

Biological Sciences Section

Pakistan J. Sci. Ind. Res., Vol. 20, No. 2, April 1977

STUDIES ON THE GRASSHOPPERS OCCURRING IN THE GRASSLANDS AND THEIR NATURAL ENEMIES IN PAKISTAN *

MOHAMMAD IRSHAD, M.A. GHANI and REHMAT ALI

Commonwealth Institute of Biological Control, Pakistan Station, Rawalpindi

(Received February 21, 1977, revised April 12, 1977)

Abstract: The population, behaviour and phenology of the important species of grasshoppers in the foot hills and the host records, distribution and the natural enemies in the northern hills and plains are studied.

Grasshoppers occur in large numbers in the grasslands causing serious damage and their importance as pests of grasses has been recognized by many workers. Wilson⁶ reported *Melanoplus atlanticus* Riley and *Camnula pellucida* Scudder to destroy 25--60% tender grasses while Nerney⁴ estimated that *Melanoplus* spp. caused a loss of 23% and 30% in the perennial and annual grasses, respectively in the U. S. A. Key³ found *Oedaleus australis* Sauss to swarm and damage in Eastern Australia. Bhatia and Ahlawalia¹ recorded *Oedaleus senegalensis* Kraus causing severe damage to pastures in India.

Some times grasshoppers found in the pastures and grasslands become source of infestation of cultivated crops by migrating to crops when grasses are not available for food. Joyce² found *Catantops axillaris* (Thunb), *C. joyce* Dirsh, *Eyprepocnemis noxius* Dirsh and *Aiolopus savigny* to migrate to sorghum and other fields when the grasses become dry. Similar behaviour was reported by Treherne⁵ for grasshoppers of Australian grasslands.

In Pakistan, no work has been done on acridid, found in the pastures. Similarly their natural enemies have also not been studied. In view of their importance, population behaviour of important species in the foot-hills was mainly studied during 1972-73 along with host records, distribution and natural enemies in the northern hills and plains (Appendix).

Results

A total of 25 species of grasshoppers were found in the grasslands. Of these 13 occurred regularly while others were casual visitors. Grasshoppers were collected both sitting and feeding on different host plant. However, measurement of feeding on each plant species was not undertaken.

A. Grasshoppers

Grasshoppers were collected through sweeping per 15 min by a standard collection net and were replicated four times. Collection of each replicate was transferred into plastic bags; afterwards their nymphal and adult population counted. The grasshoppers are discussed below in order of their importance.

1. *Stenohippus* sp.

Distribution and Hosts. It occurred in all the surveyed localities on *Arachis hypogoea*, *Cynodon dactylon*, *Desmostachya bipinnata*, *Dichanthium annulatum*, *Echinochloa* sp., *Medicago denticulata*, *Medicago sativa*, *Pisum sativum*, *Saccharum officinarum*, *Sesbania aculeata*, *Sorghum halepense*, *Sorghum sudanense*, *Trifolium alexandrinum*, *Triticum aestivum*, *Typha* sp. and *Zea mays*. It is a major pest of wild grasses and was more abundant in places where large stretches of uncultivated land were available. Foot-hills had higher populations than other areas.

Population Behaviour and Phenology. In the foot-hills, its peak population of 628 adults and nymphs per man hour occurred in August (Fig.) and decreased in September and October (414 and 439), but again increased in November and December (590 and 610). The later increase was apparently due to emergence of nymphs from some egg-pods. Thereafter, the population again declined ranging between 76 and 242 as a result of mortality due to low temperatures.

It has two complete and partial third generation in the foot-hills and overwintered in all stages. The eggs hatched in May; adults formed in June, oviposition commenced a month later and hatching of 2nd generation eggs occurred in August and adults were present by September. These adults began to oviposit in October and most of them died after laying eggs. Nymphs emerging in November from early laid eggs together with the few remaining adults of second generation and the unhatched eggs comprised the carry over population to the next season.

2. *Oedaleus abruptus* Thunb

Distribution and Hosts. This remained confined to the northern hills, foot-hills and plains and attached *A. hypogoea*, *C. dactylon*, *Cyperus rotundus*, *D. bipinnata*, *D. annulatum*, *Echinochloa* sp., *M. denticulata*, *Oryza sativa*, *Phaseolus mungo*, *Sorghum* sp., *S. halepense*, *S. sudanense*, *T. aestivum* and *Z. mays*. It was more abundant on grasses than cultivated crops, damaging the former considerably.

Population Studies and Phenology. In the foot-hills its peak population was 350 during September declining thereafter to 182 in October and 118 in

*This research has been financed in part by a grant made by the US Department of Agriculture under PL-480.

APPENDIX. ALTITUDE, TEMPERATURE AND RAINFALL OF THE REPRESENTATIVE LOCALITIES IN THE VARIOUS ECOLOGICAL ZONES.

Ecological zones	Collection locality	Height in meters	Mean annual temp. (°C)	Average precipitation (mm)
Northern hills	Ghari Dopatta	1300	17	1730
	Ghari Habibullah	1200	—	—
	Mingora	1000	18.5	950
	Madyan	1500	—	—
Foot-hills	Rawalpindi	500	21.5	920
Plains	Sialkot	250	23.3	809
	Sahiwal	150	25.2	255

November (Fig.). The population was low during winter, ranging between 2 and 36. Its phenology is almost similar to that of *Stenohippus* sp. with the exception that partial hatching of eggs in November does not occur and thus it completed only two generations a year.

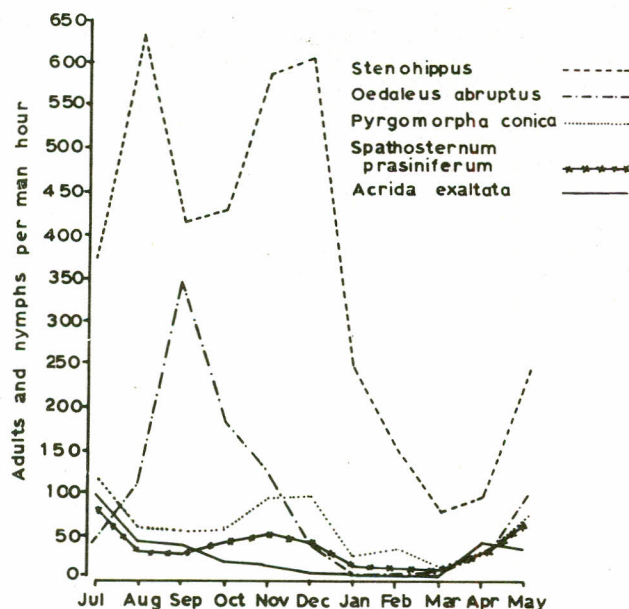


Fig. 1. Population trends of important grasshopper species in grasslands of the foothills during July 1972—May 1973.

3. *Pyrgomorpha conica* B.-B.

Distribution and Hosts. This has been collected from *Avena sativa*, *C. dactylon*, *C. rotundus*, *D. annulatum*, *M. sativa*, *P. sativum*, *S. sudanense*, *S. halepense*, *T. alexandrinum*, *T. aestivum*, *Typha* sp. and *Z. mays* and is widely distributed in Pakistan. It is a minor pest of grasses.

It was less abundant than *Stenohippus* sp. and *O. abruptus*; maximum population being 120 in July in the foot-hills (Fig.). It declined thereafter (56) and remained almost the same till October. In November and December the population again increased to 90-94, probably due to hatching of some egg-

pods. In winter its population was low, varying between 9 and 32.

4. *Spathosternum prasiniiferum* Wlk.

Distribution and Hosts. Its hosts in all the surveyed localities included *A. hypogoea*, *A. sativa*, *Brassica campestris*, *C. dactylon*, *C. rotundus*, *D. bipinnata*, *D. annulatum*, *M. denticulata*, *M. sativa*, *O. sativa*, *S. halepense*, *S. sudanense*, *T. alexandrinum*, *T. resupinatum*, *T. aestivum* and *Z. mays*. It is a minor pest of grasses.

In the foot-hills its highest population of 84 was found in July which declined to 30 in August and 26 in September (Fig.) presumably due to its shifting to nearby crops. It again increased to 40 and 50 during October and November, respectively: the increase probably could be due to return of the grasshoppers from the crops which were either mature or had been harvested.

5. *Acrida exaltata* Wlk. 6. *Acrida* sp. 7. *Truxalis grandis* Dirsh.

Distribution and Hosts. These are widely distributed in Pakistan and attacked *A. hypogoea*, *C. dactylon*, *D. annulatum*, *D. bipinnata*, *Echinochloa* sp., *Gossypium* sp., *M. denticulata*, *M. sativa*, *O. sativa*, *P. sativum*, *S. officinarum*, *S. halepense*, *S. sudanense*, *T. alexandrinum*, *T. aestivum* and *Z. mays*. These were comparatively more abundant on cultivated crops rather than on wild grasses but could only be regarded as minor pests of maize, sorghum, wheat and rice.

Phenology. These are univoltine species, overwintering in the egg and nymphal stages. In the foot-hills, the overwintered eggs hatched in April; adults formed in September and oviposition commenced a month later while the overwintered nymphs became adults in July and oviposited in August-September. Some of the eggs hatched and passed winter as nymphs,

8. *Trilophidia annulata* Thunb., 9. *Acrotylus humbertianus* Sauss.

Distribution and Hosts. These are widely distributed in Pakistan and were collected from *A. sativa*,

A. hypogoea, *B. compestris*, *Cicer arietinum*, *C. dactylon*, *D. bipinnata*, *O. sativa*, *P. mungo*, *P. sativum*, *S. officinarum*, *S. halepense*, *S. sudanense*, *T. alexandrinum*, *T. resupinatum*, *T. aestivum* and *Z. mays*.

These are eurythermal, geophilous species being more numerous on grasses but causing light damage to them.

Biology.—*T. annulata* preferred to oviposit on selected, moist bare spots on 'bunds' (artificial embankment in the field) laying on average 22 eggs in a pod. Eggs hatched in 16-29 days at 31°. Nymphal development at 23° ± 4 was completed in 75-128 days (average 109).

10. *Chrotogonus trachypterus* Blanch.

Genus *Chrotogonus* is widely distributed in Africa and Asia and contains a number of species. In Pakistan, it is represented by *C. trachypterus*. This species is widely distributed in Pakistan and was found on *C. dactylon*, *T. aestivum*, *Z. mays* *Gossypium* sp., *A. hypogoea*, *D. annulatum*, *P. typhoides*, *S. sudanense*, *S. halepense*, *S. officinarum* and *T. alexandrinum*. It is geophilous species and mainly fed on *C. dactylon*. It mostly occurs on bare soil, in fallow fields, newly sown or among grasses.

11. *Aiolopus thalassinus* (F).

This occurred on *T. aestivum*, *Z. mays*, *S. sudanense*, *S. halepense*, *A. sativa*, *A. hypogoea*, *C. arietinum*, *C. dactylon*, *D. bipinnata*, *D. annulatum*, *Gossypium* sp., *Echinochloa* sp., *M. sativa*, *P. typhoides*, *P. sativum* and *S. officinarum*.

Z. mays. It was more abundant in the hills and foot-hills.

13. *Chorthippus* sp. nr. *indicus* Uv.

It was restricted to the hills and foot-hills and was collected from *C. dactylon*, *D. bipinnata*, *D. annulatum*, *S. halepense*, *S. sudanense*, *T. aestivum* and *Z. mays*. Its population was high in the grasslands than other habitat.

Aiolopus simulatrix (Wlk.), *Aiolopus strepens* Ltr., *Atractomorpha acutipennis* (Guer.), *Aulacobothrus* sp., *Calliptamus barbarus* (Costa), *Chloebora grossa* Sauss, *Phlaeoba panteli* (I. Bol), *Pyrgomorpha conica* B.B., *Pyrgomorpha* sp., *Sphingonotus kashmirensis* Uv., *Sphingonotus longipennis* Uv., *Trilophidia ccuturbata* (Wlk.) were also found casually in the grasslands with low population.

B. Natural Enemies

(a) **Egg Parasites.** Six species of *Scelio* have been reared from the grasshoppers occurring in the grasslands. (Table 1). This data shows that *Stenohippus* sp. and *A. thalassinus* were parasitized by 5 and 2 species respectively while *S. parasiniferum* and *C. trachypterus* by one species each. Incidence of parasitism on *Stenohippus* sp. was high in the plain than the foot-hills, while for others, no comparative figures are available.

(b) **Adult and Nymphal Parasites.** Only Mermithids were recorded as internal parasites and they too mostly during raining season (Table 2).

Leptus sp. (Erythraeidae) was also collected as external parasite of *O. abruptus*. *Duroniella* sp., *A.*

TABLE 1. INCIDENCE OF PARASITISM BY *Scelio* SP. ON VARIOUS GRASSHOPPERS DURING 1970-74.

Grasshopper species	Zone	No. of egg pods examined	% Parasitized by					
			<i>Scelio aegyptiacus</i> Priesner	<i>Scelio</i> sp. nr. <i>serdanensis</i> Timb.	<i>Scelio</i> sp. <i>trisis</i> Nixon	<i>Scelio</i> sp. nr. <i>popovi</i> Nixon	<i>Scelio</i> sp. 1	<i>Scelio</i> sp. 2
<i>Stenohippus</i> sp.	Foot-hills	275	0.3	0.9	3	—	0.3	3.0
	Plains	24	17	—	—	7	—	—
<i>S. prasiniferum</i>	Foot-hills	51	—	—	5	—	—	—
	Northernhills	553	7	—	3	—	—	—
<i>A. thalassinus</i>	Foot-hills	53	—	—	10	—	—	—
	Plains	23	—	—	—	4	—	—
<i>C. trachypterus</i>	Foot-hills	30	—	—	7	—	—	—

It lays eggs both in the field and on 'bund' preferably in moderately moist sandy loam soil. Each egg-pod contained 12-21 eggs and these hatched after 17-23 days at 30°. Post-embryonic development consisting of 5 or 6 instars is completed in 29-39 days (average 33) at 24° ± 2.

12. *Duroniella* sp.

It was found all over Pakistan on *A. hypogoea*, *C. dactylon*, *D. annulatum*, *D. bipinnata*, *Echinochloa* sp., *M. sativa*, *S. halepense*, *S. sudanense*, *Sorghum* sp., *T. alexandrinum*, *T. resupinatum*, *T. aestivum* and

acutipennis, *P. conica*, *T. annulata* and *C. trachypterus*. This mite did not kill the grasshoppers, however, heavily attacked hosts could not fly well.

Discussion and Conclusions

Of the acridids in the grasslands, only *Stenohippus* sp. and *Oedaleus abruptus* seem to be significant as they were quite abundant and mostly fed on grasses. Their maximum population was recorded during August, September when the grasses were quite abundant. *Pyrgomorpha conica* and *Spathosternum prasiniferum* fed on grasses as well as crops, moreover,

TABLE 2. INCIDENCE OF MERMITHIDS ON GRASSHOPPERS DURING 1971-72.

Grasshopper species	Month and year	N. hills		Foot-hills		Plains	
		No. of grasshoppers	% parasitized	No. of grasshoppers	% parasitized	No. of grasshoppers	% parasitized
<i>Stenohippus</i> sp.	Aug 71	100	—	2225	—	463	3
<i>O. abruptus</i>	Jul 71	323	1	1313	—	255	—
	Aug 71	125	—	2957	—	349	5
<i>S. prasiniferum</i>	Jun 71	730	5	237	—	335	—
<i>A. humbertianus</i>	Jul 71	125	—	297	33	97	—
	Aug 71	90	—	154	4	57	6
	Aug 72	112	—	159	1	15	—
<i>A. thalassinus</i>	Jul 71	211	—	577	—	69	1
<i>C. trachypterus</i>	Nov 72	87	—	247	1	135	—

their population was comparatively low. Other recorded species were either casual visitors of the grasses or their population was insignificant to cause any appreciable damage.

Importance of grasshoppers lies in the hilly areas where grasses as fresh plant and dried (hay) are important food of cattle.

Natural enemies of these grasshoppers are scanty and only egg-parasites seem to be of some value. In spite of 6 recorded species of *Scelio* from 4 grasshopper hosts, their overall contribution in acridid control seems insignificant. *Scelio* sp. *tristis* on *Aiolopus thalassinus* in the foot-hills showed some higher parasitism and may prove good biocontrol agent. Among adult and nymphal parasites only the mermithids are comparatively abundant and that too in wet season.

References

1. D.R. Bhattia and P.J.S. Ahlawalia. *Oedaleus*

senegalensis Kraus, (Orthoptera: Acrididae subfamily Oedipodinae Plague in Rajasthan. Pl. Prot. Bull. 10 New Dehli, Rev. Appl. Entomol. (A) 59, 24 (1971).

2. R.J. V. Joyce. The Ecology of Grasshoppers in East Central Sudan. Anti Locust Bull. No. 11.97. Rev. Appl. Entomol., (A) 40, 259 (1952).
3. K.H.L. Key. The Regional and Seasonal Incidence of Grasshopper Plague in Australia. Coun. Sci. Industr. Res. Australia Bull. 47. pp. 87 Rev. Appl. Entomol., (A) 26, 583 (1938).
4. N.J. Nerney. Grasshoppers Damage on Short-Grass Rangeland of the San Carlos. Apache Indian Reservation Arizona. J. Econ. Ent., 53, 4, 640-646 Rev. Appl. Entomol., (A), 49, 37, (1961).
5. R.C. Treherne. The Grasshoppers and the Range. Agri. J. Victoria B. C., 6, 8, Rev. Appl. Entomol., (A) 9, 603-4. (1921).
6. H. F. Wilson. Grasshoppers in Oregon. 133-136. Rev. Appl. Entomol., (A), 3, 262 (1915).