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Studies on Lepidopterous Insects Associated with Vegetables in Aravali Range, Rajasthan, India

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ABSTRACT : The extensive studies on Lepidopterous insects associated with vegetables were conducted in different localities of Aravalli Range of Rajasthan i.e. Mount Abu, Udaipur, Rajsamand, Puskar, Ajmer, Jaipur, Sikar, Jhunjhunu, Sariska, Alwar, Dausa and Bharatpur during 2008-11. During present study 38 species of lepidopterous insects associated with vegetables in Aravalli Range of Rajasthan were recorded, out of 152 species of lepidopterous insects recorded from India. The families Crambidae and Noctuidae were the dominant families each represented by 8 species followed by Arctiidae having 4 species; Lycaenidae 3 species; then Nolidae, Pieridae and Sphingidae each having 2 species and least by Cosmopterigidae, Gelechiidae, Geometridae, Hesperiidae, Lymantriidae, Nymphalidae, Plutellidae, Pterophoridae and Saturniidae each having 1 species. On the basis of nature of damage the lepidopterous insects were also categorized as leaf feeders, pod borers, fruit borers, defoliators and leaf rollers, bud borers and leaf webbers, cut worms, leaf miners and stem borers etc. The salient details of their hosts, pest status or otherwise and their updated classification are provided.

Keywords : Lepidopterous insects, Vegetables, pest status, Aravalli Range, Rajasthan.

INTRODUCTION

India is the second largest producer of vegetables after China, about 75 million tons. The existing area under vegetable cultivation in India is around 4.5 million ha. Rajasthan's economy is primarily agricultural and pastoral. Wheat and barley are cultivated over large areas, as are pulses, sugarcane, and oilseeds. Cotton and tobacco are cash crops. Rajasthan is among the largest producers of edible oils in India and the second largest producer of oilseeds. The Aravalli ranges constitute the most dominant hilly areas of Rajasthan. The ranges run diagonally across the state from north-east Delhi to south-west upto the plains of Gujarat, covering a distance of about 690 Kms. The highest peak of Rajasthan is Guru Shikhar in Mount Abu, rising to 1722 meters. The city of Udaipur with its lake lies on the south slope of the range in Rajasthan. The Aravalli Range is the eroded stub of a range of ancient folded mountains.

Vegetable crops occupy an important status in the agricultural economy and form an essential component of the human diet especially in India and some South-East Asian countries, where sizable population basically consists of vegetarians. However, there are several factors that limits it's productively, mainly insect pests and diseases. Vegetables are more prone to insect pests and diseases mainly due to their tenderness and softness as compared to other crops and virtual absence of resistance characters because of intensive hybrid cultivation. The insect pests inflict crop losses to the tune of 40 percent in vegetable production. Vegetable growers by and large depend on chemical pesticides to counter the problem of insect pests. Indiscriminate use of pesticides has led to severe ecological consequences like destruction of natural enemies fauna, effect on non target organisms, residues in consumable products including packed pure and mineral water and ultimately resistance to the pesticides, to which we solely rely. Biointensive pest management (BIPM) is the recent trend in Indian farming and attracting the farmers for higher income to their produce. This has resulted due to increased awareness among the end users and concerns about the deteriorating ecological situations among the eco-campaigners. Hence, a detailed study on the economically important pests of vegetables is essential to understand their weak points in life history that can be exploited in their management.

Perusal of literature reveals that consolidated account is available on the Lepidopterous insects associated with vegetables in India by Lefroy, 1909; Fletcher, 1914, 1921; Pradhan, 1969; Nair, 1970; Butani and Jotwani, 1984; Gupta, 1990; David, 2001; Kumar et al., 2007, Sharma et al., 2008 and Sharma and Ramamurthy, 2009 provided detailed information on the recorded 152 species of lepidopterous insects associated with vegetables in India. In this paper an attempt has been made to provide the current status, annotated checklist of lepidopterous insects associated with vegetables in Aravalli Range, Rajasthan and details such as nature of damage, pest status/hosts, the updated classification etc.

MATERIALS AND METHODS

The adults of Lepidoptera were collected in the field with aspirator, manually and aerial sweep net and at night with the help of light traps of different light sources (ultra violet, black light and mercury vapour light). The collected

insects were killed by using tetrachloro ethane or ethyl acetate or benzene. These were stretched, pinned, labeled, identified, preserved in the wooden collection boxes and deposited in the National Zoological Collection of Zoological Survey of India, Desert Regional Centre, Jodhpur. The specimens collected from various localities were processed as per methodology discussed by workers such as Lindquist (1956), Tagestad (1974), Zimmerman (1978) and Landry and Landry (1994). For the taxonomic descriptions of various morphological characters, wing venation and genitalia, Klots (1970), Zimmerman (1978) and Robinson (1994) were followed. The scientific names of insects updated by consulting Fletcher, 1929, 1981; Fletcher and Nye, 1982; Hampson, 1892, 1894, 1895, 1896; Heppner, 1998, Holloway et al., 1987; Meyrick, 1909-11, 1913-14; Nye and Fletcher, 1985, 1991; Watson et al., 1980 and Lepindex of Natural History Museum, London website. In the field observations and in the laboratory specimens were photographed prior to studies, using a Nikon D70 and D90 SLR Cameras with attachments.

RESULTS AND DISCUSSION

Survey-cum-collection works on Lepidopterous insects associated with vegetables were conducted in different localities of Aravalli Range of Rajasthan i.e. Mount Abu, Udaipur, Rajsamand, Puskar, Ajmer, Jaipur, Sikar, Jhunjhunu, Sariska, Alwar, Dausa and Bharatpur during September, 2008 to February, 2011. A checklist of Lepidopterous insects associated with vegetables in Aravalli Range of Rajasthan prepared, which recorded 38 species belonging to 16 families of order Lepidoptera. The families Crambidae and Noctuidae were the dominant families each represented by 8 species followed by Arctiidae having 4 species; Lycaenidae 3 species; then Nolidae, Pieridae and Sphingidae each having 2 species and least by Cosmopterigidae, Gelechiidae, Geometridae, Hesperiidae, Lymantriidae, Nymphalidae, Plutellidae, Pterophoridae and Saturniidae each having 1 species (Table-1). On the basis of nature of damage the lepidopterous insects were also categorized as leaf feeders, pod borers, fruit borers, defoliators and leaf rollers, bud borers and leaf webbers, cut worms, leaf miners and stem borers etc. In the checklist the families, genera and species are arranged alphabetically and the pest status (major/minor) and host range is according to the literature cited. In India the research works of Lefroy, 1909; Fletcher, 1914, 1921; Pradhan, 1969; Nair, 1970; Butani and Jotwani, 1984; Gupta, 1990; David, 2001; Kumar et al., 2007; Sharma et al., 2008; Sharma and Ramamurthy, 2009 provided valuable information on lepidopterous pests of vegetables and in USA the work of Capinera, 2001 recorded lepidopterous pest on vegetables, which are globally distributed.

The present study provided the existing information on lepidopterous insects associated with vegetables in Aravalli Range of Rajasthan, so that it will helpful in planning strategy for Integrated Pest Management programs to the control of vegetable pests and for the higher productivity of vegetables.

Table 1: Annotated checklist of lepidopterous insects associated with vegetables in Aravalli Range, Rajasthan.

S. No.	*Species*	*Nature of damage*	*Pest status/Host*	*References*
		(1) Family: Arctiidae		
1.	*Creatonotos gangis* (Linnaeus)	Leaf feeder	Minor (Sweet Potato)	Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990
2.	*Pericallia ricini* (Fabricius)	Leaf feeder/Plume Moth/ Defoliator/ Leaf eating caterpillar/ Black hairy caterpillar	Major (Elephant foot, Drumstick); Minor (Coccina, Brinjal, Cow pea, Yam, Sweet potato, Radish, Arum (Colocasia), Pumpkin	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; David, 2001
3.	*Spilosoma obliqua* (Walker)	Leaf feeder/Leaf eating caterpillar/ Bihar hairy caterpillar	Major (Sweet Potato, Potato); Minor (Cole crops, Cow pea & garden pea, Beans, Radish, Yam)	Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; David, 2001 Fletcher, 1914
4.	*Utetheisa pulchella* (Linnaeus)	Leaf feeder	Minor (Sunn hemp)	
		(2) Family: Cosmopterigidae		
5.	*Cosmopterix mimetis* Meyrick	Leaf miner	Minor (Indian bean, French bean)	Butani & Jotwani, 1984
		(3) Family: Crambidae		
6.	*Cnaphalocrocis trapezalis* (Guenee)	Cut worm	Minor (Suger beet)	Butani & Jotwani, 1984
7.	*Crocidolomia binotalis* Zeller	Leaf webber	Major (Cruciferous vegetables: Cabbage, Cauliflower); Minor (Radish, Beet root)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; David, 2001
8.	*Cryptographis indica*	Leaf Roller/ Pumpkin	Minor (All Cucurbitaceous	Fletcher, 1914; Nair, 1970;

Contd.

	(Saunders)	Catterpillar/ Leaf eating caterpillar	plants, Melons, Cucumbers, Gourd, Sugar-beet, Chow-chow, Coccina, Bitter gourd, Pumpkin)	Butani & Jotwani, 1984; David, 2001
9.	*Dichocrocis punctiferalis* (Guenee)	Leaf defoliator/Leaf feeder	Minor (Sweet Potato, Amaranthus, Jack fruit)	Butani & Jotwani, 1984; Gupta, 1990
10.	*Glyphodes bivitralis* Guenee	Leaf feeder	Minor (Jack fruit)	Butani & Jotwani, 1984
11.	*Hellula undalis* (Fabricius)	Cabbage Borer/Fruit borer/ Leaf feeder/Oriental cabbage webworm (USA)	Major (Cabbage); Minor (Cauliflower, Radish, Beet root, Knolkhol)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; David, 2001; Capinera, 2001
12.	*Spoladea recurvalis* (Fabricius)	Leaf eating caterpillar/ Amaranthus leaf webber/ Hawaiian beet webworm	Major (Amaranthus, Spinach); Minor (Beet root, Coleus)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; David, 2001; Capinera, 2001
13.	*Syllepte derogata* (Fabricius)	Cotton Leaf Roller/ Cutworm/ Leaf feeder	Major (Okra)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; David, 2001
	(4) Family: Gelechiidae			
14.	*Helcystogramma hibisci* (Stainton)	Leaf roller	Minor (Okra) widely distributed in South-east Asia	Lefroy, 1909; Nair, 1970; Butani & Jotwani, 1984
	(5) Family: Geometridae			
15.	*Hyposidra successaria* Walker	Leaf feeder	Minor (Sweet Potato)	Nair, 1970; Butani & Jotwani, 1984
	(6) Family: Hesperiidae			
16.	*Parnara bada* (Moore)	Leaf feeder/Skipper butterfly/Leaf eating caterpillar	Minor (Cowpea, French bean & Yam)	Butani & Jotwani, 1984
	(7) Family: Lycaenidae			
17.	*Catochrysops strabo* (Fabricius)	Pod borer	Minor (Indian Bean)	Butani & Jotwani, 1984
18.	*Euchrysops cnejns* (Fabricius)	Pod borer	Minor (Indian Bean)	Fletcher, 1914; Butani & Jotwani, 1984
19.	*Lampides boeticus* (Linnaeus)	Pod borer	Minor (Cowpea, Garden pea)	Fletcher, 1914; Butani & Jotwani, 1984; Dahiya & Chauhan, 1992
	(8) Family: Lymantriidae			
20.	*Somena scintillans* Walker	Leaf feeder	Minor (Sunn hemp, Capsicum, Cowpea & Pea)	Fletcher, 1914; Butani & Jotwani, 1984; Gupta, 1990; Barwal & Joshi, 1996
	(9) Family: Noctuidae			
21.	*Agrotis spinifera* (Hübner)	Bud worm	Minor (Potato, Cabbage, Cauliflower)	Butani & Jotwani, 1984; Singh, 1989; Gupta, 1990
22.	*Agrotis ypsilon* (Rottemburg)	Cut worm/Leaf feeder	Major (Potato); Minor (Tomato, brinjal, Okra, spring okra, Cabbage, carrot, onion (damage to seedling), Chillies, turnip, cauliflower, Beet root, Cole crops)	Nair, 1970; Butani & Jotwani, 1984; Singh & Misra, 1988; Misra & Sharma, 1988; Singh, 1989; Gupta, 1990; Bhat *et al*., 1994; David, 2001; Pandey *et al*., 2006; Badenes-Perez & Shelton, 2006
23.	*Elygea materna* Linnaeus	Fruit borer/Fruit sucking moth	Minor (Amaranthus, tomato, Chillies)	Butani & Jotwani, 1984; Gupta, 1990
24.	*Helicoverpa armigera* (Hübner)	Cut worm/Fruit borer Tomato/Leaf feeder/ Gram pod borer/ Shoot borer	Major (Tomato, Beans, Brinjal); Minor (Okra, Drumsticks, Bitter gourd, Onion, Amaranthus, Chillies, Cowpea & garden pea)	Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; Dahiya & Chauhan, 1992; Raj et al., 1993; Bhatia & Verma, 1994; Thakur et al., 1998; David, 2001; Pandey et al., 2006; Badenes-Perez & Shelton, 2006

Contd.

25.	*Helicoverpa assulta* (Guenee)	Bud worm	Minor (Tomato)	Butani & Jotwani, 1984; Gupta, 1990
26.	*Othreis fullonica* (Linnaeus)	Fruit borer/ Fruit sucking moth	Minor (Amaranthus, tomato, Chillies)	Butani & Jotwani, 1984; Gupta, 1990
27.	*Spodoptera litura* (Fabricius)	Tobacco caterpillar/Fruit borer Tomato/Leaf eating caterpillar/Leaf feeder/Cut worm/Shoot & Fruit feeder	Major (Tomato); Minor (Coccina, Brinjal, Pea, Cabbage & Cauliflower damage in West Bengal, Chillies, elephant's foot, Cowpea, Colocasia, Radish, Beet root, Onion, Sweet Potato, Potato, Amranthus, Okra, yam, Arum, Beans, Elephant foot)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Saxena et al., 1988; Gupta, 1990; David, 2001
28.	T*hysanoplusia orichalcea* (Fabricius)	Leaf feeder/Green Semilooper/Tuber feeder	Minor (Brinjal, Cow pea, Cabbage,Cauliflower, Radish, Potato)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; Bhatia & Verma, 1994; Bhatia and Verma, 1995
		(10) Family: Nolidae		
29.	*Earias insulana* (Boisduval)	Fruit Borer/Spotted bollworm of Cotton	Major (Okra in drier region, spring okra)	Fletcher, 1914; Singh & Misra, 1988; Gupta, 1990; David, 2001
30.	*Earias vittella* (Fabricius)	Shoot & Fruit Borer/ Spotted bollworm of Cotton	Major (Okra) throughout the plains of India, Minor (Spring okra)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Singh & Misra, 1988; Gupta, 1990; David, 2001
		(11) Family: Nymphalidae		
31.	*Junonia orithya* (Linnaeus)	Leaf feeder	Minor (Amaranthus, sweet Potato)	Nair, 1970; Butani & Jotwani,
		(12) Family: Pieridae		
32.	*Pieris brassicae* (Linnaeus)	Defoliator/Cabbage butterfly	Major (Cruciferous vegetables: Cabbage, Cauliflower); Minor (Radish, Turnip)	Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; Bhatia & Verma, 1994; Bhatia and Verma, 1995; Bhatia & Gupta, 2003; Pandey et al., 2006; Badenes-Perez & Shelton, 2006
33.	*Pieris canidia Linnaeus*	Defoliator	Major (Cruciferous vegetables: Cabbage, Cauliflower)	Nair, 1970; Butani & Jotwani, 1984
		(13) Family: Plutellidae		
34.	*Plutella xylostella* (Linnaeus)	Leaf feeder/Leaf borer/ Diamond back Moth	Major (All Cruciferous crops: Cabbage, Cauliflower; Radish); Minor (Knolkhol)	Lefroy, 1909; Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; Rai, 1992; Bhatia & Verma, 1994; Bhatia & Verma, 1995; Devi & Raj, 1995; Chauhan et al., 1997; Rao & Lal, 1999; David, 2001; Capinera, 2001; Pandey et al., 2006; Badenes-Perez & Shelton, 2006
		(14) Family: Pterophoridae		
35.	*Sphenarches caffer* Zeller	Bud borer/ Plume Moth/ Pod Borer/ Leaf roller Pigeon pea, Snake gourd, Luffa spp.)	Major (Bottle gourd); Minor (Beans, Cowpea & Garden pea,	Lefroy, 1909; Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; David, 2001
		(15) Family: Saturniidae		
36.	*Actias selene* Hübner	Leaf feeder/Leaf eating caterpillar/ Moon moth	Minor (Drumsticks)	Fletcher, 1914; Butani & Jotwani, 1984; David, 2001
		(16) Family: Sphingidae		
37.	*Acherontia styx* Westwood	Leaf feeder/Leaf eating caterpillar/ Defoliator	Minor (Beans, Brinjal)	Fletcher, 1914; Nair, 1970; Butani & Jotwani, 1984; Gupta, 1990; David, 2001
38.	*Hippotion celerio* Linnaeus	Leaf feeder	Minor (Elephant's foot, Yam)	Nair, 1970; Butani & Jotwani, 1984

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