host plant discrimination by the gravid females of four selected Pierid butterflies was observed. The main reason behind the discrimination may be shortage of leaves, absence of shade and phenology of plants, which was reported by Rausher (1981) on *Battus philenor*. Further, it was observed that gravid females prefer to lay eggs in the habitat where both larval and adult food plants are available. This is in conformity with the observation made by Clark and Geier (1972); Moore (1986); Courtney (1984) and Kakati *et al.* (2002).


The newly hatched larvae devour a portion of eggshells as food which may be due to the stored calcium to give strength to the jaws as observed by Scudder (1999) and Kakati (2002) while working on Swallowtail butterflies.

Temperature plays an important role in the development of insects (Chapman, 1973). For every insect including the butterflies there is a favourable range of temperature at which all metabolic activities proceed smoothly. Deviation of temperature from the optimal range affects metabolism and development. The larvae of *L. nina nina*, *C. pyranthe* and *D. hyperate indica* took the longest time (18.83 days) for development during Winter season when atmospheric temperature remains low. Similarly during Monsoon season the atmospheric temperature remains high, reducing the larval duration to 11.66 days. This is similar to the observation made by Straatman (1971) in *Ornithoptera alexandrae* and Mani (1982).

In the present investigation, larval sizes were observed to increase rapidly depending on the adequacy of quality food supply and maturity stages. According to Kakati and Kalita (2002b), there is a positive correlation between availability of food resources and insect development, which they observed during their study on Swallowtail butterfly.

The fifth instar larvae stop feeding after 2-4 days, take rest for sometime, remove the last excreta from the body and move about restlessly for more than half an hour in search of a suitable site for pupation. It was observed that the larvae prefer the stem or midrib on the upper surface of the leaf, coating the leaf where they lie with a bed of silk. Kakati (2002) also observed that the fifth instar larvae at maturity become restless for about 1.5 hours moving about in search of proper pupation site. Similar observations were made by Sen and Jolly (1967) while working on the tasar silkworm, *Antheraea mylitta*.
5.2.2. Generations & life cycle duration

The study shows that *Leptosia nina nina*, *Catopsilia pyranthe* and *Delias hyperate indica* completed 22 generations in a year starting from pre-Monsoon to Winter season. Kakati (2002) reported eight generations for *Chilasa clytia dissimilis*, a swallowtail butterfly, which was completed in a year. For all the three species, life cycle duration was longest in Winter season and shortest in Monsoon or retreating Monsoon season. During the Monsoon season, the duration of life cycle was 11.66±0.82 days, whereas it was 18.83±3.13 days during the Winter season. The analysis shows that seasons play a marked effect (P<0.05) on the duration of life cycle of *L. nina nina*, *C. pyranthe* and *D. hyperate indica*. The climatic factors, such as lower temperature, rainfall and humidity along with the quality of food are presumably the main contributing factors for the increasing life cycle duration during Winter season. This finding of increasing life cycle duration due to climatic factors is supported by Sheikh & Kalita (1995), Kakati (2002), Kakati et al. (2005) and Chakraborty (2004). During Winter season, due to cessation of sprouting of tender leaves, the larvae have to depend on the older leaves available on the host plants. Due to low atmospheric temperature and less availability of quality food during Winter season, the larvae consumed inadequate amount of food, which may be the reason for lengthening the duration of life cycle. Heyer et al. (1988) stated that temperature plays an important role in development and low temperature increases the developmental period. Singer (1984) in his study also suggested that the host plant quality might affect the length of the life cycle duration. Besides, he opined that the larva, which finds itself on a poor host, may either lengthen its generation time to become a normal sized adult.
5.2.3. Larval food preference

The food plants play a vital role in the survival and growth potential of insects (Wigglesworth, 1953). All the food plants differ in dietary efficiency depending upon their chemical make up (Dutta and Devi, 1995). During the present investigation, it was observed that the larvae of *Leptosia nina nina* and *Catopsilia pyranthe* preferred to feed on *Cleome rutidosperma* followed by *Cleome viscosa* whereas *Pieris brassicae nepalensis* preferred *Brassica oleracea Var. capitata* followed by *B. oleracea Var. botrytis*. It has been observed that the larvae of *L. nina nina* and *C. pyranthe* consumed relatively higher amounts of food on *C. rutidosperma* and *C. viscosa* (p<0.05) than on other food plants (*Brassica kaber, B. campestris* and *B. oleracea Var. capitata*). Again it was observed that *P. brassicae nepalensis* consumed higher amounts of *B. oleracea Var. capitata* (p<0.01) than on other food plants (*Brassica oleracea Var. botrytis, B. campestris, C. rutidosperma* and *Tropaeolum majus*). Devi and Dutta (1994) are of the opinion that the higher rate of food consumption might be due to either some nutritional deficiency of food so that the insects had to eat more to derive sufficient nutrients or food may be adequate but may be nutritionally imbalanced. Dutta and Devi (1995) also observed similar results on *Pieris canidia* butterfly. Ram Ratan (1978) and Chibbar *et al.* (1985) also observed that nutritionally inadequate foods are consumed at higher rates to fulfil the nutritional requirement of *Acrida exaltata, A. gigantica* and *Spodoptera litura*. Contradictory result was observed in case of *Celario euphorbiae* larvae by Slansky and Scriber (1985). They found that the total food intake was lower in imbalanced diets than on balanced diets. Hence, from the amount of food intake alone, the suitability of the food plants cannot perhaps be judged as reported by Devi (1994). In the present study *Brassica oleracea Var. capitata* was found to be the least preferred food plant for both *L. nina nina* and *C. pyranthe*. In case of *Pieris brassicae nepalensis, Tropaeolum majus* was the least...
preferred host plant. Devi (1994) stated that *Tropaeolum majus* was also the least preferred food plant for *Pieris canidia*. This differential feeding response might be due to the presence or absence of plant phago-stimulants, feeding inhibitors or due to the difference in physical parameters of host leaf as reported by Dutta and Devi (1995).

The rate of increase in food consumption during the developmental stages of insects has been studied by many workers like Bogawat and Pandey (1967) on *Aulacophora* sp., Pandey et al. (1968) on *Diacrisia oblique*, Rao and Patel (1974) on *Anomis flavia*. In the present study it has been observed that the consumption of food increases progressively and highest consumption takes place during the fifth larval instar.

5.2.4. Feeding behaviour

In the present investigation it was observed that the feeding behaviour of *Leptosia nina nina*, *Catopsilia pyranthe* and *Pieris brassicae nepalensis* was similar and larval feeding varies according to leaf maturity stages. The first and second instar larvae consumed only the tender leaves but from the third instar onward larvae were found to consume the mature leaves. This observation was similar to the findings of Sheikh and Kalita (1996) while studying on *Pionea damastesalis*. The variation in the leaf preference during different developmental stages suggested that food quality is important for survival of larvae. Kakati (2002) also supports this view. The second and third instar larvae of *L. nina nina*, *C. pyranthe* and *P. brassicae nepalensis* were voracious feeders.

The fourth instar larvae of all the three species feed for 5-10 mins continuously and then discontinued feeding and remained motionless for a period of 10-15 mins. Sometimes, the larvae moved freely to the adjacent branches and then returned to the original leaves and continued feeding again. This is in conformity with the findings of Devi (1994) working on *Pieris canidia*. 
5.2.5. Larval growth

Several workers (Gordon, 1959; Dadd, 1963; House, 1961; Goswami, 1986; Stamp and Bowers, 1990) observed that the nutrition play an important role in the body growth of insects. Gordon (1959) was of the opinion that food should contain all essential nutrients in sufficient quantity to accommodate the need of the developing larvae. According to Stamp and Bowers (1990) the quality of leaves play an important role in the growth of the caterpillar. During the present investigation, it was also observed that the food plants markedly influenced the larval growth of *Pieris brassicae nepalensis* in terms of body length. The larvae reared on *Brassica oleracea Var. capitata* were the largest compared to those that fed on the other host plants. *Tropaeolum majus* and *B. campestris* fed larvae were markedly shorter in body length. The larvae reared on *B. oleracea Var. botrytis* were same as that reared on *B. oleracea Var. capitata*. The increased size of the larvae reared on these two host plants might be the results of efficient conversion of quality food to body matter. This was also supported by Devi (1994) while studying on *Pieris canidia*. Similar types of results were also obtained by Thobbi (1961) with *Prodenia litura*, Perumal et al. (1972) with *Pericallia ricini* and Singh and Mavi (1986) with *Phytomyza horticola*.

5.2.6. Pupal size

The present study showed that different host plants affect the size of pupa also. The larvae of *Pieris brassicae nepalensis* feeding on *Brassica oleracea Var. capitata* formed comparatively bigger sized pupae, maybe because of feeding on their most preferred host plant. Feeding on *B. oleracea Var. botrytis*, *Cleome viscosa* and *C. rutidosperma* also resulted in moderately large sized pupae. But rearing on host plants
like *B. campestris* and *Tropaeolum majus* yielded smaller pupae, which were also the least preferred host plants. Similar effects of host plant on pupal size were also observed in several insects by many workers, like Pandey *et al.* (1968) on *Diacrisia oblique*, Rao and Patel (1974) on *Anomis flava*, Prasad and Premchand (1980) on *Diacrisia oblique*, Perumal *et al.* (1972) on *Pericallia ricini*, Singh and Sachan (1982) on *Spodoptera litura*, Singh and Mavi (1986) on *Phytomyza horticola* and Devi (1994) on *Pieris canidia*. All of them observed that the pupal size and weight increased when the larvae were reared on their preferred host plants.

**5.2.7. Survival of larval instars**

The host plant plays a major role in the larval survival rate of *Pieris brassicae nepalensis*. The survival rate was observed to be lowest when rearing was conducted on *Tropaeolum majus*. In contrast to this, the survivality rate was highest when larvae were reared on *Brassica oleracea Var. capitata*. In all the five selected host plants, larval mortality rate progressively decreased from first to fifth instar. The mortality rate of first instar larva was above 50% when larvae were allowed to feed on *Cleome rutidosperma*, *C. viscosa*, and *Tropaeolum majus*. Similar observations were reported by Devi (1994) when working on *Pieris canidia*. The larval survival rate of *Pieris brassicae nepalensis* was higher in all the instars when reared on *Brassica oleracea Var. capitata* and *B. oleracea Var. botrytis*. This indicates that these two food plants are the most preferred for *Pieris brassicae nepalensis* compared to the other food plants. Devi (1994) also reported better larval survival rates with *Brassica oleracea Var. capitata* and *B. oleracea Var. botrytis* while working on *Pieris canidia*. Several reports showing better larval survival on preferred hosts and higher mortality on unpreferred hosts are available for insects like *Diacrisia oblique* (Borbaruah, 1973; Prasad and Premchand, 1980), *Chilo zonellus*.
(Kalode and Pant, 1967), *Prodenia litura* (Pandey and Srivastava, 1967), *Spodoptera litura* (Singh and Sachan, 1982) and *Dysdercus koenigii* (Singh and Baboo Ram, 1987).

5.2.8. Oviposition preference

Oviposition is the most vital activity in the life cycle of an insect. Every animal has the preference for oviposition site. In the present investigation *Brassica oleracea* Var. *capitata* leaves proved to be the most preferred oviposition substrates for the female *P. brassicae nepalensis*. Although *Tropaeolum majus* (Nasturtium) was not preferred as a food plant by the larvae, adult females showed equal preference for *Tropaeolum majus* and *Brassica oleracea* Var. *botrytis* for oviposition. This may be due to similar colour pattern and glabrous leaf surface of *Tropaeolum majus* with preferred food plant of *P. brassicae nepalensis*. The least preferred site for oviposition was observed to be *B. campestris* and *Cleome rutidosperma* plants. This may be due to the fact that the insect do not prefer these two plants for larval feeding. Bogawat (1967); Pandey *et al.* (1968); Beckwith (1970); Perumal *et al.* (1972); Rao and Patel (1974); Singh and Baboo Ram (1987) and Devi (1994) stated that host plants are the most suitable substrate for oviposition of phytophagous insects. This not only increases the rate of oviposition but also ensures higher larval survivality.

5.3. ECOLOGICAL STUDY

5.3.1. Population density

In the present investigation the population density of *L. nina nina, C. pyranthe, A. libythea olferna* and *P. brassicae* were found to be highly variable and significant (p<0.01) in all the study areas irrespective of the seasons. On the other hand, seasonal observations also revealed that the climate plays an important role in the building up of a
population. The climate also helps in the formation of suitable habitat for different types of butterflies.

In the Winter season, the population density of *L. nina nina*, *C. pyranthe* and *A. libythea olferna* were found to be low in each study zone, but from the later part of Winter season the population density increased and a maximum was observed in Monsoon. This is probably due to favourable climatic conditions and availability of food plants. Kakati (2002) also stated that climate and availability of food plants helps to build up the population of Swallowtail butterflies. In contrast to this, *P. brassicae* showed the highest population density during Winter season compared to the other seasons. This may be due to the availability of the primary hostplant (*Brassicae* crops) during the Winter season. According to Kakati and Kalita (2002b) there is a good correlation between availability of food resources and insect occurrence. Ford (1967) observed that population density of butterflies varied considerably within a year during different seasons. He stated that this may be due to the lack of sufficient new leaves in the preferred food plants and insufficient flowering plants, which supply food to the adult in that specified season. The findings of Mani (1982) on butterfly and food plant relationship also support the present findings. In the present investigation, it has been observed that during Winter season the atmospheric temperature ranges between 8.23-15.47 °C and average relative humidity was around 65% with scanty rainfall, which seems to be unsuitable for the survival of *L. nina nina*, *C. pyranthe* and *A. libythea olferna*. As these butterflies require warm humid climate (Blau, 1980; Kapoor, 1988) and their population was found to increase from the last part of Pre-Monsoon due to the combined affect of weather and luxuriant growth of vegetation. During the Monsoon season, temperature, humidity and rainfall influences the growth of vegetation that provides sufficient food for the butterflies, which builds up a high population. In the Retreating Monsoon season, population density decreased than the
Monsoon period but was found to be still more than the Pre-Monsoon season. The decrease of population during Retreating Monsoon season may be due to decline in sufficient new leaves, inadequate flowering plants and adverse climatic conditions. But the higher population density during Retreating Monsoon than Pre-Monsoon season may be due to continuation of population, which was built up during the Monsoon period. These findings are also supported by Arnold (1978), who stated that environment plays an important role in the distribution and evolution of species. Blend and Swayze (1973) and Edwards (1960) obtained similar results while working on grasshopper population dynamics. The present finding also support the findings of Pradhan and Peswani (1961), Putnam (1962) and Weigert (1965), who worked on pest potential and ecology of some orthopterans. In contrast to this, during Winter season the population density of *P. brassicae* increased. This may be due to the availability of preferred food plants during the season. *P. brassicae* preferred to feed on brassicae and cruciferae plants, which become naturally available during this period. Thus, low temperature, low humidity and low rainfall seems to have a positive influence on the population of *P. brassicae* butterflies. From the above observation it may be concluded that the distribution and abundance of different butterflies vary during different seasons depending on the favourable climatic conditions and availability of preferred food plants.

In the present study it has also been observed that the population densities of different butterflies were more prevalent in some parts of the study area, irrespective of climatic factors and seasons. It may be due to richness of both larval and adult food plants with adequate water resources. According to Ehrlich (1984), many factors influence the population structure of butterfly and the most important among them are the distribution and abundance of nutritional resources, primarily food plants for larvae and liquid sustenance for adults, which supports present findings. The population of *L. nina nina*, *C.*
pyranthe, A. libythea olferna and P. brassicae were observed to be the highest in Rani and Basistha reserve forests, where plenty of host plants were available during the Monsoon and Winter seasons. This observation was found to be similar with Clark and Geier (1972). According to them the distribution and abundance of the species has a direct relation with the vegetational pattern of the study area. The vegetational arrangement determines the population of butterfly species (Boggs and Watt, 1981). According to Penz and Arauya (1991), the availability of food resources for both larvae and adults control the population structure. All these above findings support the present observations. The lowest population density of all the four species was found in the Jalukbari reserve forest. In this area, the larval food plants for the butterflies were limited. This may be due to largescale deforestation, cattle grazing, soil cutting, improper forest clearing and urbanization of the area that has considerably reduced the larval and adult food plants resources. Kakati and Kalita (2002a) stated that the loss of tall tree forest canopy and warm humid climatic conditions are the prime causes for the loss of suitable habitat for growth of butterfly population.

In the present study it was observed that all environmental factors such as maximum temperature and minimum temperature, relative humidity and total rainfall showed positive relationship with the build up of butterfly population in different seasons except P. brassicae. In case of P. brassicae, a negative relationship was seen probably due to the adverse climatic conditions. Kakati (2002) also observed similar type of relation between climatic factors and butterfly population in Swallowtail butterfly. The occurrence and abundance of different butterflies as observed in the present investigation were dependent on the complex interaction of ecological factors and is supported by the observations of Hayes (1981) in the biological activities of Pierid butterfly.
5.3.2. Study on pest status

In the present investigation it was observed that the peak period of larval infestation was between 10th to 12th week of plantation of cabbage plant, i.e., when the plants are maturing. It indicates that the larvae might prefer the matured leaves of the cabbage plant than the young ones. Devi and Dutta (1994) also found similar results while studying the larval population trend of *Pieris canidia* on three cruciferous vegetables. Evans (1939) stated that for Pieris butterfly, matured cabbage leaves were more digestible than the young leaves and both were converted to the body substances with almost equal efficiency. During the present investigation, after 12th week of plantation of cabbage a sharp decline in the number of larvae was observed (Fig. 14a, b, c, d, e). This observation is in conformity with the findings of Devi and Dutta (1994). One of the possible explanations of this abrupt decline may lie in the fact that the crops (cabbage) by then were approaching harvest and there was dearth of fresh juicy leaves to sustain the larvae. According to Blum (1978), water sequestration is an energy dependent process in insects. Probably due to some energy requirement for histolysis and histogenesis during moulting there might be a preference for juicy leaves.

The harvested crops were categorised into premium, acceptable and not-acceptable category depending on the mode of infestation. Out of five locations, highest percentage of premium crop was obtained from Maliata followed by Boko, Jalukbari, Basistha and Rani. Although infestation was observed in all the five locations, it was within low and medium range. In Maliata, Jalukbari and Boko, the infestation was observed to be low compared to Basistha and Rani where infestation was medium. This may be due to the abundance of Pieridae butterfly in Basistha and Rani Reserve forests. In the present investigation, during population density study, it was observed that the population of *L. nina nina, C. pyranthe, A. libythea olferna* and *P. brassicae* were
observed to be the highest in Rani and Basistha reserve forests where plenty of host plants are available. According to Clark and Geier (1972), the distribution and abundance of the species has direct relation with the vegetational pattern of the study area. Another reason for low infestation in Maliata, Jalukbari and Boko might be due to large-scale deforestation and urbanization, resulting in limited population of Pieridae butterfly in these areas. Kakati (2002) stated that due to excessive forest cutting for timber, fuel-wood, fodder and forest products, the area under these forests is shrinking and its capacity to satisfy the need of the butterflies is simultaneously diminishing.

From the experimental observations, the following points of interest could be brought about.

1. The presence of flowering plants with larval food plants transforms the South Kamrup area into a suitable habitat for larval and adult population of Pieridae butterfly.

2. The butterflies of South Kamrup area shows distinct seasonality and well-defined seasonal peaks where only a smaller proportion of the species being active throughout the year.

3. Larval sizes of *L. nina nina*, *C. pyranthe* and *D. hyperate indica* species were found to increase rapidly depending on the adequacy of quality food supply and their maturity stages completing 22 generations in a year.

4. *L. nina nina* and *C. pyranthe* preferred to feed on *C. rutidosperma* followed by *C. viscosa* whereas *P. brassicae nepalensis* preferred *B. oleracea Var. capitata* plant, which was followed by *B. oleracea Var. botrytis*.

5. As, *C. rutidosperma* and *C. viscosa* are both medicinal plants, *L. nina nina* and *C. pyranthe* may be considered as pest for these two.

6. *Brassica oleracea var capitata* (cabbage), *B. oleracea Var. botrytis* (cauliflower) and *B. campestris* (mustard) are major economic crops of this region. An abundant
population of *P. brassicae nepalensis* thus poses a major threat to the economy of small farmers.

7. Due to largescale deforestation, cattle grazing, soil cutting, improper forest clearing and urbanization of the study area, the food plants for butterflies are considerably reduced.

8. Intercropping of the wild plants (*C. rutidosperma* and *C. viscosa*) with *B. oleracea* Var. capitata, *B. oleracea* Var. botrytis and *B. campestris* can also be considered, as this will help to minimize the pest effect on the cultivated crops, without the use of pesticides, thereby increasing the farmer's profit.

9. From the study within South Kamrup area it has been found that Rani and Basistha Reserve Forest has maximum diversity of butterflies. The topographic appearances, vegetation diversity and water resources from hilly streams created a fine warm-humid climate, which is essential for butterflies. Therefore, entry of encroachers and other destructive agents into these Reserve Forests should be banned.