Vegetable Science (2018) 45 (1) : 140-143

**Short Communication**

# Pest profiling and varietal screening of winged bean (*Psophocarpus tetragonolobus*): a lesser known green vegetable and grain legume in eastern Uttar Pradesh, India

**Jaydeep Halder*, Deepak Kushwaha, RK Dubey, AB Rai and B Singh**

Received: April 2018 / Accepted: May 2018

Winged bean [*Psophocarpus tetragonolobus* (L.) DC.], also known as or Goa bean, versatile legume or wonder legume, is an under-exploited, self-fertilizing tropical grain legume known for its multifarious usage. It is unique among leguminous crops in that, several parts of the plant - leaves, pods, seeds and tubers – are edible and rich in protein (Garcia and Palmer 1980). In winged bean, the protein content is 33.82% compared with 35% of soybean and have been suggested as a potential food source for the tropics (NAS 1981). It also contains edible oil (15-20%), Vitamin A (300-900 IU) and also rich in carbohydrate (Singh et al. 2013). Being a leguminous crop, it has shown that symbiosis of the plant and the *Rhizobium* which is highly promiscuous while in other legume it is highly specific. Insect and mites are the major biotic constraints to vegetables production in India. The crop losses to the tune of 30-40% have been reported from vegetable crops (Rai et al. 2014). Besides being pests, many of insects are beneficial serving aspollinatorsand natural enemies of the pests (parasitoids and predators). Although winged beanis a self-pollinated crop, but the role of the insect as pollinators also cannot be ruled out as Karikari (1972) observed exclusion of pollinating agents, by caging, resulted in significant yield reductions, and delayed fruit maturity. However, the insect pests associated with winged bean are reported from abroad. Shanthichandra et al. (1990) listed from Sri Lanka insect pests like *Myllocerus curvicornis*, *Hypolixus truncatulus*, *Pagrialepida*, *Euproctis sciintillans*, *Dysdercus olivaceus*, *Riptortus pedestris* etc. as pests of winged bean. Khan (1982) from Australia reported *Maruca testulalis* and *Helicoverpa armigera* as flower and pod feeders of winged bean. Reddy (2015) reviewed the pests of winged bean and reported *M. vitrata*, *Ophiomyia phaseoli*, *Lampides boeticus* and *Nezara viridula* as major pests in many parts of the world. Considering this, attempts have been made to identify and catalogue the diversity of insect and acarine fauna associated with and its response to major pests the wonder legume in the Indo-Gangetic plains of Uttar Pradeshas a first step towards development of an effective integrated pest management strategy for this region.

Periodical surveys were conducted in and around the experimental farm of ICAR-Indian Institute of Vegetable Research, Varanasi (82°52' E longitude and 25°12' N latitude) Uttar Pradesh, India to record the identity of insect and mite fauna associated with winged bean during the *Kharif*and *Rabi*seasons of 2016-18. The climate of the site is a subtropical humid type and receives an average annual rainfall of 900 mm and experiences mean annual minimum and maximum temperatures of 4.6 and 46.5°C, respectively. The experimental site was under the alluvial zone of Indo-Gangetic belt having soils silty loam in texture and low in organic carbon (0.43%) and available nitrogen (185 kg/ha). The seeds of winged bean were sown in *Kharif* seasons, *i.e.,*the first fortnight of July. The crops were raised following all the recommended agronomic practices except plant protection measures. Information was also recorded on the plant part(s) damaged, the amount and nature of damage, identity of the fauna, developmental stage, and date and area of collection. In addition to these, regular roving surveys with sweep nets (once in a week) were also conducted thorough out the growth stage to record

ICAR-Indian Institute of Vegetable Research, Varanasi, Uttar Pradesh-221305

*Corresponding author, E mail: jaydeep.halder@gmail.com

the beneficial fauna associated with this crop. Insect specimens were also sent to National Pusa Collection, Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi, India for taxonomic identification. The major pests like spotted pod borer (*Maruca vitrata* Geyer), tobacco caterpillar (*Spodoptera litura* Fab.) and bean thrips, *Megalurothrips distalis* (Karny) were considered for their reactions towards thirty five genotypes of winged bean during 2016-17. Two rows of each genotype comprising ten plants in each row were grown. Five plants in each genotype were selected and tagged at early vegetative stage to record the nature and extent of damage of these major pests on different plants parts throughout the growing period. From the total number of flower buds and flowers in the sample of five plants, the per cent of flowers damaged due to *M. vitrata* was worked out by the following formula -

$$\text{Flower damage (\%)} = \frac{\text{Number of damaged flowers}}{\text{Total number of flowers}} \times 100$$

Similarly, damage due to the *S. litura* on leaves was also calculated and expressed in per cent. In case of thrips incidence, twenty flowers from each genotype were randomly plucked. All the parts of each flower were separated and thoroughly examined under microscope (Nikon SMZ-10A) to count thrips and expressed as the number of thrips per flower.

**Phytophagous insect and acarine pests:** Insect and mite fauna recorded on winged bean have been listed in Table 1 along with their characteristic damage symptoms and incidence. Few species were found to be major pests, while others were of minor importance. The major pests with e"10% damage were the spotted pod borer, *Maruca vitrata* (Geyer); tobacco caterpillar, *Spodoptera litura* Fab.; Bean thrips, *Megalurothrips distalis* (Karny). Other pests, often showed erratic distributionwith <10% damage were considered as minor importance which include Gram pod borer, *Helicoverpa armigera* (Hubner); pea blue butterfly, *Lampides boeticus* (Linn.); and white fly, *Bemisia tabaci* (Gennadius, 1889); Yellow or broad mite, *Polyphagotarsonemus latus* Banks; Red spider mite, *Tetranychus* spp; Black bean aphid, *Aphis craccivora* (Koch.), Green stink bug, *Nezaraviridula* (Linn.) and Cow bug, *Tricentrus bicolor* Distant (Table 1).

**Predatory fauna:** Along with insect pests, different predatory fauna were also observed and identified. Amongst the predatory fauna, Lady bird beetles (Coccinellidae: Coleoptera) were dominant which include two species *viz*., *Coccinella septempunctata* (Linnaeus 1758) and *Cheilomenes sexmaculata* (Fabricius) and often seen feeding on various soft-bodied insects. Another predatory beetle *i.e*., rove beetle, *Paederus* sp. (Staphylinidae: Coleoptera) was also abundant, particularly during the post-monsoon season.

Table 1: List of insect and acarine fauna associated with winged bean in Varanasi, Uttar Pradesh

| Name and taxonomic affiliation | Crop stage and active period of infestation | Plant part(s) affected | Nature of damage |
|---|---|---|---|
| **Major pest** | | | |
| Spotted pod borer, *Maruca vitrata* (Geyer) (Lepidoptera: Pyralidae) | Reproductive stage (September – November) | Flowers and pods | Flower feeder and pod borer |
| Tobacco caterpillar, *Spodoptera litura* (Fabricius, 1775) (Lepidoptera: Noctuidae) | Reproductive stage (September – October) | Leaves | Foliage feeder |
| Bean thrips, *Megalurothrips distalis* (Karny) (Thysanoptera: Thripidae) | During flowering (September – December) | Flower and flower buds | Nymphs and adults are sap suckers. |
| **Minor pests** | | | |
| Gram pod borer, *Helicoverpa armigera* (Hübner, [1809]) (Lepidoptera: Noctuidae) | Reproductive stage (November) | Flowers and pods | Flower feeder and pod borer |
| Pea blue butterfly, *Lampides boeticus* (Linn.) (Lepidoptera: Lycaenidae) | Reproductive stage (November) | Flowers and pods | Flower feeder and pod borer |
| White fly, *Bemisia tabaci* (Gennadius, 1889) (Hemiptera : Aleyrodidae) | Both vegetative and reproductive stages (Oct.–Nov.) | Leaves | Both the nymphs and adults damage the crops by sucking the cell sap. |
| Black bean aphid, *Aphis craccivora* (Koch.)(Hemiptera : Aphididae) | Reproductive stage (November) | Tender fruits and buds, Flower and flower buds, | |
| Green stink bug, *Nezaraviridula* (Linn.) (Hemiptera : Pentatomidae) | Reproductive stage (November) | Tender pods | |
| Cow bug, *Tricentrus bicolor* Distant (Hemiptera: Membracidae) | Reproductive stage (November) | Stems and branches | |
| Yellow or broad mite, *Polyphagotarsonemus latus* (Banks.) (Trombidiformes : Tarsonemidae) | Both vegetative and reproductive stages (October – November) | Leaves and buds | Nymphs and adults are sap suckers. |
| Red spider mite, *Tetranychus* spp. (Trombidiformes : Tetranychidae) | Both vegetative and reproductive stages (October – November) | Mostly underside of the leaf. But in severe infestation leaves, buds flowers are also affected. | |

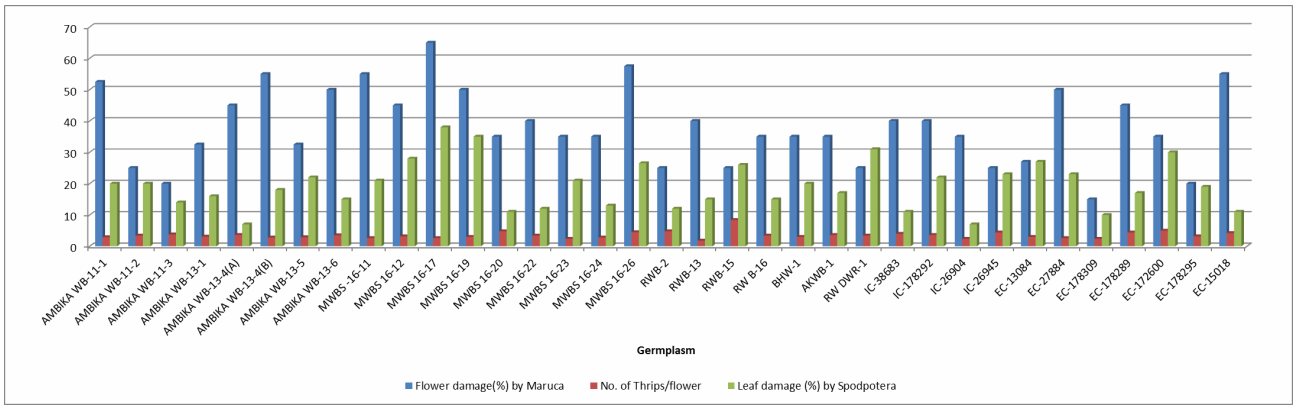


Fig.1. Varietal screening of different Winged bean genotypes against *M. vitrata*, *S. litura* and *M. distalis*

The only Diperan Syrphid predator *i.e.,* Hover fly, *Eupeodes confrater* (Wiedemann) was recorded to feed *Aphis craccivora* infesting winged bean. Few polyphagous preying mantids and reduvid bugs were also noticed during the roving survey.

**Pollinators:** Although it is a self-pollinated crop, the bright white or blueish white colored flowers of winged beanattracted a large number of pollinators. Three species of honey bees (Apidae: Hymenoptera) *viz.*, *Apis dorsata* Fabricius, 1793, *A. cerana indica* Fabricius, *A. mellifera* Linnaeus, 1758 were observed during the flowering period. However, their abundance and visiting period were non-synchronized and varied. Few Carpenter bee, *Xylocopa aestuans* (Apidae: Hymenoptera), Leaf cutter bee, *Megachile disjuncta* (Megachilidae: Hymenoptera), Stingless bee or Dammer bee, *Tetragonulairi dipennis* (Smith) (Apidae: Hymenoptera) were also recorded during the roving survey. Based on the surveys all the insect and acarine fauna are being reported for the first time on winged beanfrom this region. It also envisages the major pests that need to be tackled during development of bio-intensive ecofriendly pest management modules as well as also steps to be taken for conservation of beneficial fauna especially pollinators and other natural enemies for sustainable winged bean production in this region.

**Varietal screening towards major insect pests:** Thirty five genotypes were screened against major insect pests that caused at least 10% damage. Amongst the various insect pests, spotted pod borer, *Maruca vitrata*; tobacco caterpillar, *Spodoptera litura* and bean thrips, *Megaluro thripsdistalis* were serious. The genotype, MWBS 16-17 suffered maximum flower damage (65%) by the *M. vitrata* followed by MWBS 16-26 (57.5%). In contrast, the genotype EC-178309 suffered the lowest (15%) flower damage. Apart from a well-known pest of many tropical grain legumes in India (Halder et al. 2011), the spotted pod borer, *M. vitrata* is also reported as a most widespread flower pest of Winged bean in Papua New Guinea and Thailand (Anonymous 1981). Similarly, the incidence of tobacco caterpillar, *S. litura* as foliage feeder was recorded. The cultivar MWBS 16-17 had maximum leaf damage (38%) by this polyphagous pest during September to October whereas the genotypes AMBIKA WB-13-4(A) and IC-26904 registered lowest leaf damage of 7% each (Fig.1). Incidence of thrips was also observed on flowers and flower buds. Maximum thrips per flower (8.4) was recorded on the genotype RWB-15 followed by EC-172600 (5 thrips/flower) whereas the genotype RWB-13 harboured minimum of 1.8 thrips per flower. From the Fig.1 it is also evident that the genotype MWBS 16-17 was found highly susceptible to major insect pests like *M. vitrata* and *S. litura*, so suitable control measure should be adopted for its cultivation. Interestingly, the genotype EC-178309 suffered least damage by both *M. vitrata* and *S. litura* throughout its growing period which can be utilized in resistance breeding programme.

## Acknowledgement

The authors are thankful to the In-charge, Insect Identification Service, National Pusa Collection, Division of Entomology, ICAR-IARI, New Delhi-110012 for identifying some of the insect specimens.

## References

Anonymous (1981) The Winged Bean: A High Protein crop for the Tropics (2nd Edition). Report of an Ad Hoc Panel of the Advisory Committee on Technology Innovation Board on Science and Technology for International Development Commission on International Relations National Research Council. National Academy Press, Washington, D.C., USA, pp 31.

Garcia VV and O Palmer (1980) Proximate analysis of five varieties of winged beans. J Food Tech 15: 469–476.

Halder J and Srinivasan S (2011) Varietal screening and role of morphological factors on distribution and abundance on spotted pod borer, *Maruca vitrata* (Geyer) on cow pea. Annls Pl Prot Sci 19(1): 71-74.

Karikari SK (1972) Pollination' requirements of winged beans (*Psophocarpus* spp. Neck) in Ghana. Ghana J Agri Sci 5:235-239.

Khan TN (1982) Winged bean production in the tropics. *In*: FAO Plant Production and Protection Papers. No. 38, pp 222.

National Academy of Science (NAS) (1981) The winged bean; A high protein crop for the tropics. National Academy of Sciences, Washington DC.

Rai A, Halder J and Kodandaram MH (2014) Emerging insect pest problems in vegetable crops and their management in India: An appraisal. Pest Manag Hort Ecosys 20(2):113-122.

Reddy PP (2015) Winged Bean, *Psophocarpus tetragonolobus*. *In*: Plant Protection in Tropical Root and Tuber Crops. Springer India, pp 293 – 303.

Shanthichandra WKN, Gunasekera SA and Price TV (1990) Diseases and pests of the winged bean (*Psophocarpus tetragonolobus* (L.) DC). Trop Pest Manage 36 (4):375-379.

Singh SK, Singh SJ and Devi NR (2013) The Winged bean: A vegetable crop of amazing potential. Annls Hort 6(1):159-160.