STUDY ON THE INCIDENCE OF THE INSECT AND MITE PESTS ON DIFFERENT VARIETIES OF ROSES

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CERTIFICATE

This is to certify that thesis entitled, **"STUDY ON THE INCIDENCE OF INSECT AND MITE PESTS ON DIFFERENT VARITIES OF ROSES "**submitted to theFaculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka,in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE (MS) IN ENTOMOLOGY, embodies the result of a piece of bona fide research work carried out by NUR MOHAMMAD RAZIB, Registration no. 09-3735 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.

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Abstract

The study was conducted at the farm of Sher-e-Bangla Agricultural University, Dhaka during the period from April to December 2011 to determine the incidence of the insect and mite pests on different varieties of roses. The experiment included twelve varieties of roses viz. Wild rose, Crazy love bi-color, Yellow star, Missing love, Compassion, Charming lady, Dream bangle, Sleepy moon, Sweet doll, Moon light, Sweet love and Mini moni. Each variety represents as one treatment. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Incidence of pest viz. aphid, mite, whitefly and Japanese beetle showed significant variation due to the effect of varieties. Among the varieties, Sweet Love was tolerant of pests and the minimum number of aphid; number of mite, number of whitefly and number of Japanese beetle were recorded at vegetative and flowering stages. Varieties of rose significantly influenced the incidence of pests as well as growth characteristics of rose indicating minimum number of infested leaves per plant, minimum number of infested branch per plant and minimum number of infested flower per plant on Sweet Love variety. Sweet Love variety showed tolerant to pest of rose and gave better yield among the all varietal treatments while sweet doll variety graded as susceptible due to the lowest performance regarding pest incidence and infestation.

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LIST OF ACRONYMS

AEZ	=	Agro-Ecological Zone
BARI	=	Bangladesh Agricultural Research Institute
BBS	=	Bangladesh Bureau of Statistics
et al.	=	And others
N	=	Nitrogen
TSP	=	Triple Super Phosphate
MP	=	Muriate of Potash
RCBD	=	Randomized Complete Block Design
SAU	=	Sher-e-Bangla Agricultural University
SRDI	=	Soil Resources and Development Institute
No.	=	Number
LSD	=	Least Significant Difference
^{0}C	=	Degree Celsius

Mm	=	millimeter
Max	=	Maximum
Min	=	Minimum
%	=	Percent
cv.	=	Cultivar
NPK	=	Nitrogen, Phosphorus and Potassium
CV%	=	Percentage of coefficient of variance
Hr	=	Hour
viz.	=	Videlicet (namely)

CHAPTER I

INTRODUCTION

Rose (*Rosa sp.*) is one of the nature's beautiful creations and is universally called as 'queen of flower'. The word rose is derived from the name 'Erose' meaning 'the God of love'. In Sanskrit literature, rose is referred as 'Tarunipushpa', Atimanjula' and 'Semantika'.Rose belongs to the family Rosaceae. The genus *Rosa* consists of about 120 speciesout of which only eight species are cultivated *viz.*, *Rosa chinensis*(Jacq), *Rosa damascene* (Mill), *Rosa foetida*, *Rosa gallica*, *Rosa gigantea*, *Rosa moschara*, *Rosa multiflora*, and *Rosawischuriana*.

The rose is one of the oldest flowers in cultivation and is still considered as one of the most popular garden flowers today. The flower is so popular that in 1986 Congress named the rose our national floral emblem. Most modern roses are descendants of eight Europeanand Asian rose species. The elaborate flower forms andcolors of today are the result of extensive breeding andhybridizing that began in the 1800s.

Floriculture has become one of the important highvalue agricultural industries in many countries of theworld. International trade in cutflowers is growing at arate of 25 per cent annually (Singh*et.al.* 2010). The internationaltrade is around US$ 11 billion and cutflowers contribute60 per cent of the world trade in floriculture. The globalexports increased over ten folds from 0.5 billion in 1995to 5.1 billion to 2005, which again is poised to double by2025(Singh,*et. al.* 2010). India has a long tradition of floriculture. India'sshare in the US $11 billion global market is only 0.65per cent. The total area under cultivation of differentflowers in India is 103,000 ha. The major cutflowersgrown in India are China aster, rose, tuberose, gladiolusand jasmine (Singh,*et.Al*, 2010**).**

Roses have deep relationship with human sentiments and have highdemand in international markets on account of their use inalmost every event. Currently, major cut rose producersare the Netherlands, Colombia, Kenya, Israel, Ecuador, andJapan. In Dutch flower auctions; 3,243 million rose stemswere marketed in 2007 while 3,415 million rose stemswere marketed as cut flower during 2008 with a value ofUS $ 10 billion (Evans, 2009). Pakistan being anagricultural economy with diverse agro climaticconditions has a great potential for cut rose production.According to a survey, roses are being grown as cutflowers on 1,300 acres in Punjab (Khan, 2005).

Roses are attacked by numerous insect pests anddiseases. Good general care of roses is the first steptowards battling these problems. Some cultivars aremore resistant to disease than others, but all rosesrequire some protection from pests.

Roses are susceptible to several insects and diseases which reduce flower growth and quality as well as frustrate rose gardeners. In general, these insects do not kill the plant, but may stunt or kill parts, affect flowering, or cause aesthetic damage. According to Kevin Stroom,*et.al*(1997) learning the proper care of roses and management of pest problems increases your success in growing a beautiful rose bush.

Roses are among the most intensivelymanaged plants in many home landscapes.Part of this intensive managementmay include the frequentapplication of pesticides.Although insects and mites may attackroses from time to time, any roseenthusiasts are able to maintain vigorousplants and produce high qualityblooms with little or no use of insecticides.The keys to successare careful selection of varieties, whichvary significantly in susceptibility toinsect and disease problems, good attentionto appropriate cultural practices,and occasional handpicking or usingwater to forcefully spray away pests.Keep an eye out for rising populationsof natural enemies that often rapidlyreduce the numbers of aphids, mites and other pests.

One of the largest antique rose producers in Bangladesh is located in Jessore. There are numerous insect pests of roses. Some of the important pests in Bangladesh such as aphid (Hemiptera) Japanese beetle, *Popillia japonica* ,Newman; rose beetle, red mite, leafcutter, thrips, spider mite and so on. In temperate region, there are different types of rose pests like sawflies, leafrollers, *choristoneura spp*. Mossy, rose gall wasp, *Diplopepisrosae*, rose chafer, aphid.

Detecting and identifying pests are the first steps in managing insects attacking roses. Regular inspections can help growers detect the arrival of new pests or document the abundance of pests over time. In addition, monitoring helps growers time their suppression methods and evaluate their effectiveness better. In greenhouses, yellow sticky cards can be hung over the plant canopy and inspected regularly to indirectly monitor adult populations of many insect pests of roses, such as winged aphids, thrips and whiteflies. Correct

identification of the pests enables growers to choose the best methods to control pests while helping preserve beneficial insects. Not all insects that frequent roses are damaging. Next to mite, the rose thrips, *Scirtothripsdorsalis* is also a serious problem on rose grown under protected cultivation. Both immatures and adults feed on tender and moderately matured leaves and developing flower buds by lacerating the tissue and sucking the sap. The feeding results in mottling, severe curling, browning and drying of tender leaves, sepals, tender stalks, outer petals of green and half opened buds turn to brown color and appear as if they are burnt. Damaged flowers get discolored and distorted in shape and reduced in size (Jhansi Rani and Jagan Mohan, 1997). This pest can cause 28-95 per cent damage with a population density of 11-33 thrips/flower (Gahukar, 2003).

The present study has been undertaken with the following objectives:

i. To know incidence pattern of insect and mite pests of rose among test varieties
ii. To know the infestation status of major pests in different varieties of roses.
iii. To find out the tolerant and susceptible varieties of rose.

CHAPTER II

REVIEW OF LITERATURE

Literature pertaining to incidence of the insect pests on different varieties of roses is scanty.Hence, the information available onaphids, whitefly, beetles and mites infesting different host crops both in the field and at lab condition which have relevance to the objectives of present investigationare reviewed along with the available information on rose crop and presented here in thischapter.

2.0. Incidence of aphid on rose

Aphids are the most common insect pest on roses. The actual aphid species vary dependingon where in the state the roses are grown. These may include the rose aphid, *Macrosiphumrosae,* the potato aphid, *MacrosiphumSeuphorbiae*, and the cotton aphid, *Aphis gossypii*, among others. Aphids favor rapidly growing tissue such as buds and shoots. Low to moderate levels of aphids do little damage to plants, although many gardeners are concerned with their very presence. Moderate to high populations can secrete copious amounts of honeydew, resulting in the growth of sooty mold, which blackens the leaves. Very high numbers may distort or kill buds or reduce flower size. In most areas of California aphids arenormally a problem for only about 4 to6 weeks in spring and early summerbefore high summer temperatures reducetheir numbers.

2.1Biology of aphid

The life history of the aphid, *L. erysimiKalt*was studied (Maxwell and Lefroy, 1971) to record broad spectral variation according to locality, climate etc. It is a soft bodied, yellowish green or greenish colored species measuring 2-2.5 mm in length when full grown. The colonies were composed of only one female and may be winged or wingless. Usually mates were not found and the youngest attain maturity in a few days after birth. They also bring forth young ones. Thus the rate of asexual reproduction was enormous. The colony increased very rapidly in number. The females were wingless, when the colony was small. Afterwards winged individuals appeared, the wings develop gradually as they do in other insects which have no metamorphosis. These winged females flew from plant to plant spreading the colony over a large area; whenever they settle down, they formed a fresh colony (Maxwell and Lefroy, 1971).

The aphid breeds parthenogenetically and the female give birth to 26 to 135 nymphs. They grow fast and become full fed in 7 to 10 days. About 45 generations are completed in a year (Atwal, 1976.).Veraria and Patel (1999) conducted a laboratory experiment and reported that, the mean nymphal period of *L. erysimi*was 6.84± 0.80 days and adult

longevity was 8.20± 1.12 days. Lifetime fecundity of an apterous mother was recorded to produce 100-200 nymphs (Schumutterer, 1978).

Study of Kundu*et.al*. (1997) on short-term reproductive effort of *L. erysimi*on mustard revealed a decreasing trend of body weight from December to February but the highest number of developed embryos was found in January.

2.1.1 Nature of damage and yield loss by aphid

The aphid*L. erysimi* directly attacked the whole part of the mustard plants except root. Aphids mostly attacked the soft portions like apical twig, inflorescence and pods. The aphid infestation cause unhealthy growth of the plant. The poor and stunted growth together with curling of the leaves, drying up of the inflorescence discoloration of plant leaves and flowers, ultimately caused the plant to lodge in the field. The pods and seeds become unhealthy and unproductive. Likeother soft bodied insects such as leafhoppers, mealy bugs and scales, aphids produce honeydew serves as a medium on which a sooty fungus called sooty mold grows. Aphids serve as a vector for many plant diseases that cause greater losses than cause by direct feeding injury. This is often the greatest impact of an aphid infestation (Blackman and Eastop, 1984). A review of the insect pests of rapeseed and mustard in India reported 31 insect species associated in these crops with *L. erysimi* as the major pest (Bakheria, 1986).

Alam (1969) reported *L. erysimi* as a very destructive pest of some cruciferous crops in Bangladesh causing a considerable crop loss every year. Malik *et al.* (1998) found a negative correlation between the infestation level of *L. erysimi* and plant growth characteristics like plant height, branches per plant, siliqua per plant, grains per siliqua, test weight, seed yield, oil content and oil yield in Indian mustard. Singh *et al.* (1993) reported that available seed yield losses of mustard due to the aphid ranged between 63.91% and 82.25%, the overall being 68.17%. Pradhan(1970) reported 70% yield loss in mustard due to the infestation of this pest.

2.2Origin and distribution of whitefly, *Bemisiatabaci*Genn.

*Bemisiatabaci*was first described in 1889 as a pest of tobacco in Greece and named as *Aleyrodestabaci*, the tobacco whitefly. The first whitefly specimen was discovered shortly thereafter (collected in 1887) in the US on sweet potato (Quintance, 1900). In 1957, this species and 18 other previously described whitefly species were synonymiezed into a single taxon, *Bemisiatabaci*(Russel, 1977). However, it is also known as various crop based common names such as tobacco whitefly, cotton whitefly or sweet potato whitefly.

The outbreaks in cotton occurred in the late 1920s and early 1930s in India and subsequently in Sudan and Iran from the 1950s and 1961 in Salvador (Hirano*et al.*1993). *Bemisiatabaci* is widespread in the tropics and subtropics Weems to be on the move, having been recorded in many areas outside the previously known range of distribution. In South Asia it has been reported from India (Nariani,1960),West Pakistan (Ahmad and Harwood, 1973)Srilanka. The whitefly has been reported as greenhouse pest in several temperate countries in Europe, e.g., Denmark, Finland, Norway, Sweden and Switzerland. Besides in greenhouses, the species has been reported on outdoor plants in France and Canada (Basu, 1995). From 1926 to 1981, *Bemisiatabaci*was reported as sporadic pest and was the most important vector of plant viruses in subtropical, topical and temperate zones where winters are mild enough to permit year round survival (Cock, 1986).

2.2.1 Biology of whitefly

The majority of whitefly species cannot be identified by the morphological characters of the adults. Genera and species are usuallydefined according to the structure of the fourth nymphal instar, the so-called “pupal case” (Mound and Hasley,1978).Unfortunately, polyphagous whitefly species such as *Trialeurodesvaporariorum*(Westwood) and *B. tabaci* vary in the appearance (shape and size) of their pupal case, depending on the cuticle of the host plant on when they feed. The different developmental stages of whitefly, *B. tabaci* are described on the following sub headings:

Egg

Whitefly eggs generally are pyriform or ovoid and possess a pedicel that is a peg like extension of the chorion (Byrne and Bellows, 1991). Eggs are laid indiscriminately always on the underside of the young leaves (Hirano *et al*., 1993) and was anchored by the labium which remains closely opposed to the leaf surface (Basu, 1995).

Nymphal and pupal stages

After completion of development, the egg crackes at the apical end along a longitudinal line of dehiscence. As the first instar nymph of *B. tabaci* begins to emerge, it bends in half until its forelegs can clasp the leaf, after which nymph walk away from the spent chorion. The first instar nymph is often called crawler (Basu, 1995). When the first instar nymphs hatch, they only move a very short distance over the leaf surface before settling down again and starting to feed. Once a feeding site is selected, nymphs do not move and they remain sessile until they reach the adult stage, except for brief periods during molts (Hirano *et al*., 1993). The first instar nymphs are pale, translucent white, oval with a convex dorsum and flat ventral side. They measure 0.267±0.007mm in length and 0.144 ±0.010mm in width (Lopez Avila, 1986). They have functional walking legs (with three apparent segments). Legs of second and third nymphal instars appear to have only one segment (Gill, 1999).

Adults

The adult whitefly, *B. tabaci*is a tiny soft bodied and pale yellow, change to white within a few hours due to deposition of wax on the body and wings (Haider, *et al.,*1996). Their antennae are long and slender and mouthparts are constructed for piercing and sucking. The forewings are slightly longer than the hind wings. At least the wings cover the

abdomen like a roof (Berlinger, 1986). Byrne and Houck (1990) reported that sexual dimorphism in wing forms; the fore and hind wings of females are larger than those of males. The mean wing expanses of females and males are 2.13 mm and 1.81 mm, respectively (Byrne and Bellows, 1991). Adult longevity of males on tobacco was 4 and 7 days in winter and summer; corresponding female life span was 8 and 12 days, respectively in India (Pruthi, 1946). The maximum adult emergence occurs before 800 and 1200 hours (Butler *et al*., 1983).

2.2.2 Host range of whitefly

A survey of the literature from the early 1900s suggests that the number of host plants colonized by *Bemisiatabaci*has increased over time, probably as agricultural practices have shifted to irrigated monoculture and as different species have been cultivated during the century. Early documentation cited at least 155 plant species as hosts in Egypt alone, whereas by 1986, a worldwide detailed survey yielded an estimate of 420 host plant species (Brown *et al*., 1992). Current records indicated that *Bemisiatabaci*can successfully colonize a multitude of host plant species worldwide (Cock, 1986). Basu (1995) reported that *Bemisiatabaci*is highly polyphagous and has been recorded on a very wide range of cultivated and wild plants comprising more than 500 species of plants including numerous field crops, ornamentals and weeds, similarly reported that (Naresh, J. S. and Nene, Y. L. 1980) hosts of *Bemisiatabaci*include vegetables, cotton and other agricultural crops and ornamental plants. The host plants of *Bemisiatabaci*include cotton, tomato, tobacco, sweet potato, cassava, cabbage, cauliflower, melon, brinjal, okra and many cultivated plants.

*Bemisiatabaci*is known to be a pest of munbean (Tengkano*et al.,* 1991; Rajnish*et al*. 2004), Soybean (Tengkano*et .al.,* 1991; Hirano *et. al*., 1993) and black gram (Rajnish,

et.al. 2004). It also attacks cucumber, okra, pumpkin, lablab bean and eggplant (Kajita and Alam, 1996).

Ioannou, N. (1987) conducted a study on host range of whitefly and it was observed that more than 100 species and varieties belonging to 16 families, 7 species of Solanaceaeand 8 in other families became systemically infected following inoculation by *B. tabaci*. In the field, the virus was found from tomato at all growth stages and in all seasons, also from naturally infected *Daturastramonium*, tobacco, 3 wild *Lycopersicon spp*.

According to Russel (1977) the whitefly has a wide host range, including many agricultural crops and ornamental plants. In the Imperial Valley, extensive surveys have indicated a typical cultivated host sequences of cucurbits in the spring, cotton in the summer and alfalfa and Cole crops in the late fall and winter. Major weed hosts include velvetleaf and sow thistle in the spring and sunflower and ground cherry in the early fall.

Greathead (1986) also updated the information reported by Mound and Hasley (1978) and listed 540 species of plants belongs to 77 families. It may be pointed out that 50% of the total number of host plants belonging to only 5 families; namely leguminosae, compositae, Malvaceae, Solanaceae and Euporbiaceae.

The compilation of the list of Greathead (1986) presented here including 540 plant species belonging to 77 families

2.2.3 Nature of damage caused by whitefly

Both nymphs and adults cause directdamage by sucking and feeding sap from the underside of the host plant's leaves. This feeding cause weakening and early wilting of the plants and reduces the plant growth rate and yield. It may also cause leaf chlorosis, leaf withering, premature dropping of leaves (Berlinger, 1986).

It results due to the accumulation of honeydew secreted by the whitefly. This honeydew serves as substrate for the growth of black sooty mold fungus on leaves and fruits. The

mold reduces photosynthetic capacity of the infested plant parts (Naresh and Nene, 1980; Belinger, 1986).

The virus transmission is the main damage caused by the *B. tabaci*(Cohen, 1990). Whitefly borne viruses of six or seven morphological classes have been demonstrated so far, namely Gemini virus, cala-like, costero-like and nepo or como-like viruses (Cohen, 1990). Of these, the Gemini virus group is by far the most important, both in terms of number of diseases and their economic impact in various parts of the world (Brown and Bird, 1992). Diseases caused by whitefly transmitted Geminivirus are mungbean yellow mosaic virus (MYMV) (Honda *et al.* 1983), tomato leaf curl, tomato golden mosaic tomato mottle (Brown and Bird, 1992), tomato yellow leaf curl, tomato yellow mosaic, bean calico mosaic, bean dwarf yellow mosaic (Honda *et al.* 1983), squash leaf curl.

2.3 Incidence of spider mite on rose

Spider mites are members of the Acari (mite) family Tetranychidae, which includes about 1,200 species.Although several species of spider mites attack roses, the most common is the two-spotted spider mite. Mites are tiny, scarcely visible without magnification. Their color varies in shades of yellow, red and green marked with two darker spots on their backs. All developmental stages of spider mites usually live on the underside of the leaves, but may be found elsewhere on heavily infested plants, which they may cover with a fine web. Female mites lay clear, spherical eggs on the underside of leaves. Eggs develop into adults in 5 to 20 days, so populations grow quickly, especially in hot, dry weather. Spider mites rupture plant cells with their mouthparts and suck the juices, producing feeding punctures that look like tiny light-colored spots, giving leaves a stippled appearance. Leaves of heavily infested plants turn yellow, then brown and eventually fall from the plant. (Mollet and Scracherian, 1984).

Butani (1974) recorded the incidence of *Tetranychusurticae*(Koch) on rose in Delhi and reported that September to January as the active period for mites on rose which later started declining till April due to excess heat.

Shereef*et.al.*(1980) reported that rose was infested mainly by *Oligonychusmangiferus*and *Tetranychusutricae*, of which the *T. urticae*was predominated and had peak in September.

Sudharma*et al.* (1995) reported severe infestation of *T. urticae*on rose and also reported that it was found along with *T. ludeni*, they observed two peaks of *T. urticae*in a year with the first peak during October to November and the other during February to May. A highest population of 45-60 mites per leaf was recorded during peak population.

Hole and Salunkhe (1997) observed that the population of *T. urticae*increased gradually from February and reached peak in March (69.65 mites/plant) and declined thereafter. They also reported that population trend was found positively and significantly correlated with maximum temperature and relative humidity.

Dhooria (1999) reported that infestation of mites *T. urticae*, *T. cinnabarinus*, *Brevipalpusphoenicis*Geijskes and *Oligonychusspp*. was noticed on field roses during April to June, March to November, February to June and May to June, respectively in minor proportions.

2.3.1 Biology of spider mite

Two-spotted spider mites are widely distributed in the United States and feed on over 180 host plants, including roses. Once a plant is infested, the mites spread onto nearby crops and ornamentals. Two-spotted spider mites pierce the epidermis of the host plant leaf with their sharp, slender mouthparts. When they extract the sap, the tissue of the leaf collapses in the area of the puncture. Soon a spot without green color forms at each feeding site. After a heavy attack, an entire plant may become yellowed, bronzed or killed completely. The mites may spin so much webbing over the plant that it becomes entirely covered. Though insects and mites are in a group called the Arthropod (meaning jointed foot),

because jointed legs are common to both, spider mites are not actually insects. Being more closely related to spiders, they derive their name from the thin web that some species spin. Two-spotted spider mites overwinter as adults in the soil or on hosts such as violets and hollyhocks. In mild winter weather, two-spotted spider mites continue to feed and lay eggs, although development in the winter is much slower than in the summer. In warm weather, six-legged larvae hatch from the eggs. They develop into eight-legged nymphs, which pass through two nymphal stages. After each larval and nymphal stage, there is a resting stage. The adults mate soon after emerging from the last resting stage, and in warm weather the females soon lay eggs. Each female may lay over 100 eggs in her life and up to 19 eggs per day. Development is most rapid during hot, dry weather. A single generation may require as many as 20 or as few as 5 days to reach adulthood and begin producing offspring (Bolland*et.al.* 1997).

Spider mites, like hymenoptera and some Homopterainsects, are arrhenotoky/arrhenotochous: females are diploid and males are haploid. When mated, females avoid the fecundation of some eggs to produce males. Fertilized eggs produce diploid females. Unmated, unfertilized females still lay eggs that originate exclusively haploid males. (Graham Bell., 1982)

2.3.2 Host range of spider mite

The two spotted spider, *Tetranychusurticae*Koch, has a host range of over 150 known economically important plants (Jeppson*et.al.* 1975). Its distribution is considered to be fairly cosmopolitan, but the species was not listed as occurring in the Hawaiian islands according to recent reviews (Goff, 1986).This was surprising considering the amount and frequency of host plant importation into the islands from areas where *T. urticae* is found. A plausible explanation for this anomaly has been that the closely related *T. cinnabarinus* has filled the niche normally utilized by *T. urticae*

Separation of *T. urticae* from *T. cinnabarius* is presently not possible in mounted specimens. The adeagus ,which is normally considered a diagnostic character for spider mites, is identical in the two species and other methods of species determination (the shape of the dorsal lopes) have been shown to be ineffective

(Mollet and Scracherian, 1984).However, live specimens of the two species can be separated by the carmine color of *T. cinnabarinus* and the pale greenish color with two prominent green spots on the side of the body characteristics of *T. urticae*.

2.3.3Nature of damage caused by spider mite

Spider mites are some of the most common arthropod pests of roses, and some of the most difficult to control. They feed by sucking the fluid from plant cells. Adults and nymphs cause similar injury. Feeding by low numbers of mites is inconsequential, but these pests have a very high reproductive potential and can complete a generation in as little as 7 days(Fasulo and Denmark, 2000). Heavy infestations are capable of causing severe injury and can even kill plants. Feeding by individual mites causes localized cell death, resulting in light colored ‘stippling’. However, when mitepopulations are heavy these individual feeding sites coalesce; giving leaves a ‘bleached’ orbronzed appearance. Severely injured leaves may curl and dropfrom the plant. Initially mite infestations are normally confined to the undersides of leaves, but under heavy infestations the mites will produce webbing, hence the name spider mite, and will occur on the tops of leaves andon other plant parts (Fasuloand Denmark, 2000).

Diagnosing of symptoms

Timely inspection of susceptible landscape plants especially during periods favoring mite outbreaks is key to preventing serious damage. When scouting for spider mites, pay particular attention to plants having a history of mite problems. Spider mites often re-infest the same plants year after year. Inspect stippled and distorted leaves to determine if

mites are present. Similar symptoms can be caused by pests other than mites, including thrips, leafhoppers and lace bugs. Many spider mites prefer to feed on the lower leaf surface, so examine the undersides of leaves first. A 10 - 20 power hand lens or microscope is essential for clearly seeing the mites. The tiny mites will appear yellow, green, orange, purple, black or nearly transparent (Dhooria, 1999). Also visible on the leaf surface may be pale-colored cast skin shed by developing mites, and the spherical, often translucent eggs. An efficient way to sample vegetation for mites is to hold a sheet of white paper or foam board under a branch and tap the foliage sharply. If mites are present, they will be dislodged and appear as slow- moving, dark specks on the paper (Hole and Salunkhe, 1997)

2.4Incidence of beetle onroses:

The Japanese beetle, *Popillia japonica* Newman, is a widespread and destructive pest of turf, landscape, and ornamental plants in the United States. It is also a pest of several fruit, garden, and field crops, and has a total host range of more than 300 plant species. Adult Japanese beetles feed on foliage, flowers, and fruits. Leaves are typically skeletonized or left with only tough network of veins. The larvae, commonly known as white grubs, primarily feed on roots of grasses often destroying turf in lawns, parks, and golf courses. Currently the Japanese beetle is the most widespread pest of turf grass and costs the turf and ornamental industry approximately $450 million each year in management alone (Potter and Held, 2002).

Japanese beetle, *Popilliajaponica*,Newman (Coleoptera: Scarabaeidae), was first discovered in the United States in 1916 in New Jersey (Johnson and Lyon, 1991). As early as 1939 it was predicted that Japanese beetle populations would spread throughout the country and become permanently established (Fox, 1939).

Rose beetles are now found in almost every state east of the Mississippi River (Daar*et al.* 1996). Of the nearly 300 species of plants fed upon by beetle, roses appear to be the most preferred woody host (Hawley and Metzger 1940; Fleming 1972).

Japanese beetle adults are major insect pests of cultivated roses grown in the eastern and Midwestern portions of the United States (Johnson and Lyon, 1991). The Chicago Botanic Garden contains the Crasberg Rose Garden, which has one of the largest rose collections in the United States.

The garden displays over 5,000 roses and is updated periodically to showcase roses, including All-American Rose selection award winners (Chicago Botanic Garden 2004).Within the past 13 years, the Japanese beetle has become permanently established at the Chicago Botanic Garden (Tiddens, 2004).

As a result, many rose genotypes favored by Japanese beetles are not being incorporated into landscapes in northeastern Illinois. The primary means of minimizing Japanese beetle adult feeding on roses is the use of insecticides (Potter and Held, 2002).

Although insecticide use may be justified to maintain the aesthetic quality of roses displayed in botanic gardens, a goal of the Chicago Botanic Garden's Integrated Pest Management (IPM) program is to maintain plant quality with minimum insecticide use. There are also concerns regarding the impact of broad-spectrum insecticides on beneficial organisms (Van Driesche and Bellows, 1996).

To minimize insecticide use, selecting roses that exhibit tolerance or that is less susceptible to Japanese beetle feeding could be a method to reduce insecticide inputs in the permanent collections. In fact, plant resistance or tolerance offers the greatest promise for low-input sustainable management of Japanese beetle adults (Potter and Held, 2002).

There is significant variability in susceptibility to Japanese beetle feeding among, *Betulaspp*, (Ranney and Walgenbach 1992), flowering crabapple, *Malus spp*. (Ranney and

Walgenbach, 1992; Potter *et.al*. 1998), linden, *Tilia spp*.And*Ulmus spp*.(Miller *et.al*. 1999). However, no resistance has been discovered in roses (Potter *et.al*. 1998).

Held and Potter (2004) noted that prior to their study in determining the floral characteristics that attract Japanese beetle adults, research on roses and susceptibility to Japanese beetle adult feeding was limited, with only one previously published study investigating resistance of roses to adult rose beetle (Potter *et al*. 1998).

2.4.1 Distribution of beetle

Outside of its native Japan, *Popillia japonica* is found in China, Russia, Portugal, Canada and the USA (CABI, 2004). Since the first detection in the United States in a nursery near Riverton, New Jersey in 1916, it has spread to many states east of the Mississippi River (except Florida), as well as parts of Wisconsin, Minnesota, Iowa, Missouri, Nebraska, Kansas, Arkansas and Oklahoma. Despite regulatory efforts, by 2002 it had become established in at least 30 states (status map). Of the states in the southern region, climatological studies predict that it will establish in all states bordering the Gulf of Mexico (Johnson and Lyon, 1991).

2.4.2 Biology and life history of aphid

The following description of *Popillia japonica* biology is based on the detailed account by Fleming(1972).

Adult

The adult is an attractive and broadly oval beetle, 8 to 11 mm long (1/3 to 1/2 inch) and 5 to 7 mm (1/4 inch) wide. It is generally metallic green, with bronze or coppery-brown wing covers that do not completely cover the abdomen. The five patches of white hairs on each side of the abdomen, and one pair on the last abdominal segment distinguish *P. japonica* from all other similar looking beetles(Fleming, 1972).

Egg

Newly deposited egg may be spherical, ellipsoidal or slightly cylindrical and usually have a diameter of about 1.5 mm. It may be translucent to creamy white with small hexagonal areas on the surface. During embryo development, the egg enlarges to double its initial size and becomes almost spherical (Fleming.1972).

Larva

Translucent and creamy white, the grub is covered with scattered long brown hairs interspersed with short, blunt, and spines. The head is yellowish-brown with strong dark-colored mandibles and the body consists of three thoracic and ten abdominal segments. Each thoracic segment bears a pair of segmented legs. Accumulation of fecal matter in the hindgut may give a grayish to dark appearance to the posterior end. As typical of a scarab larva, the grub is C-shaped when at rest (Fleming.1972).

Pupa

Pupation takes place within an earthen cell formed by the last larval instar; the pupa is about 14 mm (1/2 inch) long and 7 mm (1/4 inch) wide. Its color ranges from pale cream to metallic green depending upon the age (Fleming.1972).

Life Cycle

In most parts of its range, the Japanese beetle completes its life-cycle in one year, but some populations in cooler climates may complete their development in two years (Vittum, 1986). Appearances of adult the timing of oviposition and subsequent development have been shown to vary with latitude, altitude, and also from year to year (Fleming, 1972). Adults emerge in mid-May in the warmer climates of Georgia and North Carolina. More northern populations in Massachusetts, New York, Vermont, and New Hampshire have adult emergence from late June to early July.

Males emerge a few days earlier than females but eventually the population maintains a sex ratio of 1:1 (Fleming 1972, Régnière*et.al.* 1981). Mating begins soon after emergence as virgin females release powerful sex pheromones that immediately attract large number of males. In an attempt to mate, the attracted males form a congregation around the unmated female, forming clusters referred to as beetle "balls" but mating rarely occurs under such intense competition (Ladd, 1970).

Selection of a site for oviposition is influenced by proximity to host plant, nature of ground cover, and the soil condition. In suburban areas where turf is abundant, most beetles feeding on trees, shrubs, and vines deposit their eggs in the nearby grass (Fleming, 1972). Although *Popillia japonica* generally lays most of its eggs on pastures, lawns and golf courses, eggs may also be deposited in agricultural fields. During dry summers when pastures are hard and dry, beetles are known to seek cultivated and fallow fields with loose and moist soil.

The ovipositing female burrows into the soil at a depth of 2 to 4 inches and deposits one to three eggs (singly). It will emerge the next day, or sometimes after three or four days and continue to feed, remate and may enter the soil for more than sixteen times during its adult life, to deposit a total of 40 to 60 eggs (Fleming, 1972).

Eggs hatch in 10 to 14 days. The first instar feeds on nearby rootlets and organic matter for two to three weeks and molts for the first time. The second instar continues to feed for another three to four weeks and molts to a third instar. The majority of grubs reach the third instar by the fall when soil temperature gradually decreases. The activity of the grub ceases around 10°C (50°F) and most larvae overwinter as third instar at a depth of 5 to 15 cm (2 to 6 inches). With the beginning of spring, the grubs return to the plant roots to resume feeding for four to six weeks until they are ready to pupate. Pupation usually occurs near the soil surface, and takes one to three weeks. Adults emerge from mid-May in warmer areas and June-July in cooler climates.

The life of adult beetles is relatively short under high temperatures and long under low temperatures (Fleming, 1972). Studies with Japanese beetles under captivity have shown variations as wide as nine to 74 days in males and 17 to 105 days in females; the generally accepted range is 30 to 45 days (Fleming, 1972).

2.4.3 Host Range of Japanese beetle

More than 300 species of plants are known to be host to Japanese beetle. The following are some of the better-known primary and secondary hosts (CABI, 2004).

Primary hosts

Acer (maples), *Asparagus officinalis* (asparagus), *Glycine max* (soybean),*Malusspp*(ornamental species apple), *Prunusspp* (stone fruit including plums, peaches etc), *Rheum hybridum* (rhubarb), *Rosaspp* (roses),*Rubusspp* (blackberry, raspberry),*Tiliaspp*(limes), *Ulmusspp* (elms), *Vitisspp* (grapes), *Zea mays* (corn).

Secondary hosts

Aesculusspp (buckeyes), Althaea (hollyhocks), *Betulaspp* (birches), *Castaneaspp*(chestnuts), *Hibiscusspp* (rosemallows), *Juglansnigra* (American waPlatanus (planes), Populus (poplars), Salix (willow), *Sassafras albidum* (common sassafras), *Sorbusamericana* (American mountain ash), turf grasses.

2.4.4Nature of damage caused by beetle

Both adults and larvae cause plant damage, but the host and nature of damage are usually different. Adults cause damage on foliage and flowers of a wide range of hosts and are most active on warm sunny days. The feeding on the upper leaf surface usually results in skeletonization. The grubs, which primarily feed on roots of grasses cause considerable damage to pasture, lawn and golf courses. Feeding damage on roots reduces the ability of grass to take up enough water to withstand stresses of hot and dry weather, and result in dead patches

((Vittum, 1986).

CHAPTER-III
MATERIALS AND METHOD

3.1 Experimental site

The experiment was conducted at the farm of Sher-e-Bangla Agricultural University, Dhaka during the period from April to December 2011.The location of the site in 23.774^0 N latitude and 90.335^0 E longitudes with an elevation of 8.2 meter from sea level.

3.2 Climate

The experimental site is situated in subtropical zone, characterized by heavy rainfall during the months from April to September (Kharif season) and scantly rainfall during the rest of the year (Robi season). Information regarding average monthly the maximum and the minimum temperature, rainfall and relative humidity recorded by the weather yard, Bangladesh Metrological Department (climate division) Agargaon, during the period from April 2011 to December 2011 (Appendix I).

3.3 Soil

The soil of the experimental area belongs to the Modhupur Tract in Agro ecological zone (AEZ) 28 (UNDP, 1988). The analytical data of the soil sample collected from the experimental area were determined in the SRDI, Soil Testing Laboratory and Khamarbari(AppendixII).

The experimental site was a medium high land and pH of the soil was 5.6. The Morphological characters of the soil of the experimental plots are given below:

AEZ NO	-	28
Soil series	-	Tejgaon
General soil	-	Non-calcarious dark grey.

3.4 Collection of variety

Rose varieties were collected from Bangladesh Agricultural Research Institute (BARI), Gazipur, Dhaka, BIRD, Jessore and various floriculture nurseries in Bangladesh.

3.5 Treatments under investigation

Twelve varieties of roses were included for thisexperiment. These are:

T_1=Wild rose

T_2=Crazy love bi-color

T_3=Yellow star

T_4=Missing love

T_5= Compassion

T_6= Charming lady

T_7= Dream bangle

T_8=Sleepy moon

T_9=Sweet doll

T_{10}=Moon light

T_{11}=Sweet love

T_{12}=Mini moni.

3.6 Land preparation

The land was first opened by ploughing in the month of March, 2011 with the help of power tiller and then it kept open to sun for seven days prior to further ploughing. Afterwards it was prepared by ploughing and cross ploughing followed by laddering. The weeds and stubbles were removed after each laddering. Simultaneously the clods were broken and the soil was made into good tilth. The basal dose of manures and fertilizers were mixed into the soil during final land preparation.

3.7 Experimental design and layout

The one factor experiment was laid out inRandomized Complete Block Design (RCBD)with 3 replications. Each block was divided into 12 plots, where treatments were allotted at random. Thus, there were 36 (12 × 3) unit plots altogether in the experiment. The size of each plot was 1mx0.8m. The distance between blocks was 0.5m and 0.5m wide drains were made between the plots.

3.8 CULTIVATION

3.8.1 Planting

The beds were dug deep during summer and kept open the soil due toexposed to sun. An appropriate amount of farmyard manure or cowdung manure along with 2kg superphosphate and 1kg BHC (5%) wereincorporated into the soil and bed leveled followed by watering/irrigation. The bed wasproperly leveled and there was no water logging in beds.Generally, rose beds were rectangular in shape. While grouping the varieties in a bed, tall varieties were put in theback row while dwarf ones in the front and

those having intermediate plant height in themiddle row.The rose was planted in pits of 60cm diameter and 60- 75cm depth dug atappropriate distances in a bed.

3.8.2Manuring and fertilization:

Manures were applied before planting new bushes and at the time of pruning. After pruning, the soil inthe bed was dug up with a fork with due care to avoid any damage to the roots. About 8-10kg of well rotten cow dung manure was applied to each plant.Oil cakes, preferably neem cake or castor cake@50g/plant or 15kg/100m2 was appliedat the end of the first flush of flowering. Poultry manure or sheep/goat droppings wereapplied @ of one litre/plant. The oil cakes were quick acting organic manures, as their Nbecomes available to plants within a week of their incorporation in the soil. However, fertilizer mixture having 1 part of urea, 3parts of superphosphate and 2 parts of potassium sulphate was used periodically. About 40g of this mixture wasapplied as topdressing to each plant 3 times at 15 days intervals after pruning.

3.8.3 Pruning

The rose bushes were pruned once a year during second week of October. After about 6-7 weeks of pruning, the plants started flowering. The time off lowering was adjusted according to the date of pruning. The new or so-called "Maiden"plants were not pruned.

3.8.4Irrigation

Light overhead irrigation was provided with watering to the plots once immediately after planting of seedlings for its proper growth and development, when the soil moisture level was very low. Whenever the plants of a plot had shown the symptom of wilting the plots were irrigated on the same day with a hosepipe until the entire plot was properly wet.

3.8.5 Drainage

Stagnant water effectively drained out at the time of heavy rain.

3.8.6Gap filling

Dead injured and weak seedlings were replaced by new vigor seedlings from the stock on the border line of the experiment.

3.8.7Intercultural operation

The seedlings were kept under close observation. Since, it is prerequisite to find out different numbers of insect pests from the experimental field, necessary intercultural operations were done to obtain proper growth and development of the plant

3.8.8 Weeding

The field was weeded as and when necessary.

3.8.9 Selections and tagging of plants

Ten plants from each of the plots were selected randomly for recording data for different characters.

3.9.0Collection of data

3.9.1Number of major pests and reduction percentage

Data on number of insects were recorded from five leaves, five shoots and five flowers at an interval of7 days commencing from first incidence and continued up to the 10 weeks (10 times) at morning.

The infestation of rose flowers shoots and branch were monitored during floweringstages. Infested shoots and branch were counted and recorded during vegetative stage at 7 days intervals after observing rose pests especially aphid, spider mite, whitefly and Japanese rose beetle from the experimental plots**.**

- Number of aphid per plant
- Number of spider mite per plant
- Number of whitefly per plant
- Number of beetle per plant
- Number of the infested leaves

- Number of the infestedbranches
- Number of the infested flowers

3.9.2Statistical analysis

The collected data were compiled and analyzed statistically using the analysis of variance (ANOVA) technique with the help of a computer package program MSTAT-C and the mean differences were compared by Least Significance Difference (LSD) test(Gomez and Gomez,1984).

CHAPTER IV

RESULTS AND DISCUSSION

The experimental was conducted to determine the incidence of the insect and mite pests on different varieties of roses. The results obtained from the present study for incidence of insects at different stage on rose and their tolerance against pests. Beside the incidence of insect and mite pest on different varieties of rose at different days has been also presented and discussed in this chapter with some tables and figures as follows

4.1 Incidence of aphid on rose

Incidence of aphid (*Aphis craccivora*) on rose showed significant variations among varieties at different days. The incidence of aphid on different varieties of rose at different days was presented in Table.1. Different varieties of rose were used to identify the incidence of aphid and to test the tolerant variety where the highest incidence of aphid was found under the variety of Sweet Doll (2.0, 2.67, 3.00, 4.33, 5.00, 5.33, 4.33, 5.67, 5.67, 5.33 at 7, 14, 21, 28,35,42,49, 56, 63, and 70 days, respectively) on rose. Among the varieties, the minimum incidence of aphid was found under variety of Sweet Love (0.67,

1.00, 1.33, 2.67, 1.67, 2.00, 2.00, 2.00, 2.00, 2.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) and this variety showed the highest tolerant to aphid incidence. Minimum mean number (1.73) of aphid was found in Sweet Love. The varietywild rose, Crazy love bi-color, Yellow star, Missing love,Compassion, Charming lady, Dream bangle, Sleepy moon, Moon light, Mini moniwere contained 3.30, 2.43, 2.53,2.30, 2.30, 2.77, 2.10, 2.27, 2.70 and 3.27 number of aphidat 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively. The maximum number of aphid was observed in Sweet Doll variety of rose (Fig.1).

Plate 1: The experimental plot at SAU, Dhaka.

Plate 2: Wild rose

Plate 3: Crazy love bicolor

Plate 4:Yellow star

Plate 5: Missing love

Plate 6: Compassion

Plate 7: Charming lady

Plate 8: Sleepy moon Plate 9: Dream Bangle

Plate 10: Sweet doll Plate 11: Moon light

Plate 12: Sweet lovePlat13: Mini moni

Table 1. The incidence of aphid on different varieties of roses at different days after pruning.

Number of aphid per plant										
Treatments	**7 days**	**14 days**	**21 days**	**28 days**	**35 days**	**42 days**	**49 days**	**56 days**	**63 days**	**70 days**
T_1	1.67ab	2.0abc	3.00a	3.33b	2.33cde	3.67b	4.33a	4.00c	4.00c	4.67ab
T_2	1.67ab	2.00abc	1.67bc	2.00cde	2.33cde	3.00bc	2.67bc	2.67de	2.67de	3.67cd
T_3	1.67ab	2.33ab	2.33bc	2.00cde	3.00bc	2.00d	4.33a	2.33de	2.33de	3.00de
T_4	1.67ab	2.33ab	2.00abc	2.33cd	3.00bc	2.00d	2.67bc	2.00e	2.00e	3.00de
T_5	1.67ab	1.33cd	1.67bc	1.67de	2.67cd	2.67cd	3.00bc	2.67de	2.67de	3.00de
T_6	1.00ab	2.00abc	1.33c	2.67bc	2.33cd	2.00d	2.33bc	5.00ab	5.00a	4.00bc
T_7	1.67ab	1.33cd	1.67bc	2.00cde	2.00de	2.67cd	2.33bc	2.33de	2.33de	2.67ef
T_8	1.00ab	1.67bcd	2.00abc	2.00cde	2.00de	2.67cd	2.67bc	3.00d	3.00d	2.67ef
T_9	2.00a	2.67a	3.00a	4.33a	5.00a	5.33a	4.33a	5.67a	5.67a	5.33a
T_{10}	1.33ab	2.33ab	2.00bc	2.00cde	3.67b	3.33bc	3.00bc	2.67de	2.67de	4.00bc
T_{11}	0.67b	1.00d	1.33c	2.67bc	1.67e	2.00d	2.00c	2.00e	2.00e	2.00f
T_{12}	2.00a	2.33ab	2.67ab	2.33cd	3.67b	2.67cd	3.33ab	4.33bc	4.33bc	5.00a

Means having similar letter(s) are statistically identical at 5% level of significance.Values are the meanof three replications.
T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love,
T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon,
T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni.

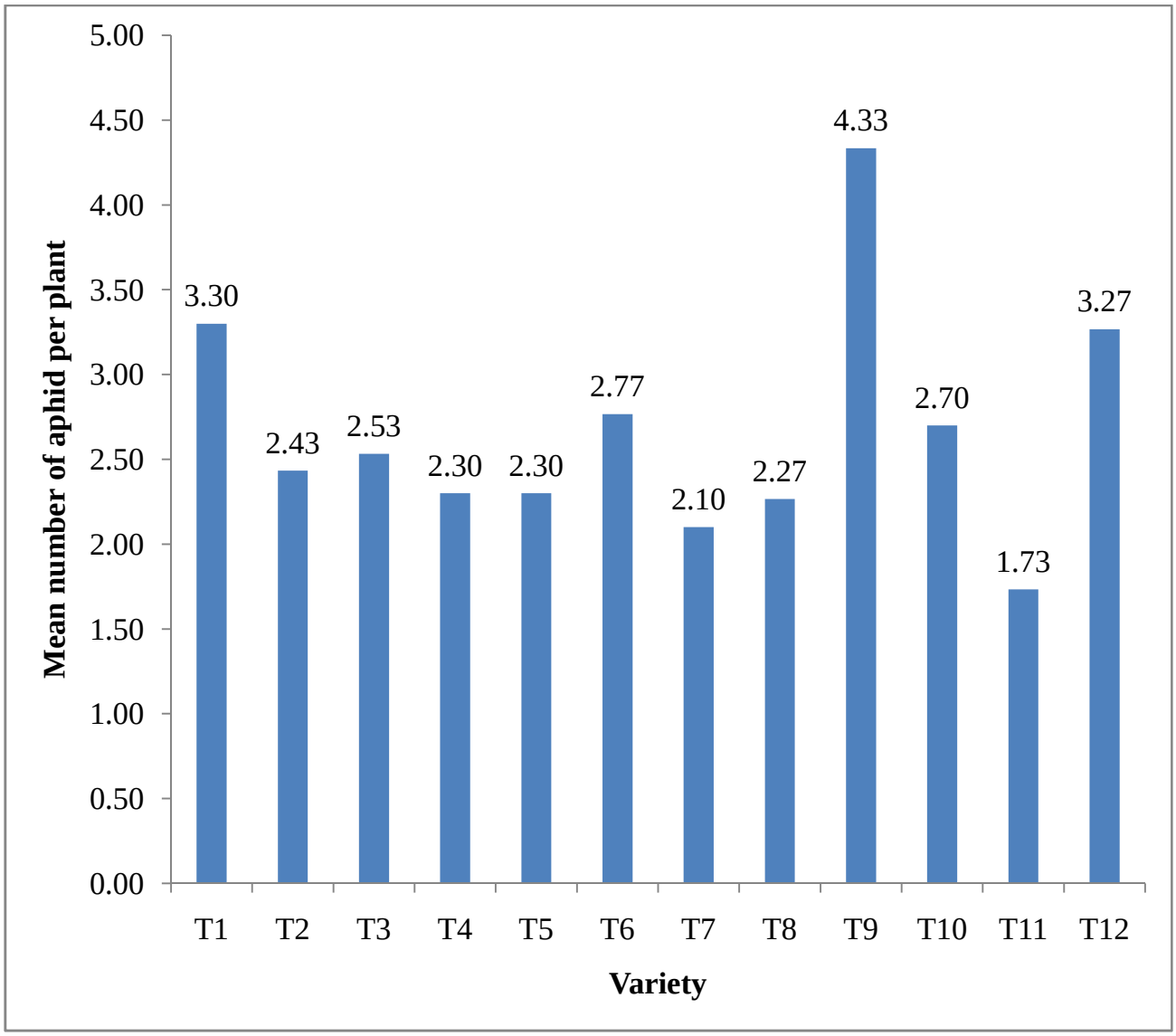

Fig.1.Number of aphid per plant on different varieties of roses.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love, T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon, T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni

Plate 14: Flower bud infested by aphid of sweet doll variety

Plate 15: Flower bud infested by aphid and its predator lady bird beetle on aphid.

From the above results, it was found that the Sweet dollvariety was more susceptible to incidence of aphid which was common incidence on rose crops. It was also found that the Sweet Love variety of rose was more effective to control aphid than among other varieties which will ensure the greater tolerant variety. Look for aphid colonies on plant stems by parting the canopy. Heavy aphid infestations will become readily visible when they spread to the upper leaves and flowers. There are no set thresholds for aphid in roses. Aphids inject toxins into the plant while feeding. Severe infestations most likely reduce rose vigour and flower. Aphid feeding produces honeydew making harvesting difficult. Honeydew produced by aphids promotes sooty mould which reduces photosynthesis.

4.2Incidence of spidermite on rose

Incidence of spider mite on rose showed significant difference at different days.The incidence of spider mite on different varieties of rose at different days was presented in Table 2. From the table 2, it was found that the sweet doll of rose had the maximum number of mite (2.0, 1.67, 2.33, 2.33, 3.33, 2.00, 3.33, 3.00, 2.33 and 2.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively).Among the rest varieties, Sweet Love was more tolerant against mite and had lowest number of mite was the lowest (0.33, 0.67, 0.33, 0.33, 1.00, 1.33, 1.67, 1.67, 1.67 and1.67 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) which increased the natural growth and maximized the yield of rose.

Minimum mean number (1.07) of mite was found in Sweet Love (Fig2). The variety such as Wild rose, Crazy love bi-color, Yellow star, Missing love, Compassion, Charming lady, Dream bangle, Sleepy moon, Moon light, Mini moniwas contained 1.97, 2.07, 2.03,2.20, 2.00, 1.80, 2.27, 2.10, 2.07 and 1.93 number of mite, respectively and data was collected at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days. The maximum number of mite was observed in Sweet Doll (2.43) variety of rose.

Plate 16: Shoot infested by spider mite of sweet doll variety of rose.

Plate 17: Healthy rose of Missing love variety of rose.

Plate 18: Flower bud infested by spider mite of Missing love variety of rose.

Plate 19: Leaves and flower infested by spider mite of Missing lovevariety of rose.

Plate 20: Leaves infested by spider mite of Missing love variety of rose.

From the above results on incidence of mite, it was found that the variety of Sweet Love on rose decreased the number of mite at vegetative and flowering stages.Sweet Love showed tolerant against mite. The remainingvarieties showed intermediate incidence of mite compared to varieties having highest and lowest incidence.

Table 2.The incidence of spider mite on different varieties of roses at different days after pruning.

Number of spider mite per plant										
Treatments	**7 days**	**14 days**	**21 days**	**28 days**	**35 days**	**42 days**	**49 days**	**56 days**	**63 days**	**70 days**
T_1	1.67ab	1.33ab	1.00bcd	0.67cd	2.33bcd	2.33ab	2.00cd	2.33abc	3.00a	3.00a
T_2	1.00bcd	1.67a	1.67abc	2.00ab	2.33bcd	2.33ab	2.67abc	1.67c	2.33abc	3.00a
T_3	1.33abc	1.33ab	1.33abcd	2.00ab	1.67def	2.67a	2.00cd	2.67ab	2.67ab	2.67ab
T_4	1.00bcd	1.67a	1.67abc	2.67a	3.00ab	2.67a	2.33bcd	2.00bc	2.33abc	2.67ab
T_5	0.67cd	1.67a	2.00ab	2.00ab	2.00cde	2.00ab	2.33bcd	2.33abc	2.67ab	2.33abc
T_6	0.67cd	1.33ab	1.67abc	1.33bc	2.67abc	1.67ab	2.33bcd	1.67c	2.00bc	2.67ab
T_7	1.33abc	1.67a	2.33a	2.33a	3.00ab	2.67a	2.33bcd	2.00bc	2.00bc	3.00a
T_8	1.00bcd	1.00bc	0.67cd	2.00ab	2.33bcd	2.67a	3.00ab	2.33abc	3.00a	3.00a
T_9	2.00a	1.67a	2.33a	2.33a	3.33a	2.00ab	3.33a	3.00a	2.33abc	2.00bc
T_{10}	1.00bcd	1.33ab	2.00ab	2.00ab	2.33bcd	2.00ab	2.33bcd	3.00a	2.67ab	2.00bc
T_{11}	0.33d	0.67c	0.33d	0.33d	1.00f	1.33b	1.67d	1.67c	1.67c	1.67c
T_{12}	1.00bcd	1.67a	1.67abc	2.67a	1.33ef	2.33ab	2.00cd	2.33abc	2.00bc	2.33abc
$LSD_{(0.05)}$	0.71	0.42	1.04	0.78	0.69	1.02	0.80	0.79	0.78	0.70
CV(%)	14.58	7.89	7.56	8.67	17.0	11.2	7.90	5.67	2.3	7.23

Means having similar letter(s) are statistically identical at 5% level of significance. Values are the mean of three replication.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love,

T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon,

T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni.

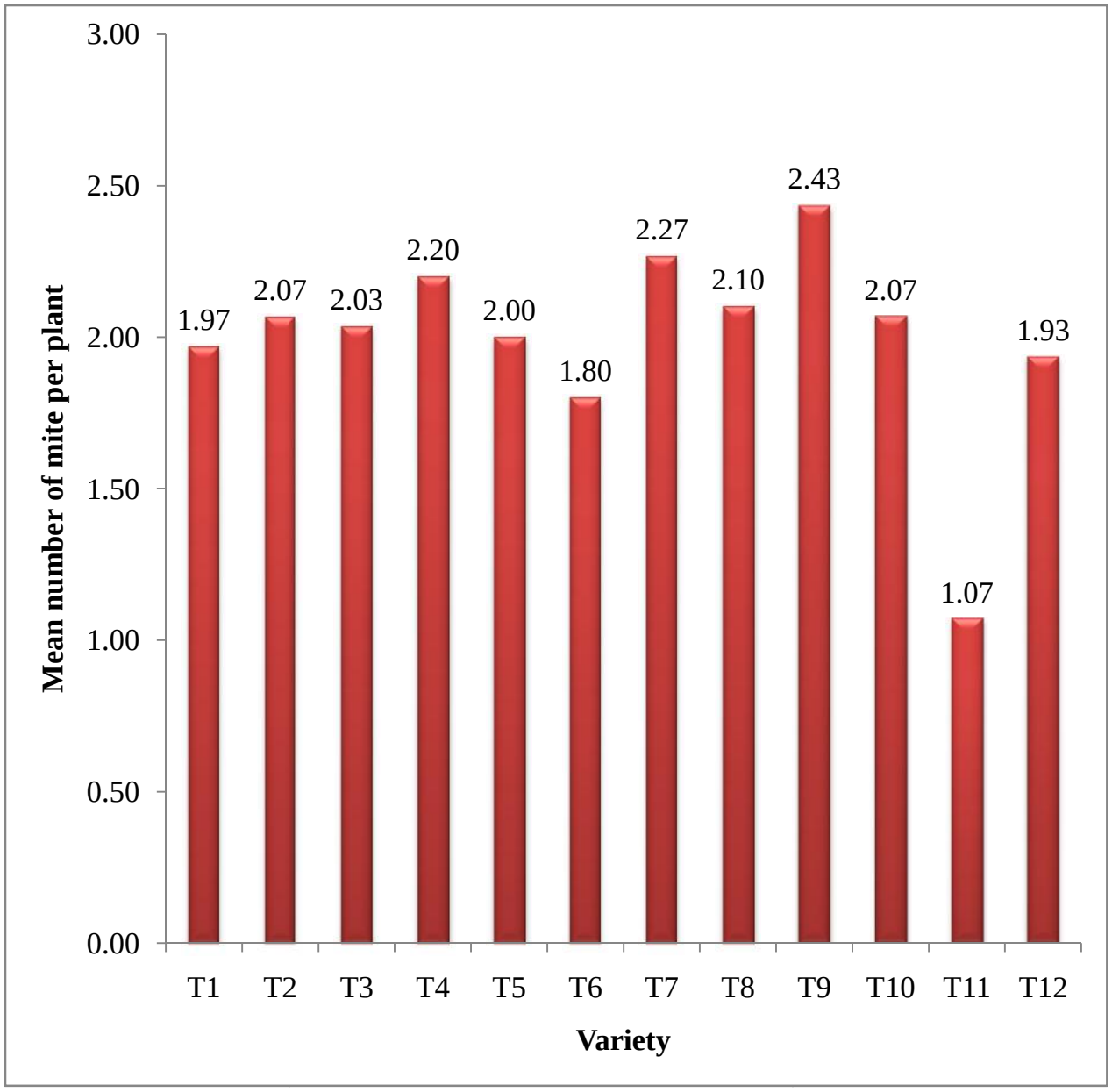

Fig. 2.Number of spider mite per plant on different varieties of roses.

T1=Wild rose ,T2=Crazy love bi-color, T3=Yellow star ,T4=Missing love ,
T5= Compassion ,T6= Charming lady ,T7= Dream bangle ,T8=Sleepy moon ,
T9=Sweet doll ,T10=Moon light ,T11=Sweet love ,T12=Mini moni .

4.3Incidence of whitefly on rose

Incidence of whitefly on rose showed significant difference at different days. The incidence of whitefly on different varieties of rose at different days was presented in Table 3. From the table 3, it was found that the sweet doll of rose had the maximum number of whitefly (2.00, 3.33, 3.00, 3.67, 3.33, 3.67, 4.00, 4.33, 4.67 and 4.33 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively). But in case of other treatments showed less number of whitefly whereas, Sweet Love variety ofrose as produced the lowest incidence of whitefly (0.33, 0.33, 1.00, 1.33, 1.00, 2.00, 2.00, 2.00, 2.00, 2.33 and 3.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) than other varieties.

Minimum mean number (1.53) of white fly was found in Sweet Love (Figure 2). The variety such as Wild rose, Crazy love bi-color, Yellow star, Missing love, Compassion, Charming lady, Dream bangle, Sleepy moon, Moon light, Mini moniwas contained 2.67, 2.07, 2.50, 2.23, 1.90, 2.30, 2.03, 2.03, 2.10 and 2.20 number of whitefly, respectively and data was collected at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days. The maximum number of mite was observed in Sweet Doll (3.63) variety of rose.

Table 3.The incidence of whiteflyon different varieties of roses at different days after pruning.

Number of whitefly per plant										
Treatments	**7 days**	**14 days**	**21 days**	**28 days**	**35 days**	**42 days**	**49 days**	**56 days**	**63 days**	**70 days**
T1	1.67ab	2.67ab	2.33b	2.67b	3.00ab	2.00b	3.33b	3.00bc	2.67bc	3.33bc
T2	0.67c	1.33cde	2.00b	2.33bc	2.67abc	2.00b	2.33d	2.67cd	2.67bc	2.00d
T3	2.00a	1.00def	2.00b	2.00bcd	2.00c	3.33a	3.00bc	3.67b	3.33bc	2.67cd
T4	1.00bc	1.67cd	2.00b	2.33bc	2.00c	2.33b	2.33cd	3.00bc	3.00bc	2.67cd
T5	0.67c	1.67cd	1.00c	2.00bcd	2.33bc	2.00b	2.00d	2.00d	2.67bc	2.67cd
T6	1.00bc	2.00bc	1.00c	2.00bcd	2.33bc	2.00b	2.33cd	2.67cd	3.67b	4.00ab
T7	0.67c	1.00def	2.00b	2.00bcd	2.33bc	2.00b	2.00d	2.67cd	2.33c	3.33bc
T8	0.33c	1.33cde	2.33b	1.67cd	2.00c	2.33b	2.00d	3.00c	2.67bc	2.67cd
T9	2.00a	3.33a	3.00a	3.67a	3.33a	3.67a	4.00a	4.33a	4.67a	4.33a
T10	0.67c	1.00def	1.33c	1.33d	2.00c	2.67b	3.00bc	2.00d	3.00bc	4.00ab
T11	0.33c	0.33f	1.00c	1.33d	1.00d	2.00b	2.00d	2.00d	2.33c	3.00c
T12	0.67c	0.67ef	1.33c	1.67cd	2.33bc	2.00b	2.33cd	3.00bc	3.67b	4.33a
LSD (0.05)	0.75	0.79	0.58	0.78	0.69	0.62	0.62	0.64	0.90	0.82
CV(%)	6.50	7.8	7.8	10.11	12.5	7.80	8.90	8.9	7.8	8.90

Means having similar letter(s) are statistically identical at 5% level of significance. Values are the mean of three replication.
Tı=Wild rose ,T2=Crazy love bi-color, T3=Yellow star ,T4=Missing love ,
T5= Compassion ,T6= Charming lady ,T7= Dream bangle ,T8=Sleepy moon ,
T9=Sweet doll ,T10=Moon light ,T11=Sweet love ,T12=Mini moni .

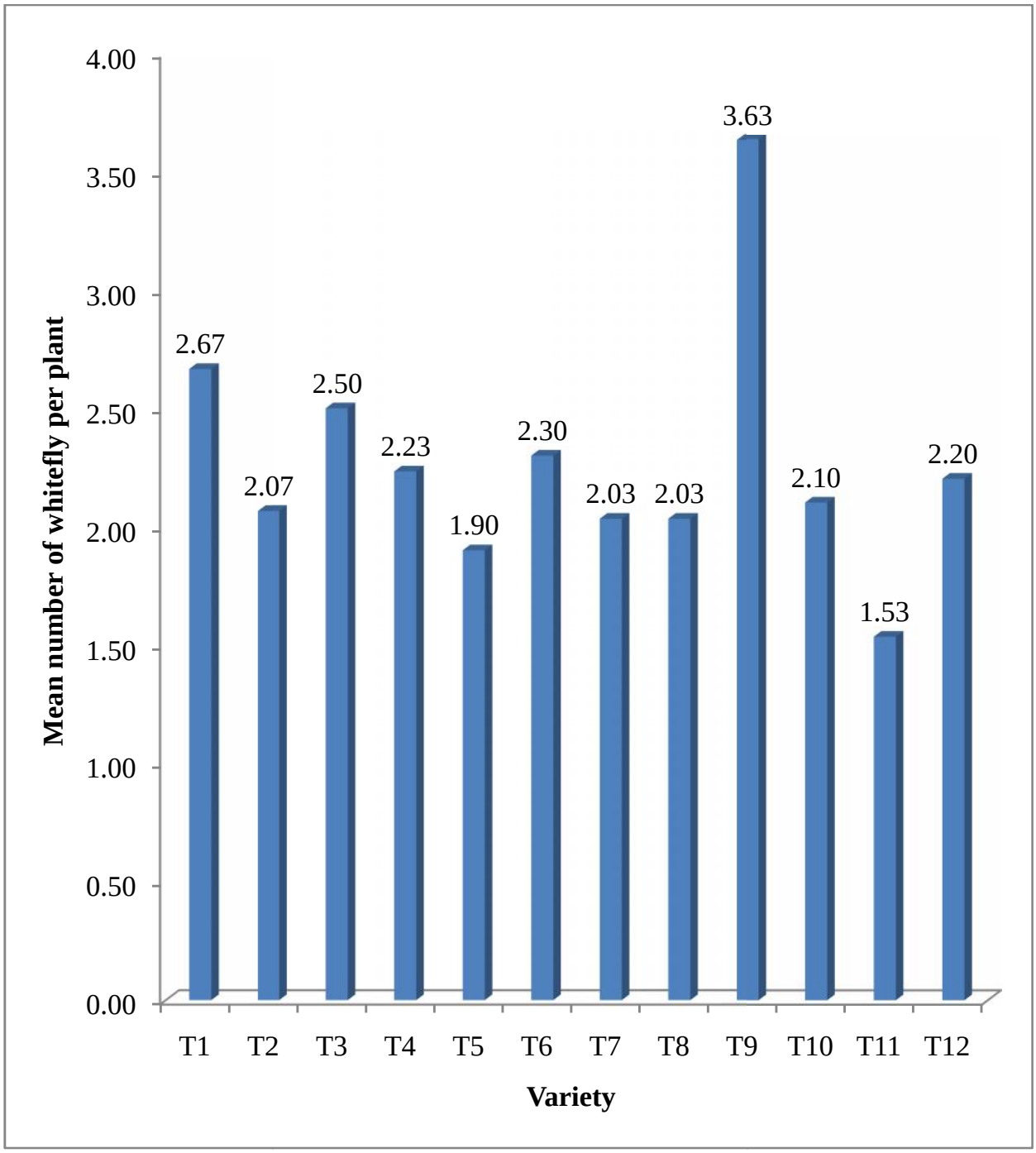

Fig. 3.Number of whitefly per plant on different varieties of roses.

Tı=Wild rose,T2=Crazy love bi-color, T3=Yellow star,T4=Missing love ,
T5= Compassion,T6= Charming lady,T7= Dream bangle,T8=Sleepy moon,
T9=Sweet doll,T10=Moon light,T11=Sweet love,T12=Mini moni.

Plate 21:Flower and flower bud infested by whitefly.

Plate 22: Shoot infested by whitefly of Sweet doll.

Above results indicate that the incidence of whitefly, it was found that the Sweet Love of variety of rose was more effective to manage the whitefly on rose research field and it was observe that the number of whitefly decrease at vegetative and reproductive stage. The variety of Sweet Love showed the superior performance against whitefly whereas the variety of Sweet Doll was lower performing to manage the whitefly. The results obtained from another varieties showed intermediate incidence of whitefly compared to highest and lowest incidence. So, Sweet Love was more effective to tolerant whitefly than other varieties.

4.4 Incidence of Japanese beetle on roses

Significant variation was observed on the incidence of Japanese beetle among all varieties of rose (Table.4). Among the varieties Sweet Love showed tolerant against Japanese beetle and the variety of Sweet doll showed susceptible toJapanese beetle. SweetLovereduced the attack ofJapanese beetle (0.33, 1.00, 1.00, 1.00, 2.00, 2.33, 2.00, 1.67, 2.00, 1.67 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days) and it will support to make sure the more yield of rose. In the similar trend, the variety of sweet doll showed lower performance against the Japanese beetle while maximum number of Japanese beetle (1.67, 1.67, 2.33, 3.00, 3.00, 3.67, 3.33, 4.33, 4.67 and 5.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) was recorded on rose(Table 4)

Plate 23: Japanese beetle on healthy flower of compassion rose.

Plate 24: Flower and leaves infested by Japanese beetle of Crazy love bicolor rose variety.

Plate 25: Leaves infested by Japanese beetle of sweet doll rose.

Plate 26: Shoot infested by Japanese beetle of Sleepy moon.

Minimum mean number (1.50) of white fly was found in Sweet Love (Figure 2). The variety such as Wild rose, Crazy love bi-color, Yellow star, Missing love, Compassion, Charming lady, Dream bangle, Sleepy moon, Moon light, Mini moniwas contained 2.00, 2.43, 2.17, 2.77, 2.07, 1.67, 2.47, 2.23, 2.10 and 2.43 number of Japanese beetle, respectively and data was collected at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days. The maximum number of Japanese beetle was observed in Sweet Doll (3.63) variety of rose.

From the above results on incidence of Japanese beetle, it was found that the variety of Sweet Love on rose decreased the number of Japanese beetle at vegetative and flowering stages. Sweet Love showed tolerant against rose beetles. The remaining varieties showed intermediate incidence of Japanese beetles compared to varieties having highest and lowest incidence.

Table 4.The incidence of Japanese beetle on different varieties of roses at different days after pruning.

Number of Japanese beetle per plant										
Treatments	**7 days**	**14 days**	**21 days**	**28 days**	**35 days**	**42 days**	**49 days**	**56 days**	**63 days**	**70 days**
T_1	0.67bc	1.33ab	1.00c	1.33cd	2.00b	2.33bc	2.67abc	2.67bcd	3.00b	3.00de
T_2	1.00abc	1.33ab	1.67abc	2.00bc	2.33ab	2.33bc	2.67abc	3.67ab	3.33b	4.00bc
T_3	1.33ab	1.33b	2.00ab	2.00bc	2.33ab	2.67bc	2.00c	2.67bcd	2.67bc	2.67ef
T_4	1.00abc	1.67a	2.33a	2.67ab	3.00a	3.33ab	2.33bc	3.67ab	3.33b	4.33abc
T_5	1.33ab	1.67a	2.00ab	2.00bc	2.00b	2.00cd	2.33bc	2.33cd	2.67bc	2.33efg
T_6	0.67bc	1.33ab	1.67abc	1.33cd	2.67ab	1.33d	2.33bc	1.67d	2.00c	1.67g
T_7	1.33ab	1.67a	1.33bc	2.33ab	3.00a	2.67bc	2.67abc	2.67bcd	3.33b	3.67cd
T_8	1.33ab	1.00b	2.00ab	2.00bc	2.00b	2.67bc	3.00ab	2.33cd	3.00b	3.00de
T_9	1.67a	1.67a	2.33a	3.00a	3.00a	3.67a	3.33a	4.33a	4.67a	5.00a
T_{10}	1.00abc	1.33ab	2.00ab	2.00bc	2.67ab	2.00cd	2.33bc	3.00bc	2.67bc	2.00fg
T_{11}	0.33c	1.00b	1.00c	1.00d	2.00b	2.33c	2.00c	1.67d	2.00c	1.67g
T_{12}	1.00abc	1.00b	1.67abc	2.67ab	2.00b	2.67bc	2.00c	3.67ab	3.00b	4.67ab
$LDS_{(0.05)}$	0.80	0.30	0.83	0.65	0.82	0.88	0.70	0.95	0.62	0.77
CV (%)	8.65	12.50	11.98	6.78	7.80	10.12	12.3	18.0	6.78	7.8

Means having similar letter(s) are statistically identical at 5% level of significance. Values are the mean of three replications.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love,

T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon ,

T_9=Sweetdoll,T_{10}=Moonlight,T_{11}=Sweetlove,T_{12}=Minimoni.

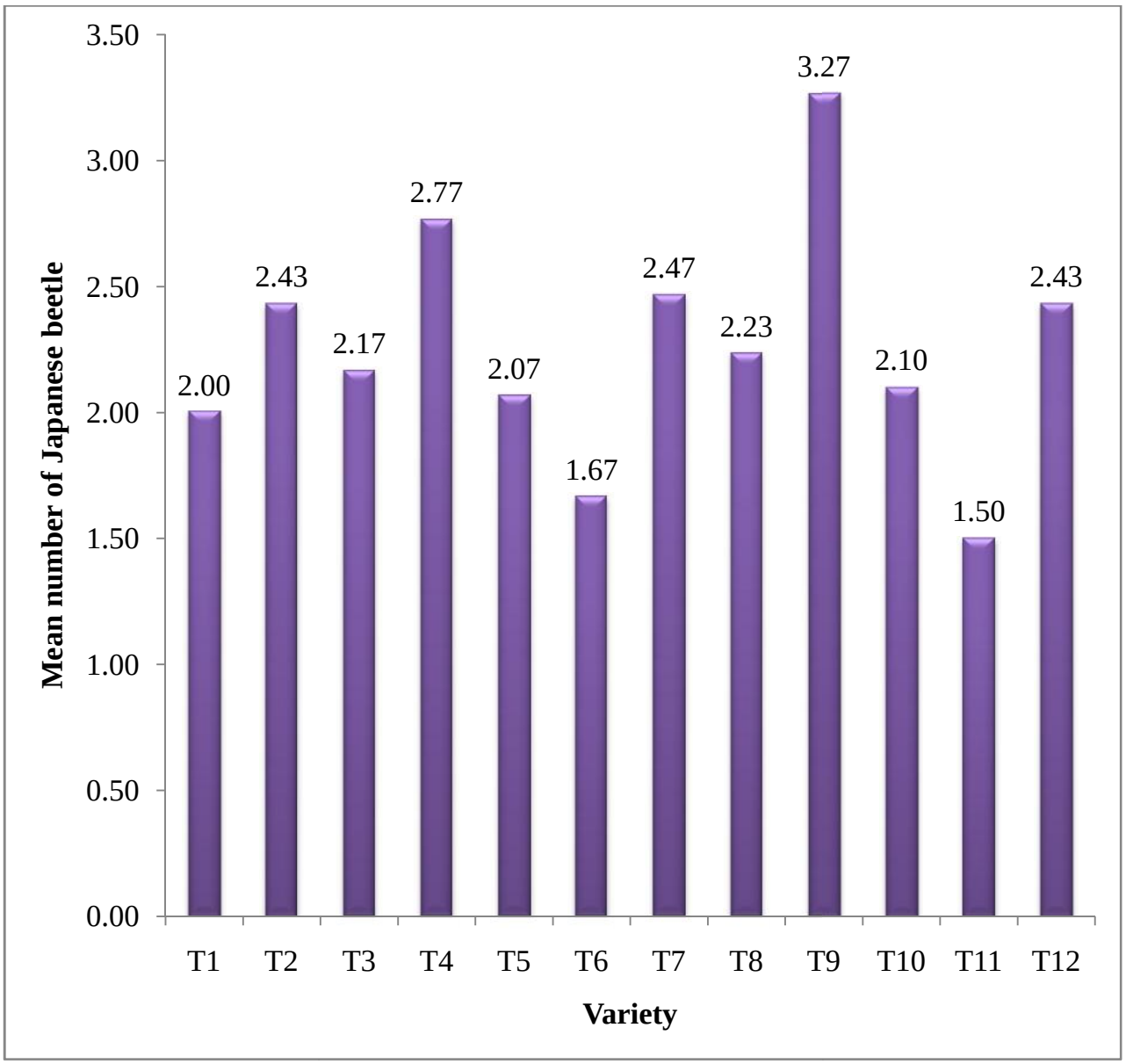

Fig.4, Number of Japanese per plant on different varieties of roses.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love, T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon, T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni.

4.5 Number of infestedleaves per plant

Significant variation loss observed among the values in respect of number of infestedleaves plant^{-1} at different days. Among the treatments, the maximum number of infestedleaves (4.00, 3.67, 3.00, 3.00, 3.00, 2.33, 2.33, 2.33, 2.00 and 1.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) was found from the variety of Sweet Doll. The lowest number of infested leaves was obtained fromvariety ofSweet Love (0.13, 0.27, 0.21, 0.24, 0.17, 0.26, 0.26, 0.18, 0.28 and 0.00at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively)(Table. 5).

Minimum mean number (0.20) of infested leave was found in Sweet Love while the maximum number of infested leave was in Sweet Doll (2.67) variety of rose (Fig.5).

4.6Number of infested branch per plant

A significant variation was also observed on thenumber of infested branch per plant among the different varieties of rose. The minimum number of infested branch per plant (2.00, 1.67, 2.00, 1.67, 1.67, 1.33, 1.33, 1.00, 0.33 and 0.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) was found on variety of Sweet Love where the pest was more effective in case of highest tolerant was obtained by Sweet love. However, Sweet doll showed the maximumnumber of infested branch (4.00, 4.00, 3.67, 3.00, 300, 3.00, 2.67, 2.00, 1.67 and 1.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) was recorded (Table.6). Minimum mean number (1.30) of infested branch was found in Sweet Love while the maximum number of infested branch was observed in Sweet Doll (2.80) variety of rose (Fig.5)

Table 5.The ofinfested leaves per plant on different varieties of roses at different days after pruning.

Number of Infested leaves per plant										
Treatments	**7 days**	**14 days**	**21 days**	**28 days**	**35 days**	**42 days**	**49 days**	**56 days**	**63 days**	**70 days**
T_1	3.08b	3.0ab	2.67ab	2.67ab	2.00c	2.33a	2.00ab	2.00ab	0.33d	0.67ab
T_2	3.17b	3.0ab	3.00 a	2.33ab	2.33bc	2.00a	2.33a	2.00ab	1.67ab	1.00a
T_3	3.0 b	2.6 b	2.00 b	2.00b	2.00c	2.33a	2.00ab	1.00cde	1.67ab	0.67ab
T_4	2.6bc	3.67a	2.67ab	2.33ab	2.00c	2.33a	2.00ab	1.00de	1.00bcd	0.33ab
T_5	2.00c	2.3 b	2.67ab	2.00b	2.00c	2.33a	1.33b	2.00ab	1.00bcd	0.33ab
T_6	3.00b	2.67b	3.00 a	2.00b	2.33bc	2.00a	1.67ab	1.33cd	1.33abc	0.33ab
T_7	2.67bc	2.67b	3.00 a	2.00b	2.00c	2.00a	2.00ab	2.00ab	0.33d	0.67ab
T_8	2.67bc	3.00ab	2.00 b	3.00a	2.67ab	2.00a	1.67ab	1.00de	1.67ab	0.33ab
T_9	4.00a	3.6 a	3.00 a	3.00a	3.00a	2.33a	2.33a	2.33a	2.00a	1.00a
T_{10}	3.33ab	2.67b	2.00 b	2.33ab	2.00c	1.00b	1.67ab	0.67ef	0.67cd	0.28ab
T_{11}	0.13d	0.27c	0.21 c	0.24c	0.17d	0.26b	0.26c	0.18f	0.28d	0.00b
T_{12}	2.67bc	3.08ab	2.75	2.33ab	2.25bc	2.25a	2.00ab	1.58bc	1.08abcd	0.42ab
$LSD_{(0.05)}$	0.77	0.78	0.62	0.72	0.50	0.77	0.76	0.53	0.82	0.83
CV (%)	7.85	9.54	5.67	8.98	12.58	14.28	10.2	5.69	7.89	23.69

Means having similar letter(s) are statistically identical at 5% level of significance. Values are the mean ofthree replications.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love,

T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon,

T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni.

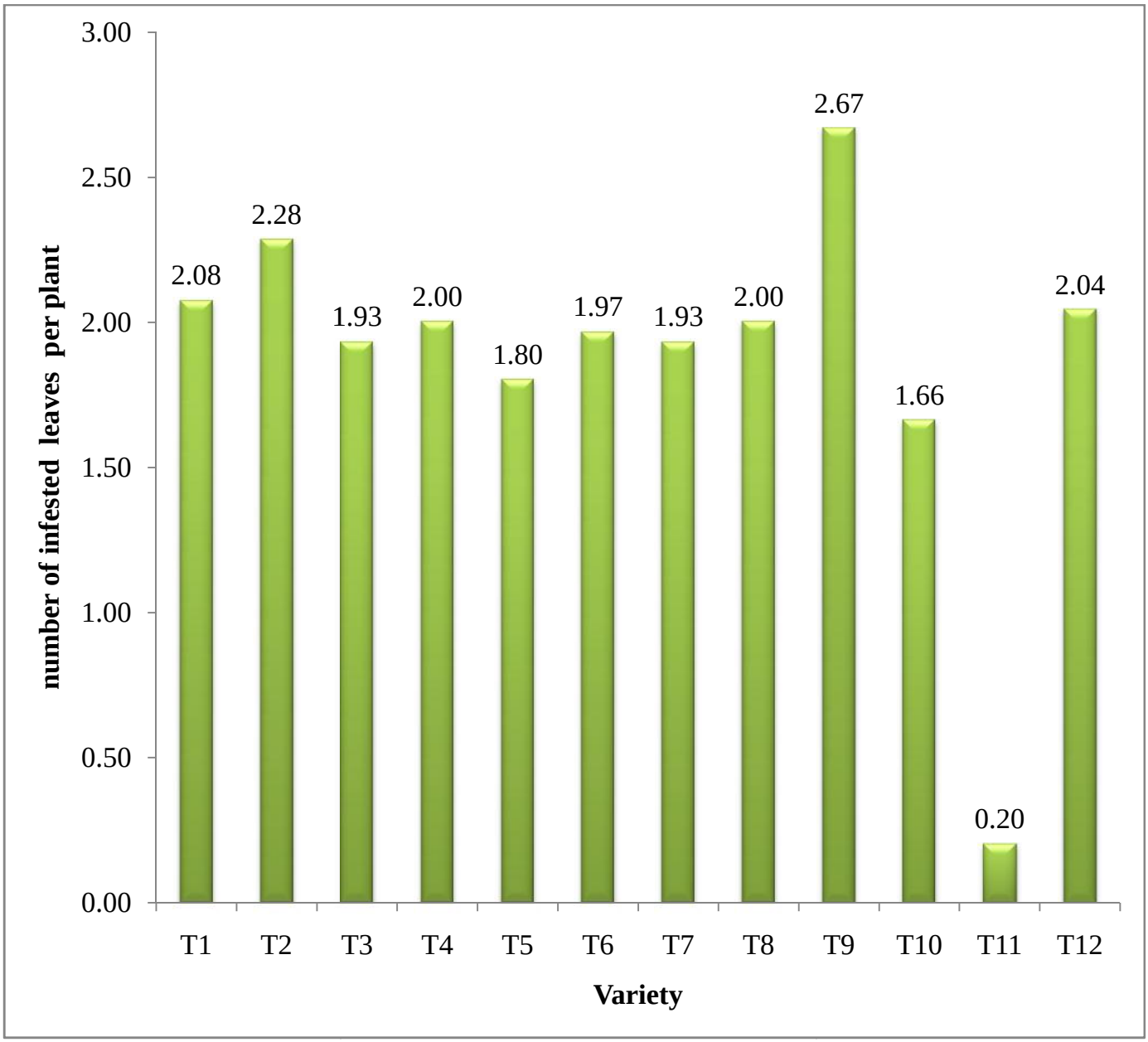

Fig.5.Infested leaves per plant on different varieties of roses.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love, T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon, T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni

Table 6.The number of infested branches per plant on different varieties of roses at different days after pruning.

Number of Infested branch per plant										
Treatments	**7 days**	**14 days**	**21 days**	**28 days**	**35 days**	**42 days**	**49 days**	**56 days**	**63 days**	**70 days**
T1	3.33abc	4.00a	3.00b	2.33abc	2.00bc	1.67cd	1.33c	1.67ab	1.33ab	0.33ab
T2	3.67ab	3.00bcd	2.67c	2.67ab	1.67c	2.33abc	2.00abc	1.33ab	1.00abc	1.00a
T3	3.00bcd	2.00ef	2.00e	2.00bc	2.00bc	3.00a	2.00abc	2.00a	1.33ab	1.00a
T4	3.00bcd	2.67cde	2.00e	2.67ab	1.67c	2.67ab	2.33ab	1.33ab	1.33ab	0.33ab
T5	2.33de	3.67ab	2.67c	3.00a	2.67ab	2.00bcd	2.33ab	1.67ab	1.67a	0.67ab
T6	4.00a	2.67cde	2.00e	2.33abc	2.00bc	2.33abc	1.67bc	1.33ab	1.00abc	0.00b
T7	2.67cde	2.33def	2.33d	2.00bc	2.33abc	2.00bcd	2.00abc	1.67ab	1.33ab	0.33ab
T8	2.67cde	2.00ef	3.00b	2.67ab	2.67ab	2.00bcd	2.00abc	2.00a	0.67bc	0.33ab
T9	4.00a	4.00a	3.67a	3.00a	3.00a	3.00a	2.67a	2.00a	1.67a	1.00a
T10	3.00bcd	3.67ab	2.67c	2.33abc	2.00bc	1.67cd	2.00abc	2.00a	0.67bc	0.67ab
T11	2.00e	1.67f	2.00e	1.67c	1.67c	1.33d	1.33c	1.00b	0.33c	0.00b
T12	4.00a	3.33abc	2.67c	2.00bc	2.67ab	2.00bcd	2.33ab	2.00a	0.67bc	0.00b
LSD(0.05)	0.83	0.68	0.22	0.72	0.716	0.83	0.74	0.56	0.85	0.73
CV (%)	7.98	5.36	12.85	23.8	7.25	6.98	11.29	12.36	9.68	5.38

Means having similar letter(s) are statistically identical at 5% level of significance. Values are the mean of three replications.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love,

T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon ,

T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni..

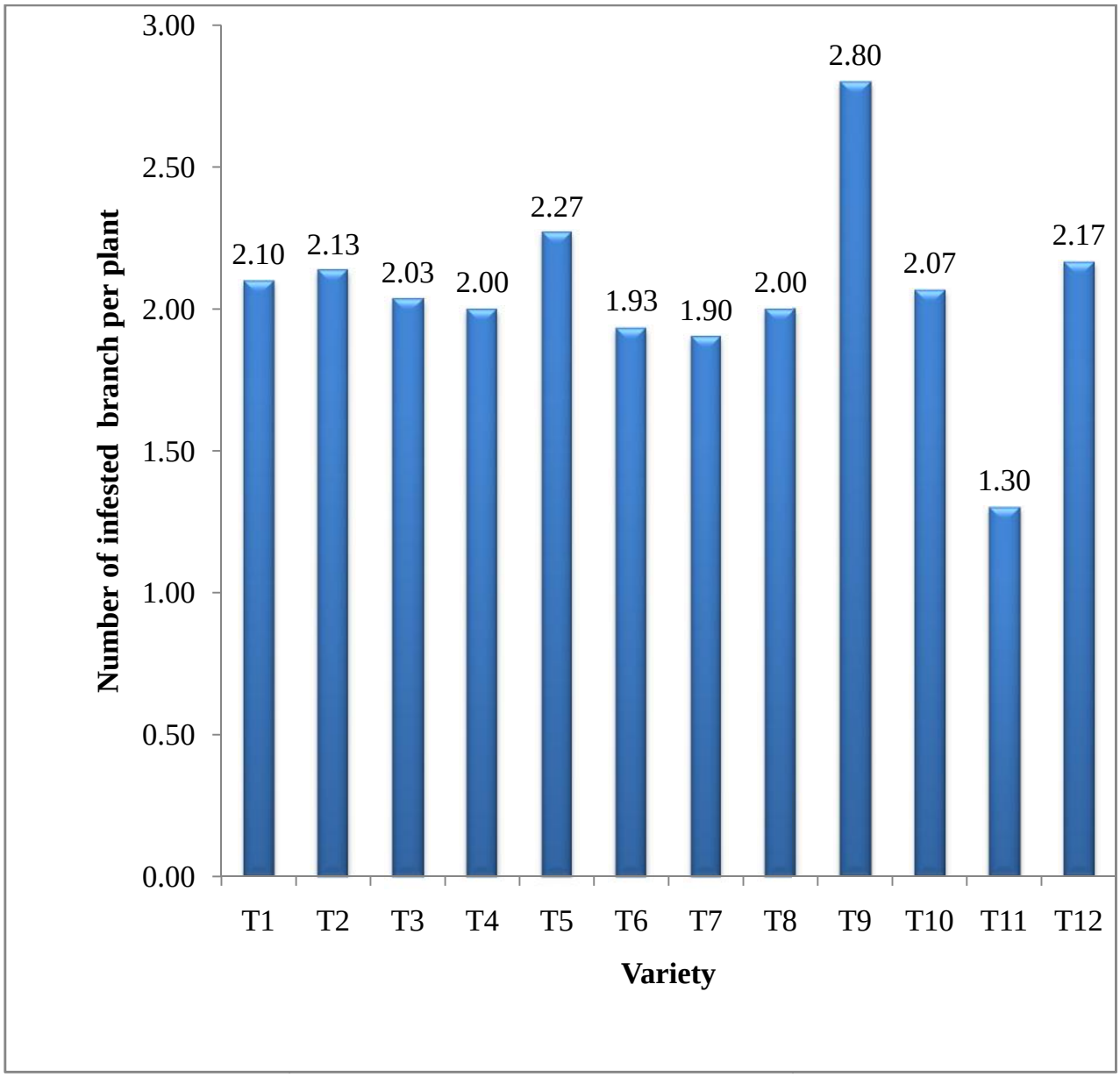

Fig.6.Infested branches per plant on different varieties of roses.

T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love, T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon, T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni.

4.7Number of infestedflower per plant

A significant variation was observed on the number of infestedflower per plant among different varieties of rose. The minimum number of infestedflower per plant (1.67, 1.33, 1.00, 1.33, 1.33, 1.67, 1.00, 1.00, 0.67 and 0.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) was found on the variety of Sweet Love which may be graded as tolerant variety. However, Sweet doll showed the maximum number of infested flower per plant (3.67, 3.33, 3.00, 3.00, 32.67, 2.33, 2.67, 2.33, 1.33 and 1.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) (Table 7). Minimum mean number (1.10) of infested flower was found in Sweet Love the maximum number of infested flower was observed in Sweet Doll (2.53) variety of rose (Fig.7).

Table.7. The number of infested flowers per plant on different varieties of roses at different days after pruning.

Number of Infested flower per plant										
Treatments	**7 days**	**14 days**	**21 days**	**28 days**	**35 days**	**42 days**	**49 days**	**56 days**	**63 days**	**70 days**
T_1	3.00abc	3.00ab	2.67ab	2.67ab	2.33a	2.67a	1.33cd	2.00ab	0.67a	0.33ab
T_2	2.00de	2.33bc	2.67ab	1.67cd	2.00ab	2.33a	2.00abc	1.00d	0.67a	0.00b
T_3	2.67bcd	2.67abc	2.33ab	2.00bcd	2.67a	2.00a	2.00abc	2.00ab	1.00a	0.33ab
T_4	3.00abc	3.00ab	2.67ab	2.67ab	1.33b	2.33a	1.33cd	1.33cd	1.00a	0.33ab
T_5	2.33cde	2.67abc	2.33ab	2.33abc	2.00ab	2.00a	2.00abc	2.00ab	1.00a	0.33ab
T_6	3.33ab	2.67abc	2.33ab	2.33abc	2.33a	2.33a	1.33cd	1.67bc	1.00a	0.67ab
T_7	2.33cde	2.33bc	2.00b	2.00bcd	2.33a	2.67a	2.33ab	1.33cd	1.00a	0.00b
T_8	3.00abc	3.00ab	2.33ab	2.00bcd	2.00ab	2.00a	2.00abc	2.00ab	1.00a	0.33ab
T_9	3.67a	3.33a	3.00a	3.00a	2.67a	2.33a	2.67a	2.33a	1.33a	1.00a
T_{10}	2.00de	2.67abc	3.00a	2.33abc	2.00ab	2.67a	1.67bcd	2.00ab	1.00a	0.67ab
T_{11}	1.67e	1.33d	1.00c	1.33d	1.33b	1.67a	1.00d	1.00d	0.67a	0.00b
T_{12}	1.67e	2.00cd	1.00c	2.00bcd	2.67a	2.00a	2.00abc	1.00d	0.67a	1.00a
$LSD_{(0.05)}$	0.78	0.78	0.78	0.76	0.86	0.88	0.68	0.56	0.87	0.77
CV(%)	7.85	6.97	5.23	23.58	6.79	7.85	5.23	7.8	7.89	12.35

Means having similar letter(s) are statistically identical at 5% level of significance. Values are the mean of three replications.
T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love,
T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon,
T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni.

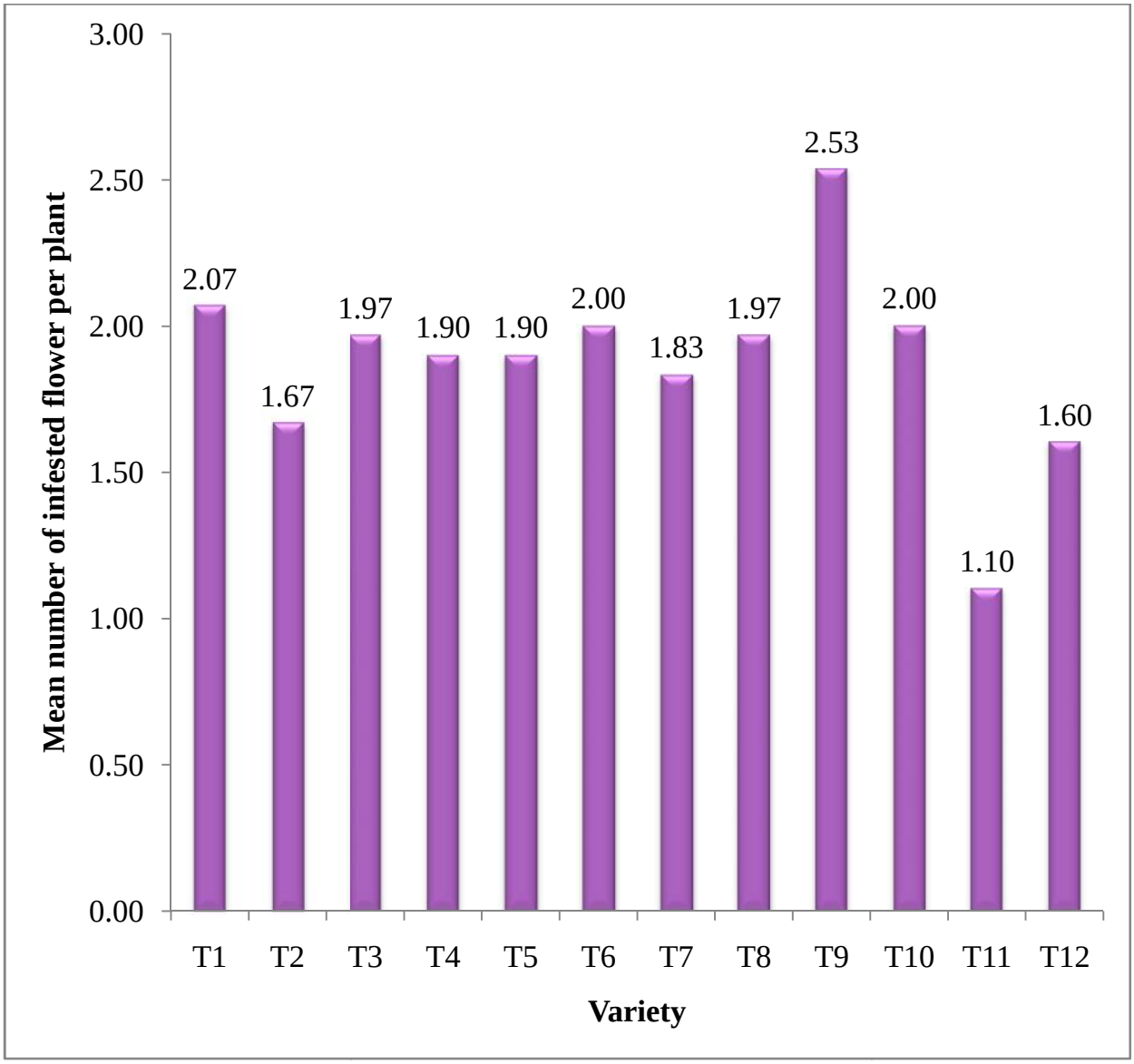

Fig.7.Number of infested flowers per plant on different varieties of roses.
T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love, T_5=Compassion, T_6= Charming lady, T_7= Dream bangle, T_8=Sleepy moon, T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni.

CHAPTER V

SUMMARY AND CONCLUSION

The experiment was conducted at the farm of Sher-e-Bangla Agricultural University, Dhaka during the period from April to December 2011 to study the incidence of the insect pests on different varieties of roses. Each variety was considered as individual treatment. There are twelve varieties of roses, viz. T_1=Wild rose, T_2=Crazy love bi-color, T_3=Yellow star, T_4=Missing love, T_5= Compassion, T_6=Charming lady, T_7=Dream bangle, T_8=Sleepy moon, T_9=Sweet doll, T_{10}=Moon light, T_{11}=Sweet love, T_{12}=Mini moni. A single factor experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Incidence of pest viz. aphid, mite, whitefly and Japanese beetle showed significant variation on different varieties of roses. Among the varieties, Sweet Love was graded as tolerant to pests and had the minimum number of aphid (0.67, 1.00, 1.33, 2.67, 1.67, 2.00, 2.00, 2.00, 2.00, 2.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively), mite (0.33, 0.67, 0.33, 0.33, 1.00, 1.33, 1.67, 1.67, 1.67 and1.67 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively), whitefly (0.33, 0.33, 1.00, 1.33, 1.00, 2.00, 2.00, 2.00, 2.00, 2.33 and 3.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) and number of Japanese beetle (0.33, 1.00, 1.00, 1.00, 2.00, 2.33, 2.00, 1.67, 2.00, 1.67 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days) at vegetative and flowering stages. Similarly, maximum number of aphid (2.0, 2.67, 3.00, 4.33, 5.00, 5.33, 4.33, 5.67, 5.67, 5.33 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively), mite (2.0, 1.67, 2.33, 2.33, 3.33, 2.00, 3.33, 3.00, 2.33 and 2.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively), whitefly (2.00, 3.33, 3.00, 3.67, 3.33, 3.67, 4.00, 4.33, 4.67 and 4.33 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) and Japanese beetle (1.67, 1.67, 2.33, 3.00, 3.00, 3.67, 3.33, 4.33, 4.67 and 5.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) was recorded from Sweet doll, respectively.

Varieties of rose significantly influenced the growth characteristics of rose whereas minimum number of infested leaves plant^{-1} (0.13, 0.27, 0.21, 0.24, 0.17, 0.26, 0.26, 0.18, 0.28 and 0.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively), minimum number of infested branch per plant (.00, 1.67, 2.00, 1.67, 1.67, 1.33, 1.33, 1.00, 0.33 and 0.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) and minimum number of infested flower (1.67, 1.33, 1.00, 1.33, 1.33, 1.67, 1.00, 1.00, 0.67 and 0.00 at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days, respectively) per plant were found on Sweet Love variety rose of .

CONCLUSION

From the results of the present study, it can be concluded that sweet love variety of rose had the lowest number of infested leaves per plant, infested branch per plant and lowest number of infested flower per plant due to lower incidence of insect pests among all varieties of rose.

The variety sweet love might be graded as tolerant to pests. The variety sweet doll showed the lowest performance regarding the incidence of insect pests, the number of infested leaves, branches and flowers per plant of rose. The variety sweet doll might be graded as susceptible to insect pests.

The following recommendation may be suggested from the present study:

1. The sweet love showed the highest performance regarding the incidence of insect pest among all varieties of roses.
2. Further study may be done to confirm the findings of the present study.
3. Multi-locational trial should be needed to explore tolerant and susceptible varieties of rose for commercial cultivation.

APPENDICES

Appendix I: Monthly record of air temperature, rainfall and relative humidity of the experimental site during the period from April 2011 to December 2011

Date/Week	Temperature		Relative humidity (%)	Rainfall (mm) (Total)
	Maximum	Minimum		
April	33.5	23.2	64	123
May	33.4	24.6	76	235
June	32.6	26.3	80	314
July	32.3	26.7	79	356
August	31.1	26.5	82	409
September	32.4	26.4	77	207
October	32.7	24.7	73	112
November	29.7	19.2	67	0
December	26.8	17.5	61	0

Source: Bangladesh Meteorological Department (Climate and Weather Division), Agargoan, Dhaka- 1207

Appendix II. Physiological properties of the initial soil

Characteristics	Value	Critical value
Partical size analysis		
% sand	26	-
% silt	45	-
% clay	29	-
Textural class	Silty clay	-
pH	5.6	Acidic
Organic carbon (%)	0.45	-
Organic matter (%)	0.78	-
Total N (%)	0.03	0.12
Available P (ppm)	20.00	27.12
Exchangeable K (me 100^{-1} g soil)	0.10	0.12
Available S (ppm)	45	-