

New Insect Problems in Arid Ecosystem

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Abstract: Changes in cropping systems and introduction of unconventional crops in western Rajasthan over the past four decades have appreciably changed the pest complex. Insects with tendencies of polyphagy appear to have shifted their preferences. Seasonality of the appearance of scarab adults and damage by root grubs have changed due to introduction of canal irrigation in the region. Castor defoliator *Achaea janata* is now established as a severe pest of henna (*Lawsonia* spp.) and it also attacks senna (*Cassia angustifolia*). *Papilio polytes* and *P. demoleus* are recorded on *Aegle marmelos* and *Murraya koenigi*. Changes in the pestilence behavior of scarabs, accentuation of sucking pests and alternate hosts are discussed. Some other new records now reported include *Amblyrhinus poricollis* weevils on jujube; psylla *Diaphorina cardiae*, sphingids *Polypticus dentatus* and *Psilogramma menephron* on sebesten (*Cordia dichotoma*); *Maladera nathani* (grubs) on sweet potato; *Acaudaleyrodes rachipora* (= *citri*) on clusterbean; *Pachyrrhinadoretus* sp. beetles, coreid *Mirperus jaculus*, *Sogatella vibix*, chloropid *Anacamptoneurum obliquum* (maggots) on pearl millet, pseudococcid *Ferrisia virgata* on henna, *Cretonotus gangis* on mung bean and moth bean; and *Aphis craccivora* on clusterbean.

Key words: *Acaudaleyrodes rachipora*, *Achaea janata*, *Amblyrhinus poricollis*, *Anacamptoneurum obliquum*, *Maladera nathani*, *Diaphorina cardiae*, *Ferrisia virgata*, *Mirperus jaculus*, *Papilio polytes*, *Polypticus dentatus*, *Psilogramma menephron*, *Sogatella vibix*, clusterbean, henna.

Increasing human and livestock pressure in the Thar Desert of India has been a matter of concern for quite some time but there appears to be no amelioration in the situation. Denudation of forest cover, degradation or encroachment of common property resources or grasslands for agriculture and the introduction of canal and other sources of irrigation to meet the increasing demands of food and fodder have brought in immense ecological changes. Uvarov (1961) for the first time elucidated the impact of human activities on natural insect fauna turning into pests. Effect of the clearance of forests, immoderate grazing, opening of virgin lands for cultivation, abandoned and fallow lands, planted tree

components, and irrigation affect pestilence. Vyas (1996) gave an account of the changes in the incidence of different pests in Rajasthan. Verma (1999a) discussed the changes in pest status of different groups in changing arid ecosystem due to introduction of canal irrigation, landuse patterns, introduced plant species, input use, etc. This paper reports unusual pest activity and resurgence of new pests as a result of human intervention.

Material and Methods

Information generated from surveys in the arid regions of western Rajasthan, laboratory rearing of insects for identification and recording of observations

since 1977 has been compiled to give an overall picture of the changing scenario of insect pest complex in the area. New records of insect pests are also given.

Results and Discussion

Coleoptera

A list of new coleopteran pests recorded in arid zones of Rajasthan is given in Table 1. Introduction of jujube (*Ziziphus mauritiana*) as a commercial fruit crop and its incorporation in hortipasture systems has aggravated the problem of the scarabaeid *Holotrichia consanguinea* Blanchard. Scarabaeid grubs are an important faunal group in *Cenchrus* grasslands in arid regions and the problem of grubs in cultivated crops and the beetles in jujube has accentuated. Natural stands of *Ziziphus nummularia* in the pastures support grubs but not the adults of *H. consanguinea*. Extensive exploitation of these bushes as top-feed for livestock (particularly goats) and as fencing material has helped spread of the root grub problem. *Prosopis cineraria* used to be the most preferred host for adults of *H. consanguinea*. Now jujube has become the preferred host for the beetles. The grubs feed on grass and shrub roots. Verma (1999a) reported rutelid beetles *Anomala bengalensis* (Blanchard) and *Adoretus punjabensis* Arrow feeding on various hosts. *Pachyrrhinadoretus* sp. grubs have been reared from pearl millet roots and the adults are seen feeding on ears. Vyas (1996) reported frequent incidences of melolonthids *Apogonia uniformis* Blanchard and *Maladera ruficollis* (Blanchard) and the rutelid *Anomala ruficorphylla* Burmeister. As a result of canal irrigation and

introduction of new crops and cropping pattern in arid regions, peculiar changes in the seasonality of scarabaeids have been observed. Earlier, the grubs attacked only the rainy season crops and adult emergence was confined to the pre-monsoon or monsoon showers. The major melolonthid species have the same pattern of life cycle and activity. However, smaller species have distinct changes in their pattern of infestation and life cycle. Root grubs were never a problem in winter season but the smaller melolonthids (*Maladera* spp.) have now established as serious pests in onion.

In Jodhpur region, sweet potato roots were observed infested by root grubs *Maladera nathani* Frey. Promotion of groundnut as an oilseed crop in Bikaner region and elsewhere may pave a way for the tamarind beetle *Caryedon serratus* (Olivier) to establish on stored nuts.

Grubs of a buprestid *Chrysobothris parvipunctata* Oben. were reported attacking sapwood of *Holoptelea integrifolia* trees. Another buprestid, *Sternocera chrysis* Fabricius was recorded infesting the sapwood of *Salvadora persica* and the emergent adults feed on the foliage during April-May (CAZRI, 1995b). Activity of buprestid grubs as sapwood feeders appears to be on the increase. Grubs of unidentified cerambycid beetles are reported to cause mortality of established *P. cineraria* trees (CAZRI, 2001). However, there is lack of sufficient evidence to hold these beetles responsible for the mortality of well-established trees. It is believed that these insects are responsible for infections leading to mortality of the trees. Cerambycid *Derolus* spp. is known to attack *Acacia tortilis* and *A. senegal* and *Derolus*

Table 1. Record of some new coleopteran pests from arid zone of Rajasthan

Family	Species	Host	Reference
Bostrichidae	<i>Sinoxylum pugnax</i> Lesne	<i>A. albida</i> , <i>A. senegal</i> , <i>A.</i>	CAZRI, 1990
	<i>Sinoxylum indicum</i> Lesne	<i>tortilis</i> , <i>Prosopis cineraria</i>	
	<i>Calopertha truncatula</i> Ancave	as sapwood borers	
Bostrichidae	<i>Sinoxylum crassum</i>	<i>Acacia albida</i>	CAZRI, 1991
	<i>dekkanense</i> Lesne		
Bruchidae	<i>Bruchidius albizzae</i> sp. nova,	Leguminous tree pods	Vir and Verma, 1996
	<i>Br. andrewesi</i> Pic., <i>Br.</i>		
	<i>pygomaculatus</i> sp. nova,		
	<i>Bruchus bilineatopygus</i> Pic.,		
	<i>Callosobruchus prosopidis</i> sp. nova		
Buprestidae	<i>Chrysobothris parvipunctata</i>	<i>Holoptelea integrifolia</i>	CAZRI, 1995b
	Oben.	(Roxb.)	
Buprestidae	<i>Sternocera chrysis</i> Fabricius	<i>Salvadora persica</i>	CAZRI, 1995c
Cerambycidae	<i>Derolus discicollis</i> Gahon	<i>P. cineraria</i>	
Cetoniidae	<i>Protaetia terrosa</i> (Gory and Percheron)	Adults on clusterbean roots	Verma, 1998
Chrysomelidae	<i>Clytra succincta</i> Lacordaire	Adults on <i>Prosopis cineraria</i>	Verma, 1982
Curculionidae	<i>Amblyrhinus poricollis</i> Schönh	Jujube foliage	*
Curculionidae	<i>Atactogaster orientalis</i>	Mung bean, clusterbean	Verma and Saxena, 1987
Meloidae	<i>Cyaneolytta coerulea</i> Leuckart	Pearl millet, <i>P. cineraria</i> ,	Verma, 1980a; Vir and Verma, 1996
	<i>Cyaneolytta acteon</i> (Laporte)	<i>P. juliflora</i>	
Melolonthidae	<i>Autoserica nathani</i> Frey	Sweet potato	*
Melolonthidae	<i>Maladera insanabilis</i> Brenske	Many cultivated plants	Verma, 1999a
Ptinidae	<i>Gibbium psylloides</i> (Czenpinski)	<i>Convolvulus macrophylla</i> and <i>Cenchrus ciliaris</i> seeds	*Storage pest
Rutelidae	<i>Anomala bengalensis</i> (Blanch.)	<i>Lawsonia alba</i> , adults on foliage	Verma, 1999a
Rutelidae	<i>Pachyrrhinadoretus</i> sp.	Pearl millet (adults on ears)	*

*New pest record, being reported now

discicollis Gahon has been recorded on *P. cineraria*.

Unusual activity of the adults of cetoniid beetles *Protaetia terrosa* (Gory and Percheron) has been recorded to damage the roots of clusterbean plants (Verma, 1998). The diurnal adults are seen flying in the *Cenchrus ciliaris* grassland during late morning and noon hours. The damage

to aboveground grass biomass by the beetles, however, was not established. Obviously, preference of clusterbean over grasses exhibited by the beetle is an indication of the possibility of its becoming an important pest in due course. The chrysomelid *Clytra succincta* Lacordaire has been observed to feed exclusively on the foliage of *P. cineraria* (Verma, 1985).

Mylocerus spp. have a tendency of polyphagy. However, the black weevil *Cyrtozemia cognata* Marshall remains confined to, and is apparently successful only on grain legumes, especially clusterbean. Several bostrichids, particularly *Sinoxylum* spp. have been recorded damaging the sapwood of many leguminous agroforestry trees (CAZRI, 1990). *Mylocerus laetivirens* Marshall, a small greenish inconspicuous weevil, was recorded on millets (Verma, 1980a) and mung bean (Verma and Saxena, 1987). *Atactogaster orientalis* (Chevrolet), a medium size weevil, sporadic on clusterbean, was a new record on mung bean. From Jaipur region, Swaminathan and Verma (1991) reported *Xanthochelus faunus* (Olivier) damaging jujube leaves. After pruning, activity of weevils on newly sprouted foliage buds in jujube is at its peak during April to May, when other food sources are scarce. The dominant species of weevils on young sprouts after pruning in jujube is *Amblyrhinus poricollis* Schönh.

The meloid beetles generally affect only the flowers but *Mylabris* spp. also defoliate in the advanced stage of crop growth. Unusual incidence of *Cyaneolytta coerulea* Leuckart in the seedling stage of pearl millet is reported (Verma, 1980a, 1999a).

The unripe fruits of *Capparis decidua* are stored after indigenous method of processing: boiling and dressing with wood ash. The commodity remains free from all storage pests. However, recently, infestation by the anobiid beetle *Stegobium paniceum* (Linnaeus) has been observed at Jodhpur. Spider beetle *Gibbium psylloides* (Czenpinski) has been observed to occasionally infest stored medicinal plants

such as chaffed *shankhapushpi* (*Convolvulus macrophylla*) and seeds of *C. ciliaris* stored for 3 years.

Lepidoptera

After Coleoptera, Lepidoptera constitutes another large group exhibiting significant variations in host range and incidence. A list of new pests of the order recorded in arid regions is given in Table 2. The pierid butterfly *Catopsilia pomona* (Fabricius), reported by the author as a serious pest on *Cassia fistula* (CAZRI, 1995c) has since also been recorded on *Cassia angustifolia*, a relatively new crop in many parts of arid zone of Rajasthan (CAZRI, 2000). In 1999, several pests were found on senna crop and in the surveys during 2000 in the Sojat area, the crop was also found infested by a pyraustid caterpillar attacking flowers and young pods.

Papilio demoleus Linnaeus is a pest on citrus plants. However, in recent years, it has been noticed on *Aegle marmelos* and *Murraya koenigi* along with another species, *Papilio polytes* Linn. On *A. marmelos*, the infestation occurs during August to September on the top leaves of 1 to 3-year-old plants and 4 to 9 larvae plant⁻¹ have been observed (Table 3). Rearing during September-October 2000 established that the two species occur simultaneously. It is difficult to distinguish the two species in larval stage. However, *P. demoleus* larvae are faster in growth than *Papilio polytes*, although butterflies of the latter species are robust and larger than *P. demoleus*. In the present study, only 5% larvae reached adult stage, probably because of predation by lizards.

Table 2. Record of some new Lepidoptera pests from arid Rajasthan

Family	Family Species	Host	Reference
Arctiidae	<i>Cretonotus gangis</i> Linnaeus	Mung bean and moth bean	*
Carposinidae	<i>Meridarchis scyroides</i> Meyrick	Jujube fruits	CAZRI, 1999a
Cosmopterygidae	<i>Stemmatophora</i> sp.	<i>Tecomella undulata</i> foliage	Verma and Vir, 1995
Noctuidae	<i>Achaea janata</i> Linn.	Jojoba leaves Henna and senna leaves	Singh <i>et al.</i> , 1991 *
	<i>Helicoverpa (Heliothis) armigera (Hübner)</i>	Pearl millet ears	Verma, 1980a
	<i>Mythimna separata</i> (Walker)	Pearl millet foliage Chickpea	Verma, 1980a
	<i>Spodoptera litura</i> Boisduval	Mung bean, Sunflower, Pearl millet	
	<i>Othreis materna</i> Linnaeus	<i>Quisqualis indica</i> flowers	*Adults only
Oecophoridae	<i>Tonica zizyphi</i> Stainton	Jujube leaves	Verma, 1993
Papilionidae	<i>Papilio polytes</i> Linn. and <i>P. demoleus</i> Linn.	Bael (<i>Aegle marmelos</i>) leaves and curry leaf, <i>Murraya koenigi</i>	*
Pieridae	<i>Catopsilia pomona</i> (Fabricius)	Senna, <i>Cassia angustifolia</i>	CAZRI, 2000
Sphingidae	<i>Polypticus dentatus</i> (Cramer), <i>Psilogramma menephron</i> (Cr.)	<i>Cordia dichotoma</i>	*
Tortricidae	<i>Leguminivora (=Cydia) ptychora</i> (Meyrick)	Mung bean pods	Verma, 1986

*New pest record, now reported.

During August-September 2000, the presence of the adults of *Othreis materna* Linnaeus attracted on lights indicated a resurgence of these fruit-sucking moths as a new development in the Jodhpur region. So far, moths of only this species have been observed, but the possible presence of other species is not ruled out. The adults were seen up to the month of October. These pests are usually restricted to sub-humid regions in guava and citrus orchards. With the increase in orchards, following the canal irrigation, their area of activity appears to be increasing. Life history of these moths is not well established except that the caterpillars feed on

vegetation such as *Tinospora cordifolia*. Attempts of force oviposition by captive moths in laboratory did not succeed.

Helicoverpa (=Heliothis) armigera (Hübner) is a well-established fruit borer on tomatoes and chillies. This pest is known to exhibit diverse and changing patterns of host preference over time and area. Verma (1980a) reported it attacking the ears of pearl millet. Now *H. armigera* seems to be on an increase in cotton. The castor semilooper, *Achaea janata* Linnaeus is a specific defoliator of castor (*Ricinus communis*) and it also attacks several other hosts (Kavadia and Verma, 1973). Singh *et al.* (1991) apprehended it to become

Table 3. Incidence of *Papilio polytes* and *P. demoleus* on the foliage of young (<3 year-old) plants of *Aegle marmelos* at Jodhpur during September 2000

Plant No.	No. of larvae			Remarks	Pupa formed
	On leaf triplet	Total	Mean		
1	2, 1, 3, 0, 1	7.0	1.4	Mostly on top leaves	0
2	2, 2, 3, 1, 1	9.0	1.8	Mostly on top leaves	1
3	1, 1, 1, 0, 2	5.0	1.0	Mostly on mid leaves	0
4	2, 1, 3, 4, 3	13.0	2.6	Mostly on top leaves	0
5	1, 1, 0, 1, 1	4.0	0.8	Mostly on mid leaves	1

a major pest of jojoba (*Simmondsia chinensis*). The moths are serious fruit sucking pests on guava. However, in the semi-arid conditions of Pali district (around Sojat, Ranawas, Marwar) and in Jodhpur (around Bilara and Pipar city), the larvae are now established as almost regular and specific pests on henna (Table 4). Henna crop was introduced in the area some 35 or 40 years ago, but the problem of semilooper has cropped up only recently. Apparently, introduction of guava cultivation, supported by sporadic growing of castor plants alongside henna, appear to have encouraged the pest on its new host. Newly planted crop of henna is seriously damaged during July-August, frequently necessitating replanting.

The damage takes place in all types of henna crop (old as well as new plantations) and it continues up to September. The pest has several generations and the severe damage to leaves causes direct loss in foliage yield. Henna is grown in a traditional system of cultivation wherein use of chemicals such as fertilizers or pesticides has little place. During the last week of August 2000, the mean number of semiloopers on one-year-old henna plants at Sojat was 1.6 (range 0-4). At Bikaner, the larvae have been observed to damage

the foliage of senna (*Cassia angustifolia*) also.

Verma (1980a) reported *Mythimna separata* Walker in the whorls of pearl millet. Curiously, the live moths of the pea semilooper *Plusia orichalcea* Fabricius, a pest in winter season, were observed in the forenoon of April 23, 1999 at Geegasar (Bikaner). The area is unirrigated and the crops are grown with ingenious indigenous traditional knowledge called *Birani Badi* (dryland vegetable cultivation) using 0.5 L water for individual plants in 15 days.

The improved and high yielding varieties of jujube are regularly pruned to maintain bushy habit to facilitate harvest. Prostrate branches of such plants in orchards attract increased infestation by *Psorosticha (=Tonica) zizyphi* (Stainton) as a minor pest (Verma, 1993). Training of the plants to grow in bushy habit makes them prone to the attack of the bark-eating caterpillars, *Indarbela quadrinotata* Walker.

Tortricids as crop pests are rare in arid regions. The tortricid *Leguminivora (=Cydia) ptychora* (Meyrick) is a less known pod borer of mung bean, but 45% pods with 73% grain damage has been observed in mung bean grown as a companion crop with *Cenchrus* spp. The

Table 4. Henna growing areas with serious infestation of the crop by *Achaea janata*

Zone	Villages with light soils, good water	Villages with saline sodic soils, <i>telia</i> water
Marwar Junction	Somesar, Bhinwalia, Danta, Dhamli	Marwar Jn., Khairwa, Bithuda, Bhagwanpura, Dhakdi, Suraita, Bilawas, Dhinawas, Naga beri, Basni, Dhundawas, etc.
Sojat	Sojat road, Saaran, Siriari, Dadia, Rajamali, Phulad, Siyat, etc.	Raika ki Dhani, Basni, etc.
Jodhpur	Neda bera, Piplas, Devli, Atpada, Bilara, Bar, Piplia kalan, Raipur, Chandawal, Jaton ki Dhani, Charnon ki Dhani, Sinhad	Chadwas, Dhangadwas, Chamundia, Gaguda, Dhakli

incidence of the pest becomes negligible when mung bean is intercropped with pearl millet, in drought or low rainfall years (Verma, 1986). In storage, *Corcyra cephalonica* is an established pest on pearl millet. Its incidence on oilseeds and grain legumes such as cowpea is known in peninsular India. Therefore, the pest has a potential to establish on grain legumes such as mung bean and cowpea in arid regions as well.

On improved varieties of jujube, fruit fly has been the major concern of management. Although lepidopteran fruit borer *Meridarchis scyrodes* Meyrick (Family Carposinidae) has been reported from Jodhpur (CAZRI, 1999), it is not likely to establish as a regular or significant pest. Similarly, citrus leaf roller *Tonica zizyphi* also has not assumed any serious proportions (Verma, 1993). Verma and Vir (1995) reported *Stemmatophora* sp. as a shoot borer on *Tecomella undulata*.

Lefroy (1909) recorded *Polypticus dentatus* Cramer on *Cordia myxa*. At Jodhpur, occasional incidence of another sphingid *Psilogamma menephron* (Cramer) has been noted and the moths come on

light trap during July. Hairy caterpillars are usually polyphagous but on cultivated crops, only *Amsacta* spp. and *Pericallia ricini* Fabricius occur. Recently, sporadic infestation of mung bean and moth bean by *Cretonotus gangis* Linnaeus has been observed at Jodhpur. Infestation of grain legumes by this arctiid is preferred in weedy or millet intercropped fields. Lymantrid caterpillars have a tendency to occasionally show changed host preference, especially the *Euproctis* sp. Vyas (1996) reported the shift of *Euproctis* sp. from jujube to cowpea.

Hemiptera

A list of new sucking insect pests recorded from arid Rajasthan is given in Table 5. One of the dryland agriculture technologies is to minimize risk is agri-pasture system of strip cultivation of grasses with pulses. This system helped aphrophorid bugs (exclusive pests of grasses) to establish on several rainy season crops. Verma (1979) reported *Clovicia puncta* Walker on several hosts and Verma and Saxena (1987) recorded *Poophilus costalis* Walker on mung bean. Infestation of aphrophorids on crops has since been

observed in widespread areas in Bikaner, Nagaur, Jodhpur and Pali.

During August 2000, massive infestation by the mealy bug *Ferrisia virgata* Cockerel was found on henna plants at Sojat (district Pali). Earlier the pest was observed to occur and feed on established trees of guava at Mathania (Jodhpur). The bugs remained confined to branches and stems of guava. On henna plants also, the bugs were lodged usually on the main stem or shoots, up to 20 plant⁻¹, usually in groups of 2 to 3. The insects preferred shade and moved upward in the evening. When exposed to sun, downward movement was also noticed. Although the pest is well known for its polyphagy, its incidence on henna has not been recorded in this region earlier.

In rainfed areas, an increase in the incidence of sucking pests whiteflies and aphids is observed. Vir *et al.* (1991) enumerated 10 important aphid species occurring on 39 different plant species. *Macrosiphoniella sanborni* (Gillette) and *Uroleucon globorus* Matsumara were the new report from arid regions. Besides the common aphid *Brachyunguis calotropicus* Menon and Pawar, *Aphis nerii* was a new record on *Calotropis*. During 1999, widespread incidence of *Aphis craccivora* (Koch.) was recorded on clusterbean in Jaisalmer region. In IGNP area, Vyas (1996) reported *Rhopalosiphum rufiabdominalis* (Sasaki) on wheat.

White flies form another group with widespread infestation of grain legumes and leguminous trees. In a survey made in the year 1993, major spp. on citrus were *Acaudaleyrodes rachipora* (=citri) Singh and *Aleurocanthus* sp. *Acaudaleyrodes rachipora* was very prominent on *Prosopis*

juliflora while *Bemisia tabaci* Gennadius was common on *Jasminum* spp. (CAZRI, 1995b). Contrary to common conviction, the major species on grain legumes in arid regions is *Acaudaleyrodes rachipora* and not *Bemisia tabaci*. It also attacked *Cordia dichotoma*. The spotted aleyrodid *Neomaskellia bergii* (Signoret), a pest of sorghum and sugarcane is not common in arid areas but Verma (1980b) observed it infesting pearl millet at Daijar, Jodhpur. All the stages (eggs, nymphs and adults) occurred on the lower leaves of the plants.

On sebesten (*C. dichotoma*), a celebrated tree for its preserved fruits used as vegetable, the author recorded a psyllid *Diaphorina cardiae* Crawford in 1989 (CAZRI, 1991). The pest active from March to early December, the peak period being August-September. The pest is usually not a serious problem on naturally growing or unattended plants. In maintained orchards, where defoliation during December is a regular practice to obtain good yield of the fruits, psyllids start rapid multiplication from April to October (CAZRI, 2000). Besides sebesten, unidentified psyllids have also been reported to seriously infest *S. oleoides* and *S. persica* (CAZRI, 1995c). The probable species is *Euphyllura obsolata* (Mathur), earlier reported on this host (Mathur, 1975).

Mustard painted bug is variously referred to as *Bagrada hilaris* (Burmeister), *Bagrada cruciferarum* (Kirkaldy) and *Bagrada picta* Kirkaldy. The bug is known for its host cross over to cereals including pearl millet (Verma, 1980a) and groundnut (Vyas, 1996). *Cleome gynandra* and *C. viscosa* are the off-season weed hosts of the bug (CAZRI, 1997). *Stenogyzum pseudo-*

Table 5. Record of some new sucking pests (Hemiptera) from arid Rajasthan

Family	Species	Host	Reference
Aleyrodidae	<i>Acaudaleyrodes rachipora</i> (=citri) Singh	Clusterbean, <i>sebesten</i> , <i>Prosopis juliflora</i>	* CAZRI, 1995b
	<i>Aleurocanthus citripedes</i>	Citrus plants	CAZRI, 1995b
	<i>Neomaskellia bergii</i> (Sign.)	Pearl millet	Verina, 1980b
	<i>Diaphorina cardiae</i> Crawford	<i>Cordia dichotoma</i>	CAZRI, 1991
Aphalaridae	<i>Diaphorina cardiae</i> Crawford	<i>Cordia dichotoma</i>	CAZRI, 1991
Aphidae	<i>Aphis craccivora</i> (Koch.)	Clusterbean	
	<i>Macrosiphoniella sanborni</i> Gill.	<i>Chrysanthemum</i> sp.	Vir et al., 1991
	<i>Rhopalosiphum ruftabdominalis</i> (Sasaki)	Wheat	Vyas, 1996
	<i>Uroleucon globorus</i> Matsumara	<i>Lablab purpureus</i>	Vir et al., 1991
Aphrophoridae	<i>Clovio puncta</i> (Walk.)	Most rainy season crops	Verma, 1979
	<i>Poophilus costalis</i> Walk.	Many cultivated plants	Verma and Saxena, 1987
Coreidae	<i>Clavigralla scutellaris</i> (Westwood)	Pigeon pea	Verma and Henry, 2003
	<i>Cletus signatus</i> Walker, C. sp.	Pearl millet	Verma, 1980b
	<i>Homoeocerus signatus</i> Walk.	<i>Acacia senegal</i> , <i>A. nilotica</i>	CAZRI, 1998
	<i>Mirperus jaculus</i> (Thunberg)	Pearl millet ears	*
Delphacidae	<i>Sogatella vibix</i> Haupt {=S. <i>longifurcifera</i> (Es. and Ish.)}	Pearl millet	*
Diaspididae	<i>Parlatoria blanchardi</i> (Targ.)	Date palm	Sachan, 1976
Lygaeidae	<i>Spilostethus</i> (=Lygaeus)	<i>Murraya koenigi</i> ,	*
	<i>pandurus</i> (Scopoli)	<i>Quisqualis indica</i>	
Pentatomidae	<i>Bagrada hilaris</i> (Burmeister) = <i>B. cruciferarum</i> (Kirkaldy)	<i>Cleome gynandra</i> , C. <i>viscosa</i>	CAZRI, 1996
		Groundnut	Vyas, 1996
Pentatomidae	<i>Stenogyzum pseudospeciosum</i> Ghuri	<i>Capparis decidua</i> shoot and fruits	CAZRI, 1995a
	<i>Ferrisia virgata</i> Walker	Henna (<i>Lawsonia</i> spp.) stem	*
Psyllidae	<i>Euphyllura obsolata</i> (Mathur)	<i>Salvadora</i> spp.	Mathur, 1975
	<i>Diaphorina cardiae</i> Crawford	<i>Cordia dichotoma</i> *	*
Tingidae	<i>Cochlochila bullita</i> (Stål)	Sacred basil	CAZRI, 1990

*New pest record, being reported now

speciosum Ghauri is another pentatomid bug, which attacks shoots and fruits of *Capparis decidua* (CAZRI, 1995a). On

sacred basil, a tingid bug *Cochlochila bullita* severely damages the leaves during July to October.

Coreid bugs are common in rainy season and feed on a variety of plants. Verma (1980a) reported *Cletus signatus* on pearl millet and, *Homoeocerus signatus* Walker on *Acacia senegal* and *A. nilotica* (CAZRI, 1998). Occasionally, the coreid *Mirperus jaculus* (Thunberg) has been observed to occur on pearl millet ears since 1977. *Sogatella vibix* Haupt {=*S. longifurcifera* (Es. and Ish.)} is a new delphacid recorded feeding on pearl millet leaf whorl. The pest is most active during August (15-25 per whorl) and the numbers go down by the first week of September. During 1987-88, the author noticed heavy infestation of pigeon pea flowers and pods by *Clavigralla scutellaris* (Westwood) at CAZRI, Jodhpur. Vyas (1996) reported *C. gibbosa* Spinola on pigeon pea from canal command areas of Indira Gandhi Nahar Pariyojna (IGNP) in western Rajasthan.

Spilostethus (= *Lygaeus*) *pandurus* (Scopoli), a pest of cucurbits, reported on pearl millet (Verma, 1980a) occurs on several plants. During 1999-2000 its incidence was noted on several garden plants such as *Quisqualis indica*. Another lygaeid, *Elasmolomus sordidus* (Fabricius), a specific pest of sesame has shown resurgence in 1998 and the bugs are observed to occur on pearl millet as well.

Other groups

Records of new insect pests belonging to orders Diptera, Hymenoptera, Isoptera and Orthoptera are given in Table 6. Anthomyiid flies are present in the arid ecosystem but not as phytophagous pests, except under pecuniary circumstances. A change in cropping pattern or components is likely to bring them to the forefront.

For example, introduction of proso millet as a crop in Jodhpur caused a regular incidence of *Atherigona miliaceae* Malloch as a major pest damaging ears of the crop (Verma, 1988) between 1981-1987. Abandoning the crop resulted in disappearance of the pest since no other crop supports this species. In Pali region, sporadic incidence of *Atherigona soccata* Rondani on late-sown sorghum is known.

In good rainfall years, the incidence of chloropid fly *Anacamptoneurum obliquum* Becker has been observed by the author on pearl millet. The maggots develop on developing grains and flowers, particularly in varieties that have flag leaf partly covering the ears. Kumar and Kumar (1996) reported another chloropid fly *Pachyloptus rufescens* (de Meijere) from Jodhpur region.

Grasshopper fauna are primarily associated with pastures but bringing such lands into cultivation results in an unusual increase in their numbers on shrinking grasslands. Depletion of food in natural niche by overgrazing leads to increase in the grasshopper populations. Tendencies of swarming and migration develop in otherwise resident populations. In the semi-arid region of Pali, night swarming of macropterous adults of *Hieroglyphus nigrorepletus* Bolivar has been observed (Verma, 1999b).

Poecilocerus pictus (Fabricius) is an oligophagous grasshopper, which seldom infests economic plants. As a result of decline in the intensity of its natural host (*Calotropis* sp.), reports of *P. pictus* infestation on plants of economic importance are there (COPCR, 1982).

Table 6. Some new flies, wasps and termites recorded in arid Rajasthan

Family	Pest	Host	Reference
Diptera			
Anthomyiidae	<i>Atherigona miliaceae</i> Malloch	Proso millet	Verma, 1988
Cecidomyiidae	<i>Lobopteromyia</i> (=Contarinia) <i>prosopidis</i> (Mani)	<i>Prosopis cineraria</i> leaf rachis	CAZRI, 1995a
Chloropidae	<i>Anacamptoneurum obliquum</i> Becker	Pearl millet ears	*
Chloropidae	<i>Pachyloptus rufiscens</i> (de Meijere)		Kumar and Kumar, 1996
Hymenoptera			
Chalcidae	<i>Pediobopsis</i> sp.	<i>Prosopis cineraria</i> branches	CAZRI, 1990
Isoptera			
Termitidae	<i>Psammotermes rajasthanicus</i> Roonwal and Bose	<i>Tecomella undulata</i>	CAZRI, 1995a
Orthoptera			
Pyrgomorphidae	<i>Poekilocerus pictus</i> (Fabricius)	Several garden plants	Verma, 1998
		<i>Acacia bivenosa</i>	Vir and Verma, 1996
Gryllotalpidae	<i>Gryllotalpa orientalis</i> (=fossor) Burmeister	Seedlings of ornamental annuals	*

*New pest record, now reported.

Verma (1998) recorded several new hosts of this grasshopper but its occurrence on pearl millet or other arable crops has not been recorded. Vyas (1996), however, reported its occurrence on mung bean and paddy in canal command areas of western Rajasthan.

Uvarov (1961) discussed the effect of irrigated cultivation on the increased activity of desert cricket, *Acheta domesticus* (Linnaeus) as a pest on oilseeds and grain crops in Pakistan. Damage to establishing field crops, even rainy season crops, by field crickets has also been observed since early eighties in the arid western Rajasthan. During 1999 and 2000, a sudden appearance of field crickets in large numbers even in urban areas has been observed. In irrigated lands, mole cricket *Gryllotalpa orientalis*

(=fossor) Burmeister, earlier reported by Bhargava (1996) has been observed to damage seedlings of ornamental annuals around Jodhpur. Activity of unidentified smaller arthropods on the surface soil of lawns and gardens in Jodhpur since October 2000 is a conspicuous phenomenon.

Rohida (*Tecomella undulata*), teak of the desert is believed to be free from termite damage. *Psammotermes rajasthanicus* Roonwal and Bose has been reported infesting this tree (CAZRI, 1995a). Besides mites and cecidomyids, a chalcid *Pediobopsis* sp. was found to induce galls on the branches of *P. cineraria* (CAZRI 1990).

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References

- Bhargava, R.N. 1996. Grylloid fauna of Thar Desert. In *Faunal Diversity in the Thar Desert: Gaps in Research* (Eds. A.K. Ghosh, Q.M. Baqri and I. Prakash), pp 151-154. Scientific Publishers, Jodhpur.
- CAZRI 1990. *CAZRI Annual Report 1988-89*. Central Arid Zone Research Institute, Jodhpur.
- CAZRI 1991. *CAZRI Annual Report 1989-90*. Central Arid Zone Research Institute, Jodhpur.
- CAZRI 1995a. *CAZRI Annual Report 1992-93*. Central Arid Zone Research Institute, Jodhpur.
- CAZRI 1995b. *CAZRI Annual Report 1993-94*. Central Arid Zone Research Institute, Jodhpur.
- CAZRI 1995c. *CAZRI Annual Report 1994-95*. Central Arid Zone Research Institute, Jodhpur.
- CAZRI 1997. *CAZRI Annual Report 1996-97*. Central Arid Zone Research Institute, Jodhpur.
- CAZRI 1998. *CAZRI Annual Report 1997* (Eds. S.K. Verma, D. Kumar and N.L. Joshi). Central Arid Zone Research Institute, Jodhpur.
- CAZRI 1999. *CAZRI News* 4(1&2): 2-3. Central Arid Zone Research Institute, Jodhpur.
- CAZRI 2000. *CAZRI Annual Report 1999* (Eds. S.K. Verma, A. Kar and N.L. Joshi). Central Arid Zone Research Institute, Jodhpur.
- CAZRI 2001. *CAZRI Annual Report 1999* (Eds. Pratap Narain, M.P. Singh, Nisha Patel, Praveen Bhatnagar and Dinesh Mishra). Central Arid Zone Research Institute, Jodhpur.
- COPCR 1982. *The Locust and Grasshopper Agricultural Manual*. Centre of Overseas Pest Research, London.
- Kavadia, V.S. and Verma, S.K. 1973. *Quisqualis indica* and *Dodonea viscosa* as new hosts of castor semilooper, *Achaea janata* L. *Journal of Bombay Natural History Society* 70: 226-227.
- Kumar, S. and Kumar, S. 1996. Diptera fauna of the Thar desert. In *Faunal Diversity in the Thar Desert: Gaps in Research*. (Eds. A.K. Ghosh, Q.M. Baqri and I. Prakash) pp. 241-251. Scientific Publishers, Jodhpur.
- Kushwaha, K.S. and Bhardwaj, S.C. 1977. *Forage and Pasture Insect Pests of Rajasthan*. Indian Council of Agricultural Research, New Delhi.
- Lefroy, H.M. 1909. *Indian Insect Life*. Today & Tomorrows Publishers, New Delhi (1971 print). xii + 786 p.
- Mathur, R.N. 1975. *Psyllidae of the Indian Subcontinent*. ICAR, New Delhi. 429 p.
- Sachan, J.N. 1976. Insect pests of date palm in western Rajasthan. *Entomologists Newsletter* 6: 36.
- Singh, M.P., Vir, S. and Verma, S.K. 1991. Castor semilooper and other insect pests on jujube in the arid regions of Rajasthan. *Transactions of Indian Society of Desert Technology* 16: 105-106.
- Swaminathan, R. and Verma, S.K. 1991. Relative foliar damage by *Xanthochelus superciliosus* (Coleoptera: Curculionidae) in jujube cultivars. *Annals of Arid Zone* 30: 73-74.
- Uvarov, Boris 1961. Insect hazards in land development. *Span* 4: 154-157.
- Verma, S.K. 1979. Incidence of spittlebug, *Clovira puncta* Walk. (Aphrophoridae: Hemiptera) on kharif crops in arid zones of Rajasthan. *Bulletin of Entomology* 20: 119-121.
- Verma, S.K. 1980a. Field pests of pearl millet in India. *Tropical Pest Management*. 26: 13-20.
- Verma, S.K. 1980b. Occurrence of the spotted aleyrodid *Neomaskellia bergii* (Sign.) on pearl millet. *Annals of Arid Zone* 19: 171-172.
- Verma, S.K. 1985. The leaf beetle, *Clytra succincta* on *Prosopis cineraria*. *FAO Plant Protection Bulletin* 33: 123-124.
- Verma, S.K. 1986. *Cydia ptychora* (Meyrick) [Tortricidae: Lepidoptera] as a pod borer of mung bean in Rajasthan. *Annals of Arid Zone* 25: 89-91.
- Verma, S.K. 1988. Incidence of *Atherigona miliaceae* (Diptera: Anthomyiidae) on proso millet in Rajasthan. *Indian Journal of Agricultural Sciences* 58: 414-415.
- Verma, S.K. 1993. Biology of *Tonica zizyphi* Stainton on jujube (*Ziziphus mauritiana* Lamk.). *Annals of Arid Zone* 32: 179-181.
- Verma, S.K. 1998. Incidence of *Poeciloceris pictus* (Pyrgomorphidae: Orthoptera) on some new hosts in arid western Rajasthan. *Entomon* 23: 233-234.

- Verma, S.K. 1998. *Protaetia terrosa* (Cetoniidae: Coleoptera) beetles attacking roots of clusterbean (*Cyamopsis tetragonoloba*). *Annals of Arid Zone* 37: 103-104
- Verma, S.K. 1999a. Changing status of insect pests in arid environment of western Rajasthan. In *Management of Arid Ecosystem* (Eds. A.S. Faroda, N.L. Joshi, S. Kathju and Amal Kar) pp 61-68. Arid Zone Research Association of India, and Scientific Publishers, Jodhpur.
- Verma, S.K. 1999b. Incidence of phadka grasshopper, *Hieroglyphus nigrerepletus* in arid western Rajasthan. *Annals of Arid Zone* 38: 191-192.
- Verma, S.K. and Henry, A. 2003. Incidence and Intensity of *Clavigralla scutellaris* on Pigeonpea Varieties in Western Rajasthan. In *Advances in Arid Legumes Research* (Eds. A. Henry, D. Kumar and N.B. Singh), pp. 470-473. Indian Arid Legumes Society and Scientific Publishers (India), Jodhpur.
- Verma, S.K. and Saxena, R.C. 1987. Pest complex of mung bean in India. *Annals of Arid Zone* 26: 67-85.
- Verma, S.K. and Vir, S. 1995. Field insect pests of *Rohida* (*Tecomella undulata*) in arid zones of Rajasthan. *Annals of Arid Zone* 34: 51-55.
- Vir, S. and Verma, S.K. 1996. Insect pests of agroforestry leguminous trees in India. *Annals of Arid Zone* 35:349-359.
- Vir, S., Verma, S.K. and Singh, M.P. 1991. Important aphid species in the arid zones of Rajasthan. *Annals of Arid Zone* 30: 79-80.
- Vyas, H.K. 1996. Insect pests in Indira Gandhi Canal region of the Thar desert. In *Faunal Diversity in the Thar Desert: Gaps in Research* (Eds. A.K. Ghosh, Q.M. Baqri and I. Prakash), pp. 203-213. Scientific Publishers, Jodhpur.