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RS Pawar
M.Sc. (Agri.) Student, Department of Agricultural Entomology, College of Agriculture, Dapoli Tal. Dapoli District Ratnagiri, Maharashtra, India

RS Mule
Assistant Professor, Department of Agricultural Entomology, College of Agriculture, Dapoli Tal. Dapoli District Ratnagiri, Maharashtra, India

VN Jalgaonkar
Deputy Director of Research, Directorate of Research, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

PB Sanap
Professor of Horticulture, College of Post-Harvest Management, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Killa-Roha, Tal. Roha, District Raigad, Maharashtra, India

MS Karmarkar
Professor (CAS), Department of Agricultural Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

SS Gurav
Professor (CAS), Department of Agricultural Entomology, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Mulde, Tal. Kudal, District Sindhudurg, Maharashtra, India

SP Patankar
M.Sc. (Agri.) Student, Department of Agricultural Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, District Ratnagiri, Maharashtra, India

DR Gimhavanekar
M.Sc. (Agri.) Student, Department of Agricultural Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, District Ratnagiri, Maharashtra, India

Corresponding Author:
RS Pawar
M.Sc. (Agri.) Student, Department of Agricultural Entomology, College of Agriculture, Dapoli Tal. Dapoli District Ratnagiri, Maharashtra, India

Record of pests infesting snake gourd, *Tricosanthes cucumerina* L. and their seasonal incidence

RS Pawar, RS Mule, VN Jalgaonkar, PB Sanap, MS Karmarkar, SS Gurav, SP Patankar and DR Gimhavanekar

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Abstract
The results of field experiment indicated that a total of nine different pests were recorded feeding and damaging the snake gourd crop during *Kharif* 2024-25. They include snake gourd semilooper, *Anadevidia peponis* (Fabricius), pumpkin caterpillar, *Diaphania indica* (Saunders), leaf miner, *Liriomyza sativae* (Blanchard), pumpkin beetles, *Aulacophora foveicollis* (Lucas), *Aulacophora intermedia* (Jacoby), melon fruit fly, *Bactrocera cucurbitae* (Coquillett), Aphid, *Aphis gossypii* (Glover), *Myzus persicae* (Sulzer), white fly, *Bemisia tabaci* (Gennadius), brown stink bug, *Coridius brunneus* (Thunberg) and leaf footed bug, *Leptoglossus phyllopus* (Linneaus).
Aphid population showed a significant positive correlation with RH-I (r = 0.507*), non-significant positive correlation with T_{min} (r = 0.166), RH-II (r = 0.166) and BSS (r = 0.086) and non-significant negative correlation with T_{max} (r = -0.080), wind speed (r = -0.208) and rainfall (r = -0.028). White fly showed non-significant positive correlation with T_{max},T_{min}, RH-I, RH-II and BSS (r = 0.054, 0.197, 0.245, 0.083 and 0.185), whereas, snake gourd semilooper, pumpkin caterpillar and melon fruit fly exhibited non-significant positive correlation with T_{max},T_{min}, RH-I and BSS (r = 0.245, 0.077, 0.136 and 0.306; r = 0.187, 0.175, 0.152 and 0.221; r = 0.198, 0.138, 0.261 and 0.295). Leaf miner showed a highly significant positive correlation with T_{max} (r = 0.804**) and bright sunshine hours (r = 0.711**), whereas, highly significant negative correlation was observed with RH-II (r = -0.718**) and wind speed (r = -0.664**). Pumpkin beetle exhibited a highly significant positive correlation with RH-II (r = 0.652**) and wind speed (r = 0.629**) and a significant positive correlation with T_{min} (r = 0.584*).

Keywords: Record of pests, *T. cucumerina*, seasonal incidence

Introduction
Snake gourd (*Trichosanthes cucumerina* var. *anguina*) also known as serpent gourd is an annual, rapid growing vine of the Cucurbitaceae family, grown for its edible fruits. This subtropical plant is a native of South East Asia and Australia, mostly popular in India and widely cultivated in Sri Lanka, China, Thailand, Nigeria and Australia. It is widely cultivated in kitchen garden. The snake gourd is grown throughout the year in some parts of Thane, Raigad, Ratnagiri and Sindhudurg districts of Konkan region. It is extensively cultivated during *Kharif* as well as in *Rabi* season in Palghar tahasil of Palghar district and Pen and Alibag tahasils of Raigad district (Patil, 1988) [23]. Besides meager adoption of high yielding varieties and improved package of practices, the losses due to insect pests are also responsible for low yields in snake gourd. A total of 17 species of insect-pests belonging to four economically important orders *viz.*, Lepidoptera, Coleoptera, Hemiptera and Diptera were recorded feeding and damaging the snake gourd crop (Sharath, 2019) [36]. Out of these, a few pests like semilooper, *A. peponis*, pumpkin beetle, *Aulocophora* spp., fruit fly, *B. cucurbitae*, stink bug, *Coridius brunneus*, epilachna beetle, *Epilachna* spp, aphid, *Aphis gossypii* and pumpkin caterpillar, *D. indica* etc. usually damage the snake gourd in the Konkan region (Patil, 1988) [23]. Singh (1966) [40] and Shivarkar and Dumbre (1985) [39] stated that more than fifty per cent of fruits of cucurbits were either partially or fully damaged by fruit fly. Nair (1999) [19] also noticed that defoliators and aphids are serious problems in snake gourd. Due to cultivation of snake gourd throughout the year, a number of pests attack this crop in addition to the above mentioned insect pests and cause severe damage every year. For better understanding of the population behaviour, proper timing for adopting

control strategy, consideration of biotic and abiotic factors is very much important. Seasonal abundance of the pest provides not only the information of the initiation of the pest but also provides the peak activity of the particular pest. Natural enemies also contribute in reducing the pest population to some extent. Weather parameters *viz.*, temperature, relative humidity, rainfall, bright sunshine hours, wind speed, evaporation etc. play a pivoted role in population build-up of insect pests (Ghongade *et al.*, 2021) [9]. Correlation study helps in to provide positive or negative association of pest population with weather parameters. It also shows direct influence of particular parameter on pest population build-up as well as its indirect effect through other parameters.

Material and Methods

A field experiment was conducted at Vegetable Improvement Scheme (VIS), Central Experiment Station, Wakawali Tal. Dapoli Dist. Ratnagiri 415712 during *Kharif* season of 2024-25, to record the pests infesting snake gourd, study their seasonal incidence and correlation with weather parameters. A separate plot of 110 m^2 (11m x 10m) was kept free from insecticides throughout the crop season for recording the observations on the pests of snake gourd and their seasonal incidence. Twenty-five plants from entire plot and 10 leaves from each plant were selected randomly and tagged to record the observations on the incidence of different pests. The observations were recorded at weekly interval till the harvest of the crop by following standard methodology as per given below.

The observations on sucking pests *viz.*, aphid and white fly were recorded on 10 leaves per plant from randomly selected twenty-five plants at weekly interval. The observations on leaf eating caterpillars *viz.*, snake gourd semilooper and pumpkin caterpillar were recorded on total number of larvae from 10 leaves per plant from randomly selected twenty-five plants at weekly interval. The observations on number of pumpkin beetles were recorded from 10 leaves per plant from randomly selected twenty-five plants at weekly interval. The observations on leaf miner were recorded by counting number of mined leaves from 10 leaves per plant under observation from randomly selected twenty-five plants at weekly interval. The data thus obtained were averaged out and presented. For incidence of fruit fly, the observations on number of healthy and infested fruits were recorded from randomly selected 10 plants from experimental plot at weekly interval. Then the data was analyzed and presented.

The prevailing weather data was collected from Meteorological Observatory, Central Experiment Station, Wakawali Tal. Dapoli Dist. Ratnagiri 415 712. The correlation studies between pest wise incidence recorded and prevailing abiotic factors *viz.*, maximum temperature, minimum temperature, relative humidity (morning), relative humidity (afternoon), rainfall, bright sunshine hours and wind speed were carried out and impact of these factors on occurrence and per cent infestation by different pests was worked out by calculating the simple correlation (r) following standard procedure.

Results and Discussion

1. Record of pests

A total of nine different pests from orders *viz.*, Lepidoptera, Coleoptera, Hemiptera and Diptera were recorded feeding on and damaging the snake gourd, *T. cucumerina* crop during *Kharif* season of 2024-25. They include snake gourd semilooper, *Anadevidia peponis* (Fabricius), pumpkin caterpillar, *Diaphania indica* (Saunders), leaf miner, *Liriomyza sativae* (Blanchard), pumpkin beetles, *Aulacophora foveicollis* (Lucas), *Aulacophora intermedia* (Jacoby), melon fruit fly, *Bactrocera cucurbitae* (Coquillett), Aphid, *Aphis gossypii* (Glover), *Myzus persicae* (Sulzer), white fly, *Bemisia tabaci* (Gennadius), brown stink bug, *Coridius brunneus* (Thunberg) and leaf footed bug, *Leptoglossus phyllopus* (Linneaus) (Table 1).

The larvae of snake gourd semilooper, *A. peponis* were greenish in colour with white longitudinal lines and black tubercles with thin hairs arising on them and humped last abdominal segment. During the crop growth, the caterpillar was found to feed on leaf lamina, cut the leaf veins near the base of the leaf, fold it over the leaf and feed within the leaf roll. The larvae defoliated the plants when the infestation was severe.

The larvae of pumpkin caterpillar, *D. indica* were elongated, bright greenish in colour with a pair of mid dorsal lines. They feed on flowers and leaves causing considerable defoliation if infestation was severe.

The larvae of leaf miner, *L. sativae* were found initially colourless and later become yellowish in colour, causing damage by mining the leaf tissue and make zigzag tunnels or mines on leaves. These mines became enlarged as the larvae grow in size, they got coalesced as a result the leaves get dry up.

Adult of pumpkin beetle, *A. foveicollis* was red coloured dorsally and black ventrally whereas, the adult of *A. intermedia* was black dorsally. The adult beetles were found damaging snake gourd plant above ground attacking on the flowers, leaves and fruits. They were found feeding voraciously on leaf lamina between the veins making irregular holes preferring younger seedlings and tender leaves.

The adult of melon fruit fly, *B. cucurbitae* was observed reddish brown with lemon yellow markings on the thorax and have fuscous areas on the outer margins of their wings. The maggots were legless thicker at one end and tapering to a point at the other. When the infested fruit was cut, the maggots were found feeding inside on the pulp of fruit. As a result of maggot infestation, the fruits started rotting, got distorted and malformed in shape and fall down prematurely.

Two species of aphid *viz., A. gossypii* and *M. persicae* were recorded infesting the snake gourd crop. The nymphs of *A. gossypii* were yellowish to greenish brown in colour found on the undersurface of leaves whereas, adults were greenish brown, soft bodied insects. The nymphs of *M. persicae* were light green in colour, but soon turned to yellowish. The adults have black head and thorax and a yellowish green abdomen with a large dark dorsal patch. Nymphs and adults of both the species were observed feeding on leaves and tender shoots by sucking the cell sap. Excessive feeding causes leaf curling, crinkling and stunted growth. They were seen excreting large amount of sticky substance called honeydew, which attracted ants and promoted the growth of sooty mould fungus interfering in the photosynthesis activity of the plant.

Table 1: Pests recorded on snake gourd, *T. cucumerina* during *Kharif* 2024

Common name	Scientific name	Order	Family
Snake gourd semilooper	*Anadevidia peponis* (Fabricius)	Lepidoptera	Noctuidae
Pumpkin caterpillar	*Diaphania indica* (Saunders)	Lepidoptera	Crambidae
Leaf miner	*Liriomyza sativae* (Blanchard)	Diptera	Agromyzidae
Pumpkin beetle	*Aulacophora foveicollis* (Lucas) *Aulacophora intermedia* (Jacoby)	Coleoptera	Chrysomelidae
Melon fruit fly	*Bactrocera cucurbitae* (Coquillett)	Diptera	Tephritidae
Aphid	*Aphis gossypii* (Glover) *Myzus persicae* (Sulzer)	Hemiptera	Aphididae
White fly	*Bemisia tabaci* (Gennadius)	Hemiptera	Aleyrodidae
Brown stink bug	*Coridius brunneus* (Thunberg)	Hemiptera	Dinidoridae
Leaf footed bug	*Leptoglossus phyllopus* (Linnaeus)	Hemiptera	Coreidae

The nymphs of white fly, *Bemisia tabaci* were noticed greenish in colour and flat in body structure whereas, the adults were having yellow bodies and white wings. Nymphs and adults were found infesting undersurface of leaves and sucking the cell sap. The infestation lead to development of chlorotic spots on the leaves, which coalesce into yellowing, stunted growth, premature defoliation and the development of sooty mould fungus which inhibited photosynthesis. They also act as a vector of yellow vein mosaic virus in snake gourd.

The adults of brown stink bug, *C. brunneus* were observed brown in colour whereas, the adults of leaf footed bug, *L. phyllopus* were large and having brown or black colour with a distinctive leaf-like expansion on their hind legs. Both the species were recorded as minor pests of snake gourd and were found feeding by sucking the cell sap from different parts of the snake gourd plant (stem, leaves and fruits). Infestations lead to reduced plant vigour, stunted growth and affecting the overall health of the snake gourd plant.

2. Seasonal incidence of major pests infesting snake gourd, *T. cucumerina*

2.1 Sucking pests

The aphid, *A. gossypii*, *M. persicae* population started building up from the 12th WAS corresponding to 35th SMW with an initial population of 5.84 nymphs and adults per plant. The aphids multiplied rapidly and reached a maximum population density of 21.92 nymphs and adults per plant in the 17th WAS (40th SMW) (Table 2). This exponential growth during mid-season can be attributed to favourable humidity and plant succulence. Being sap feeders, their numbers declined as the plants aged and leaves became less tender and suitable for feeding.

Whiteflies, *B. tabaci* were recorded slightly earlier than aphids, beginning during the 11th WAS corresponding to 34th SMW with a marginal count of 0.16 nymphs and adults per per plant (Table 2). The pest population showed a consistent upward trend, culminating in a peak of 11.30 individuals (nymphs and adults) per plant during the 17th WAS (40th SMW). The increase in whitefly population coincided with warm and moderately humid conditions. As whiteflies are phloem feeders and also vector of viruses, their gradual decline after the 17th WAS may be due to reduced plant sap flow, senescence or potential antagonism with other insect populations.

2.2 Foliage feeders

The snake gourd semilooper, *A. peponis* appeared in the crop ecosystem during the 13th week after sowing (WAS) which corresponded with the 36th standard meteorological week (SMW). The initial population recorded was 0.40 larvae per plant, indicating the onset of infestation. The pest population increased steadily, and a significant surge was noticed during the 15th WAS (38th SMW), when the larval count peaked at 4.40 larvae per plant, marking the first infestation peak (Table 2). Subsequently, the larval population slightly dipped but rose again to 4.12 larvae per plant during the 17th WAS (40th SMW), suggesting a second infestation peak. These peaks were likely synchronized with the availability of tender foliage during the vegetative to early fruiting stages. Following the 17th WAS, a gradual decline in population was recorded, indicating a natural reduction in pest activity, possibly due to increased plant age and reduced host suitability.

The pumpkin caterpillar, *D. indica* another defoliator pest, was observed earlier than the semilooper. Its initial appearance was recorded in the 12th WAS (35th SMW) with a larval population of 0.72 larvae per plant. The population increased gradually and steadily over the following weeks (Table 2). By the 18th WAS (41st SMW), the infestation reached its maximum intensity with 5.64 larvae per plant, the highest recorded during the entire observation period. This suggests that the caterpillar prefers the mid-to-late vegetative and early reproductive stages for feeding and development. The trend thereafter showed a noticeable decline in population, aligning with the crop's progression to maturity and possible exhaustion of tender foliage.

The leaf miner, *L. sativae* a minor pest during early stages, made its first appearance in the 12th WAS (35th SMW) with a low infestation of 0.20 infested leaves per plant. This was followed by a steady increase in the number of infested leaves over time. The infestation reached its highest point in the 21st WAS (44th SMW) with 2.12 infested leaves per plant (Table 2), suggesting that the pest became more prominent during the late fruiting and senescence stages of the crop. The presence of older leaves and reduced plant vigour during this phase may have facilitated leaf miner development and survival. Thereafter the infestation declined gradually towards maturity of the crop.

The pumpkin beetles, *A. foveicollis*, *A. intermedia* were among the earliest pest recorded infesting the snake gourd crop. Their infestation began as early as the 8th WAS (31st SMW) with an average of 3.56 adult beetles per plant. The beetle population continued to rise, peaking in the 11th WAS (34th SMW) with 6.48 adults per plant, the highest incidence recorded for the pest during the cropping period (Table 2). These beetles are known to prefer young plants and seedlings for feeding, which explains their early and intense activity. After the 11th WAS, the beetle population exhibited a consistent decline, likely due to the hardening of plant tissues, lower nutritional quality and increasing resistance of mature vines.

2.3 Fruit feeders

The melon fruit fly, *B. cucurbitae* infestation was not observed during the initial vegetative phase but became evident with the onset of fruiting. The pest first appeared

during the 14th WAS (37th SMW) with 27.03 per cent infested fruits per plant. The infestation increased rapidly and reached its peak level of 41.66 per cent infested fruits per plant during the 16th WAS (39th SMW), indicating its preference for immature and soft-skinned fruits (Table 2). The sharp rise in fruit infestation during this period suggests favourable environmental conditions for oviposition and maggot development. The infestation began declining post peak, with 25.00 per cent and 22.86 per cent infestation observed in 19th and 20th WAS (42nd and 43rd SMW) respectively, continuing to reduce until fruit maturity.

The present results on record of pests infesting snake gourd, *T. cucumerina* and their seasonal incidence are in close agreement with Narayanan and Batra (1960) [20] who reported that *B. cucurbitae* become active in March, with the peak during July-August causing heavy damage to cucurbits. Singh (1966) [40] estimated the losses caused by fruit flies infesting cucurbits and observed that more than 50 per cent fruits of cucurbits were either partially or fully damaged and made unfit for human consumption. Lal and Lal (1974) [13] reported that the damage to the cucurbit crops was severe due to the attack of *Dacus cucurbitae* and *Raphidopalpa foveicollis*, while *Pseudoplusia peponis* (Fabr.), *A. janus* and *Aphis gossypii* (Glov.) were found to cause moderate damage. Narayanan and Subramanium (1976) recorded that *A. peponis* (Fabr.) infest snake gourd at Coimbatore. Butani and Verma (1977) [7] found that the melon fruit fly, *D. cucurbitae* was the most destructive and more common species as compared with *D. diversus* and *D. zonatus*. Besides this, red pumpkin beetle, *R. foevicollis* was also found severe. Leaf-footed plant bug, *Leptoglossus australis* (F.) was recorded as a pest of snake gourd in Kerala (Visalakshi *et al.*, 1980) [46].

Premchand and Prasad (1981) [27] concluded that the semilooper, *Plusia peponis* F. was considered as a pest of minor significance assumed a status of major pest infesting snakegourd in Bihar. Ram and Pathak (1984) [30] observed the serious infestation of fruit fly, *D. cucurbitae* during the month of July to September on cucurbitaceous crops. However, mild to moderate damage of aphid, *Myzus persicae* (Sulzer), stink bug, *A. janus* (F.) and pumpkin caterpillar, *Palpita (Margaronia) unionalis* (Hb.) and *P. annulata* (F.) were also noticed during July to August. Further, Patil (1988) [23] recorded twelve pests on snake gourd in Konkan region. Out of which six pests *viz.*, semilooper (*A. peponis*), stink bug (*Coridius brrunneus*), pumpkin beetle (*A. calva*), fruit fly (*D. cucurbitae*), aphid (*A. gossypii*) and pumpkin caterpillar (*D. indica*) were found major pests of snake gourd. Peak population per plant of stink bug, semilooper, aphid, pumpkin beetle and pumpkin caterpillar were recorded in August, 1987 in Dapoli block. Similarly, peak population per plant of semilooper, aphid, pumpkin beetle, pumpkin caterpillar and fruit fly were recorded in October, 1987 in Palghar block. Besides, leaf footed plant bug (*Leptoglossus australis*) was recorded as minor pest. Mann (1990) also reported that fruit flies passed through many overlapping generations and overwinters as larva, pupa or adult and infestation was low during April-May, which increased rapidly from July-August on cucurbits and by the end of October, causing heavy fruit infestation.

Inayatullah *et al.* (1991) [11] concluded that the *B. cucurbitae* activity on cucurbitaceous crops started in March, reached to its maximum in August and progressively declined thereafter, becoming negligible during winter. Peter and David (1991) [25] revealed that April-September was the peak period of incidence of *D. indica*, while in November-February its incidence was the lowest. Roy and Pande (1991) [33] observed that the red pumpkin beetle remained active throughout the year and its' maximum (104 adults/30 leaves) and minimum (34 adults/30 leaves) populations were recorded during months of December and August, respectively. Borah (1997) [5] revealed that the population of red pumpkin beetle on cucumber was significantly higher in June and July sown crop as compared to that of April-May sown crop. Borah (1999) [6] recorded highest number of beetles in rainy season crop (June) on all the three varieties with 3.6 to 4.2 beetles/plant and 39.2 to 46.6 per cent plant damage. Sivakumar (2001) [41] reported that the major pests of snake gourd found in farmers' field were *B. cucurbitae*, *A. peponis*, *D. indica*, *Aulacophora spp.*, *A. gossypii* and *L. trifolii*. Johri and Johri (2003) [12] observed greater incidence of red pumpkin beetle, at Kanpur on cucurbitaceous crops during March to September, ranging from 27.70 to 47.49 per cent. Rathod (2006) [31] observed that the higher incidence of red pumpkin beetle, *A. foveicollis* on cucurbitaceous vegetables (bottle gourd, pumpkin, cucumber, ridge gourd and smooth gourd) was noticed during the *kharif* season. Saljoqi and Khan (2007) [34] noticed the relative abundance of pumpkin beetle on different cucurbitaceous vegetables from first week of May up to second week of August.

Neena Lenin (2011) [22] revealed the incidence of pumpkin caterpillar, *D. indica* in bitter gourd, snake gourd and cucumber and the extent of infestation was high in these cucurbitaceous crops. Lekshmi *et al.* (2014) [15] observed higher population of whiteflies in bitter gourd when crop was young and declined later. Halder *et al.* (2017) [10] reported that the population of *D. indica* commenced from 31st SMW and maximum population was recorded during 38th SMW and 39th SMW during September.

Pramanik *et al.* (2021) [26] reported that during the snake gourd fruiting season, the rate of fruit fly infestation varied from 6.93 to 44.09 per cent. Sharath *et al.* (2021) [37] revealed the occurrence of 17 species of insect pests belonging to four economically important orders such as Lepidoptera (three species), Coleoptera (five species), Diptera (two species) and Hemiptera (seven species) which are of both major and minor importance on snake gourd, *T. cucumerina*. Shelke and Kunkalikar (2021) [38] reported the natural incidence of *Diaphania indica* (Saunders) on watermelon in the state of Goa. Manikandan *et al.* (2022) [17] from Tamil Nadu reported that the population of *A. foveicollis* was the highest in pumkin (12.83 adults/plant) and least in snake gourd (0.61 adult/plant) in field conditions. Riyaz and Sivasankaran (2022) [32] documented the first record of *A. peponis* from North-Western Himalayas-Kashmir. The larvae were found feeding on cucurbitaceous species, including *Citrullus lanatus*, *Cucumis sativus*, *Cucurbita moschita*, *C. pepo*, *Cyclanthera pedata*, *Sechium edule* and *Tricosanthes dioica*. Sharada Devi and Venkatesha (2022) [35] found that the abundance of *D. indica* was maximum between June-July as compared to early summer and winter. In contrast, Rahman *et al.* (2023) [28] reported that the larval abundance and leaf infestations by *D. indica* were higher in the summer season than in the winter season. Snake gourd was the most preferred, ridge gourd was moderately preferred and bitter gourd was the least preferred host by *D. indica*.

3. Correlation with weather parameters

3.1 Sucking pests

Aphid, *A. gossypii* and *M. persicae* population showed a significant positive correlation with morning relative humidity (r=0.507*). Non-significant positive correlations were observed with minimum temperature (r=0.166), afternoon relative humidity (r=0.166) and bright sunshine hours (r=0.086). Negative but non-significant correlations were found with maximum temperature (r = -0.080), wind speed (r = -0.208) and rainfall (r = -0.028).

Whitefly, *B. tabaci* incidence was positively correlated with maximum temperature (r = 0.054), minimum temperature (r=0.197), morning relative humidity (r = 0.244), afternoon relative humidity (r=0.083) and bright sunshine hours (r=0.185). Negative correlations were noted with wind speed (r=-0.224) and rainfall (r=-0.111). All the correlations were non-significant (Table 3).

3.2 Foliage feeders

The population of snake gourd semilooper, *A. peponis* exhibited a positive correlation with maximum temperature (r=0.245), minimum temperature (r=0.077), morning relative humidity (r=0.136) and bright sunshine hours (r=0.306). Conversely, it showed a negative correlation with afternoon relative humidity (r=-0.103), wind speed (r=-0.394) and rainfall (r=-0.244). All the correlations were non-significant.

The incidence of pumpkin caterpillar, *D. indica* revealed a non-significant positive correlation with maximum temperature (r=0.187), minimum temperature (r=0.175), morning relative humidity (r=0.152), afternoon relative humidity (r=0.002) and bright sunshine hours (r=0.221). Negative correlations were recorded with wind speed (r=-0.311) and rainfall (r=-0.158) and both were non-significant.

Leaf miner, *L. sativae* population showed a highly significant positive correlation with maximum temperature (r=0.804**) and bright sunshine hours (r=0.711**). A highly significant negative correlation was observed with afternoon relative humidity (r=-0.718**) and wind speed (r=-0.664**), while non-significant negative correlations were noted with minimum temperature (r=-0.419) morning relative humidity (r=-0.225), and rainfall (r=-0.455).

The population of pumpkin beetle, *A. foveicollis* and *A. intermedia* exhibited a highly significant positive correlation with afternoon relative humidity (r=0.652**) and wind speed (r=0.629**) and a significant positive correlation with minimum temperature (r=0.584*). Morning relative humidity (r=0.206) and rainfall (r=0.405) were also positively correlated but non-significant. In contrast, highly significant negative correlations were recorded with maximum temperature (r=-0.736**) and bright sunshine hours (r=-0.632**) (Table 3).

3.3 Fruit feeders

The incidence of melon fruit fly, *B. cucurbitae* was positively correlated with maximum temperature (r=0.198), minimum temperature (r=0.138), morning relative humidity (r=0.261) and bright sunshine hours (r=0.295) and all were non-significant. Negative correlations were observed with afternoon relative humidity (r=-0.104), wind speed (r=-0.371) and rainfall (r=-0.197) and they were also non-significant (Table 3).

The perusal of data on correlation by infestation of pests with various weather parameters (Table 3) are in close agreement with those of Su (1986) [43] who observed that the temperature was the most important factor affecting population size of the tephritids, followed by rainfall, humidity and duration of sunshine. Inayatullah *et al.* (1991) [11] elucidated that the correlation between male counts of *B. cucurbitae* and the maximum, minimum and average temperature was positive, but it was negatively correlated with relative humidity. Pawar *et al.* (1991) [24] reported that the increase in population of *B. cucurbitae* in bitter gourd was positively and significantly correlated with increased temperature, humidity and rainfall. Roy and Pande (1991) [33] showed negative relationship between the pest population of *A. foveicollis* and temperature and rainfall which also supports the present findings. Thakur *et al.* (1992) [44] noticed that the mean temperature between 30 °C and 31 °C was the most favourable for the attack of *B. cucurbitae* in bitter gourd. Rajak (2000) [29] observed that the correlation of beetles, *A. foveicollis* on muskmelon with temperature was significantly positive and that with relative humidity was negative but non-significant which were in contrast with present observations.

Johri and Johri (2003) [12] reported that temperature, humidity and rainfall had no significant effect on infestation of red pumpkin beetle on cucurbitaceous crops. These observations also showed disparity from the present study. Vanisree *et al.* (2005) [45] found that *D. indica* exhibited significant negative correlation between larval incidence and morning relative humidity, deviating from the present investigation. Mandal *et al.* (2006) [16] revealed that *B. cucurbitae* incidence on bitter gourd exhibited significant positive correlation with minimum temperature and relative humidity, but non-significant correlation with maximum temperature supporting the present findings. Rathod (2006) [31] observed that during *kharif* season, red pumpkin beetle, *A. foveicollis* population had significantly negative relationship with wind speed on ridge gourd and smooth gourd. The relative humidity had significantly positive association on bitter gourd, pumpkin and cucumber. Laskar and Chatterjee (2010) [14] observed significant positive correlation (r) of fruit fly incidence with minimum temperature (r= +0.759) and maximum temperature (r= +0.737), negative correlation with maximum humidity (r= -0.424) and positive (r= +0.436) with the minimum humidity. Barma and Jha (2011) [1] reported that maximum and minimum temperature had significant positive correlation (r = +0.386 and +0.501, respectively) on the population build-up of fruit fly in pointed gourd. The evening relative humidity had positive correlation (r= +0.284) and bright sunshine hours had non-significant positive correlation (r= +0.103) which are in line with the present study. Barma and Jha (2013) [2] found that maximum temperature, minimum temperature, morning RH, evening RH, rainfall and bright sun shine hours had significant association with *D. indica* population during June and July months. Barma *et al.* (2013) [3] reported that the maggot population of *B. cucurbitae* in pointed gourd was found to be having significant positive correlations with atmospheric temperature (r= 0.386 for maximum temperature and 0.501 for minimum temperature) and showed almost neutral relationship with bright sun shine hours (r= +0.103). Rainfall could not influence the population of this internal feeding maggot. Ganie *et al.* (2013) [8] concluded that the population of fruit flies was significantly correlated with the minimum and maximum temperature. Lekshmi *et al.* (2014)

[15] observed that the maximum, minimum and average temperatures had significant negative correlation on the population build-up of whitefly and aphid, whereas, the maximum, minimum and average temperature had positive correlation with fruit fly, *B. cucurbitae* population. Bhowmik and Saha (2017) [4] reported that maximum temperature (r= 0.542*) showed a significant positive correlation, while minimum temperature (r= -0.725*) significantly impacted the red pumpkin beetle, *A. foveicollis*. Minimum RH (r= -0.482*) had a negative effect on the beetle, while maximum RH (r= 0.612) showed a positive correlation with the incidence of the beetle.

Sharath *et al.* (2021) [37] observed that major defoliater pest *viz.*, *A. peponis* population showed significant positive correlation with morning relative humidity (RH) (r=0.69*), while, population of *L. trifolii* was significantly and negatively correlated with morning relative humidity (r = -0.66*), population of *D. indica* was significantly positively correlated with afternoon RH (r=0.60*), pumpkin beetle, *Aulacophora* spp. population showed significant positive correlation with total rainfall (r=0.69*), whereas, mirid bug, *N. tenuis* population exhibited significant negative correlation with sunshine hours (r=0.65*). Sharada Devi and Venkatesha (2022) [35] found that the pest population of *D. indica* and relative humidity was positively correlated (r= 0.585 and 0.786; r= 0.647 and 0.635) and temperature was negatively correlated (r= -0.609; -0.561 and -0.076), respectively, during two years of study. Further, Rahman *et al.* (2023) [28] reported that the larval abundance of *D. indica* on snake gourd crop was affected by the variation of temperature and relative humidity. The temperature was found to be influential in increasing larval abundance. On the other hand, relative humidity played the opposite role of temperature and negatively influenced larval abundance. Solanki *et al.* (2023) [42] observed that maximum and minimum temperature showed significant and positive correlation with *B. cucurbitae* infestation on cucumber, whereas, the morning and evening relative humidity had non-significant and positive correlation.

Table 2: Seasonal incidence of pests infesting snake gourd, *T. cucumerina*

WAS*	SMW**	Aphid	White fly	Snake gourd semilooper (Mean no. of larvae/plant)	Pumpkin caterpillar (Mean no. of adults/plant)	Leaf miner (Mean number of infested leaves/plant)	Pumpkin beetle (Mean no. of adults/plant)	Melon fruit fly (Mean % infested fruits/plant)
		Mean. no. of nymphs and adults/plant						
8	31	0.00	0.00	0.00	0.00	0.00	3.56	0.00
9	32	0.00	0.00	0.00	0.00	0.00	3.80	0.00
10	33	0.00	0.00	0.00	0.00	0.00	5.24	0.00
11	34	0.00	0.16	0.00	0.00	0.00	6.48	0.00
12	35	5.84	0.44	0.00	0.72	0.20	5.40	0.00
13	36	14.18	1.60	0.40	1.16	0.32	3.48	0.00
14	37	13.58	2.76	1.28	1.60	0.48	3.28	27.02
15	38	16.28	4.28	4.40	2.56	0.68	1.88	39.13
16	39	18.00	8.00	3.70	3.84	1.08	1.04	41.66
17	40	21.92	11.29	4.12	4.48	1.36	1.16	35.97
18	41	14.26	5.73	3.68	5.64	1.56	0.64	32.43
19	42	8.24	3.50	3.20	3.40	1.56	0.52	26.47
20	43	5.18	1.04	1.60	1.88	1.96	0.40	25.00
21	44	3.20	0.64	1.20	0.96	2.12	0.24	22.86
22	45	2.12	0.00	0.68	0.32	1.52	0.20	0.00
23	46	1.08	0.00	0.32	0.12	0.96	0.04	0.00
S.D.		7.50	3.36	1.68	1.81	0.75	2.13	16.87

***WAS:** Week after sowing
****SMW:** Standard meteorological week

Table 3: Correlation coefficient between weather parameters and incidence of different pests infesting snake gourd, *T. cucumerina*

Weather parameters	Correlation coefficient (r)						
	Aphid	White fly	Snake gourd semilooper	Pumpkin caterpillar	Leaf miner	Pumpkin beetle	Melon fruit fly
Tmax (^{0}C)	-0.080	0.054	0.245	0.187	0.804**	-0.736**	0.198
Tmin (^{0}C)	0.166	0.197	0.077	0.175	-0.419	0.584	0.138
RH-I (%)	0.507*	0.245	0.136	0.152	-0.225	0.206	0.261
RH-II (%)	0.166	0.083	-0.103	0.002	-0.718**	0.652**	-0.104
Wind speed (Kmph)	-0.208	-0.224	-0.394	-0.311	-0.664**	0.629**	-0.371
Rainfall (mm)	-0.028	-0.111	-0.244	-0.158	-0.455	0.405*	-0.197
BSS (hrs.)	0.086	0.185	0.306	0.221	0.711**	-0.632**	0.295

* Significant at 5 per cent level of significance (r = ± 0.497) N = 16
** Significant at 1 per cent level of significance (r = ± 0.623)

Conclusion

The present study revealed that snake gourd, *Trichosanthes cucumerina* var. *anguina*, during Kharif 2024-25 was infested by a complex of nine insect pests belonging to Lepidoptera, Coleoptera, Hemiptera and Diptera. Among them, aphids, whitefly, snake gourd semilooper, pumpkin caterpillar, pumpkin beetles, leaf miner and melon fruit fly were the major pests causing significant damage to foliage and fruits, while brown stink bug and leaf footed bug occurred as minor pests. The seasonal incidence studies indicated that pest appearance and peak activity were closely linked with crop phenology and prevailing weather conditions. Correlation analysis established that temperature, relative humidity, wind speed and bright

sunshine hours exerted varying degrees of positive or negative influence on different pest populations. Notably, leaf miner incidence was highly and positively associated with maximum temperature and bright sunshine hours, while pumpkin beetle population showed significant positive correlation with minimum temperature, afternoon relative humidity and wind speed. These findings emphasize that understanding pest dynamics in relation to abiotic factors is crucial for predicting pest outbreaks and formulating timely, eco-friendly management strategies to reduce yield losses in snake gourd cultivation.

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