Diversity of Coleopterans in Two Different Sites of Alukkal Village, Malappuram District, Kerala

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Abstract

Beetles (Order: Coleoptera) constitute a large quantity of total insect biodiversity and play a key role in trophic chains. They are well represented in all terrestrial habitats and are often used as indicators of environmental change because of their great habitat specificity. Diversity and abundance of coleoptera were studied and analyzed in two different habitats of Alukkal village of Areekode, Malappuran District, Kerala. The study was conducted during December 2014 to May 2015. For the study, the beetles were collected, preserved and identified. The collection methods include hand picking and sweeping. Beetles were preserved by pinning and keeping in 70% alcohol. The identification was done by experts and by comparing with pictures and descriptions. A total of 805 beetles belonging to eleven families was reported. Of these, 17 were identified up to the species level and 14 up to the genus level. Species diversity and evenness were much higher in site 2 than in site 1 (Shannon's diversity index = 2.7 and 2.64, Shannon's equitability E_H = 0.856 and 0.72 respectively. The most abundant family was Chrysomelidae in both sites (70% and 64% in site 1 and site 2 respectively),in which *Aulacophorasp., Oidesdorsosignata* Clark,1864 and *Altica sp.* were most abundant. Monthly abundance of beetles show the order December > April> May> January> February> March. Temperature and relative humidity influences the abundance of beetles in the study area. 40.3% of similarity has been recorded between two sited in their beetle species compositions using Sorenson similarity Index. Most beetle species are abundant, and they don't need to be specially conserved. But beetles that live in habitat that are getting changed could be in trouble and should be conserved.

KEY WORDS: Coleoptera, Beetles, Sorenson similarity index.

Introduction

The order coleoptera or beetles forms the largest order of insects(Borer et.al,1984) worldwide with about 3,90000 described species representing about 40% of the known insects. Every year approximately 2000 new species are described (Zoological record). They are distinctive with the hardening of their forewing into elytra. They occupy almost every available terrestrial and freshwater habitat and a few marginal marine habitats as well and have got adapted to life at all latitudes and in nearly every habitat to feeding on any substances of organic origin.

Order coleopteran is divided into four suborders viz.Polyphaga, Adephaga, Myxophaga and Archostemata. Polyphaga is the largest suborder containing 85% of the known species and Myxophaga is a small suborder whose members are minute with less than 100 known species. Archostemata contains several families of beetles most associated with wood and Adephaga includes most of the predacious beetles.

Beetles have a lot of ecosystem roles and some common species of them respond sensitively to the state of natural environment and may serve as convenient indicators of anthropogenic pollution. They have played an important part in the biological control of insect pests and noxious plant species. Most of them are beneficial as decomposers and recyclers of organic nutrients which contribute to soil fertility, like dung beetles which help to get rid of waste, and

those which eat wood help breakdown of dead trees. Tenebrionidae play an important role as primary decomposers (Henschelet.al., 2010).Larval forms of many beetles are also used as food in many countries. Many beetles are regarded as serious pests of agricultural crops, pasture plants, timber resources and stored products.

Alukkal village of Areekode lies in 11°4'N and 76°01'E with an altitude of 58m.The climate is generally mid hot and humid in nature and mean rainfall of the area is 3100mm and mean temperature ranges from 20°C to 35°C. The area is situated along the river Chaliyar and a major portion is comprised of agricultural lands. Main crops cultivated by agricultural practices include paddy and plantain. Other plantations like tapioca, cucumber, beans, okra etc… will also be there in some seasons. The river side is shrubby and grassy with several kinds of shrubs and grasses and some kinds of agriculture too. The study area was divided into two sampling sites; area in the agricultural fields (Site 1) and area near to the river Chaliyar (Site 2). Site 1 was the place containing the wetland with some agricultural crops and grasses, with an average area of 80cents. The habitat is suitable for a number of insects, spiders, fishes, planktons, birds etc. Grassy areas are used for cattle grazing. Site 2 was a riparian habitat with an area of about 75cents diverse with aquatic and terrestrial insects, birds, fishes, amphibians, reptiles, spiders etc.

Most of the insect records available at present are the results of taxonomic studies carried out in the past, but in them estimation of abundance and diversity was not a major objective. A study on the diversity of coleoptera will not only help to assess the diversity of the area but also will help to carry out further studies to conserve the biodiversity over there. No work has been reported so far on Beetle's faunal diversity from Alukkal region.

Materials and Methods

Coleoptera of Alukkal village were studied from December 2014 to May 2015. The study area was divided into two sampling sites, namely the area in the agricultural fields (Site1) and the area near to the river Chaliyar(Site2). Collections were made twice in a month from two sites in the morning (9.00 to 11.00), made by handpicking and sweeping with a proper net. The methods employed for preservation were Pinning and by keeping in 70% alcohol. Afield camera with 42X optical zoom and a 13 megapixel camera were used to take photographs of beetles.

A major portion of beetles were identified by experts, comparing with pictures and descriptions. Population diversity was determined by using Simpson's index (Simpson,1949) and the similarity between two sites using Sorenson's similarity index(1948).

Results and Discussion

A total of 805 beetles represented by eleven families were recorded. Beetles represented by the families Chrysomelidae, Coccinellidae, Scarabaeidae, Cerambycidae, Curculionidae and Tenebrionidae were identified upto the genus or species level. Whereas, beetles represented by the families Elateridae, Lampyridae, Dytiscidae, Carabidae and Mordellidae were not identified upto the genus level (Table:1)

TABLE 1: List of Coleopterans Recorded From The Study Area

FAMILY	COMMON NAME	GENUS	SPECIES
Chrysomelidae	Leaf beetle	Oides	*Oidesdorsosignata*Clark,1864.
		Dicladispa	*Dicladispaarmigera*Olivier,1808.
		Platycorynus	*Platycorynusperegrinus*Herbst,1783.
		Cassida	*Cassidacircumdata*Herbst,1799.
		Aulacophora	*Aulacophoracincta*Fabricius,1775.
		Aspidimorpha	*Aspidimorphamiliaris*Fabricius,1775.
		Coptocephala	
		Lilioceris	
		Altica	
		Monolepta	
		Aulacophora	
		Aspidimorpha	
		Chiridopsis	
		Aulacophora	
		Cassida	
Coccinellidae	Lady bird beetle	Coccinella	*Coccinellatransversalis*Fabricius,1781.
		Cheilomenes	*Cheilomenessexmaculata*Fabricius,1781.
		Epilachna	*Epilachnaseptima*Dieke.
		Epilachna	
Scarabaeidae	Scarabs/Lamellicorn beetle	Popilla	*Popillacomplanata*Newman,1838.
		Oryctes	*Oryctes rhinoceros* Linnaeus,1758.
		Chrysina	*Chrysinabayeri*Skinner.
		Apogonia	
		Copris	
Cerambycidae	Long horned beetle	Apomecyna	*Apomecynasaltator*Fabricius,1787.
		Nupserha	*Nupserhamadurensis*Pic,1926.
		Aeolesthes	*Aeolesthesholosericea*Fabricius,1787.
		Prionomma	*Prionommaatratum*Gmelin,1789.
Curculionidae	True weevil	Cosmopolites	*Cosmopolites sordidus*Germar,1824.
		Myllocerus	
Elateridae	Click beetle		
Tenebrionidae	Darkling beetle	Gonocephalum	
Lampyridae	Fireflies		
Dytiscidae	Predacious diving beetle		
Carabidae	Ground beetle		
Mordellidae	Tumbling flower beetle		



OidesdorsosignataDicladispaarmigeraPlatycorynusperegrines



CassidacircumdataAulacophoracinctaAspidimorphamiliaris



Coptocephala sp.Lilioceris sp.Altica sp.



Monolepta sp.Aulacophora sp.Aspidimorpha sp.



Chiridopsis sp.Aulacophora sp.Cassida sp.



CoccinellatransversalisCheilomenessexmaculataEpilachnaseptima



Epilachna sp.Epilachna sp.Popillacomplanata



Oryctes rhinoceros ChrysinabayeriApogonia sp.

Copris sp.Apomecyna saltator Nupserha madurensis

AeolesthesholosericeaPrionommaatratumCosmopolites sordidus

*Myllocerus sp.Gonocephalum sp.*Family:Carabidae

Family:CurculionidaeFamily:DytiscidaeFamily:Elateridae


Family:LampyridaeFamily:Mordellidae

The agricultural field area (site 1) showed higher number of beetles with a total of eleven families than the river side area (site 2). Among the collected eleven families of beetles, eleven were reported from site 1 and seven were reported from site 2.The most abundant family was Chrysomelidae in both sites. Since the area comprised of different kinds of plantations and high vegetation, it provides a suitable habitat for leaf beetles. So, this study concurs with a similar study in different habitats (Ohsawa and Nagaike, 2006) in terms of the influence of vegetation composition and vegetation cover on chrysomelidae communities. Also, the area contained agricultural practices which favored a variety of pest species too (like *Dicladispaarmigera,Epilachna sp. etc...).*These may be the main reasons for their abundance Many environmental factors affect diversity of species (Rosenzweig, 1995).

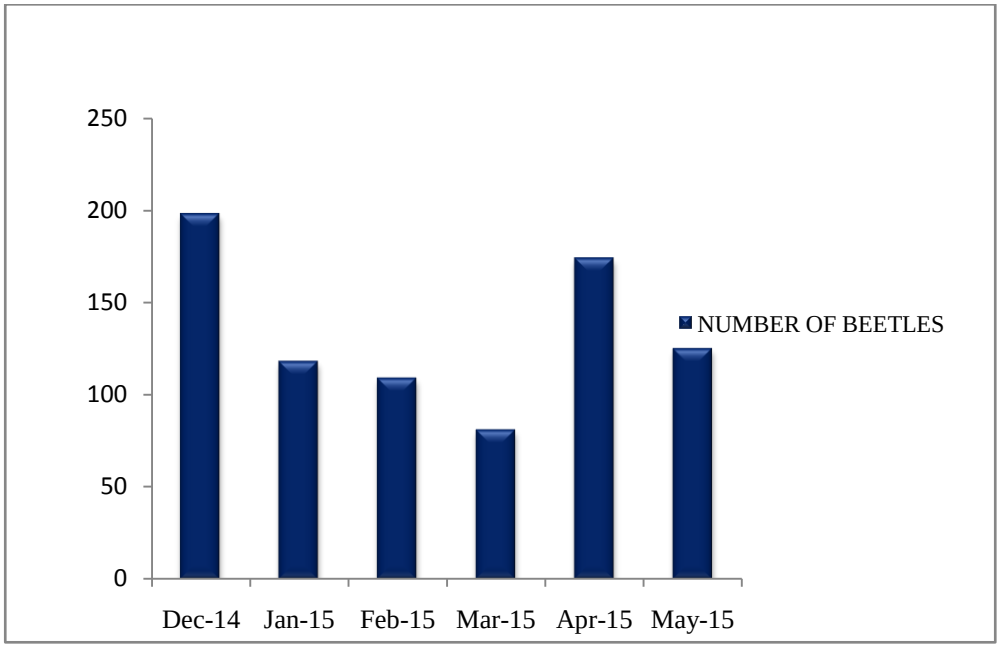
TABLE 2: Percentage Of Occurrence Of Different Families Of Beetles From Both Sites:-

FAMILY	**TOTAL NUMBER**		**PERCENTAGE**	
	SITE 1	**SITE 2**	**SITE 1**	**SITE 2**
Chrysomelidae	391	160	70.1974865	64.516129
Coccinellidae	110	41	19.7486535	16.5322581
Scarabaeidae	23	14	4.12926391	5.64516129
Cerambycidae	6	6	1.07719928	2.41935484
Curculionidae	3	19	0.53859964	7.66129032
Elateridae	2	0	0.35906643	0
Tenebrionidae	2	3	0.35906643	1.20967742
Lampyridae	14	0	2.51346499	0
Dytiscidae	3	0	0.53859964	0
Carabidae	1	0	0.17953321	0
Mordellidae	2	5	0.35906643	2.01612903
TOTAL	**557**	**248**	**100**	**100**

Monthly abundance of beetle species showed the order December >April>May >January > February>March(Graph1).Three species,namely,*Oidesdorsosignata,Aulacophora sp.*(Family:Chrysomelidae) and *Coccinellatransversalis*were reported in all months(December2014 to May2015).Climatic variations in temperature and humidity during the study period was also recorded.The highest number of coleopterans were collected during the months of December2014 and April2015.Lowest temperature was recorded during these two months which indicates that

there is an increase in beetle abundance while decreasing the temperature. Beetle abundance was directly proportional to the Relative humidity.

Mean monthly abundance of coleopterans recorded during (december2014 to may2015):



GRAPH 1: Number Of Beetle Species Recorded In Each Month.

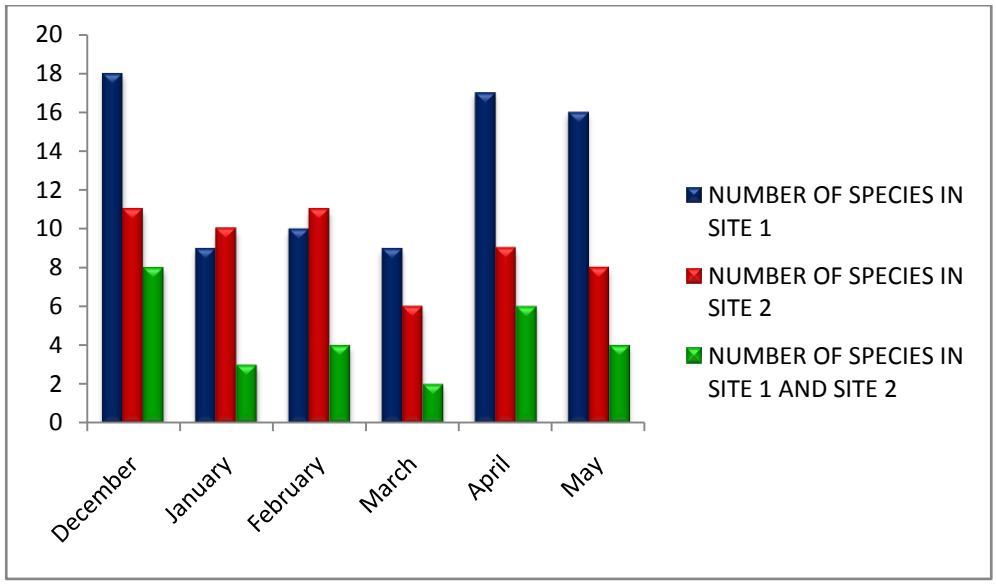


TABLE 3: Diversity Indices Of Number Of Individuals Of Different Beetle Species In Site 1:-

FAMILY	SPECIES	Total number	Percentage	Pi	Simpson index	Shannon index
Chrysomelidae	*Oidesdorsosignata*	96	18.532818	0.185328	0.0343465	0.312394
	Dicladispaarmigera	17	3.2818532	0.032818	0.0010770	0.112132
	Platycorynusperegrinus	2	0.3861003	0.003861	0.000015	0.021455
	Cassidacircumdata	3	0.5791505	0.005791	0.0000335	0.029832
	Aulacophoracincta	0	0	0	0	0
	Aspidimorphamiliaris	1	0.1930501	0.001930	0.0000037	0.012063
	Coptocephala sp.	14	2.7027027	0.027027	0.0007304	0.097592
	Lilioceris sp.	2	0.3861003	0.003861	0.000015	0.021455
	Altica sp.	63	12.162162	0.121621	0.0147918	0.256237
	Monolepta sp.	14	2.7027027	0.027027	0.0007304	0.097592
	Aulacophora sp.	67	12.934362	0.129343	0.0167297	0.264544
	Aspidimorpha sp.	11	2.1235521	0.021235	0.0004509	0.081799
	Chiridopsis sp.	2	0.3861003	0.003861	0.000015	0.021455
	Aulacophora sp.	76	14.671814	0.146718	0.0215262	0.281587
	Cassida sp.	3	0.5791505	0.005791	0.0000335	0.029832
Coccinellidae	*Coccinellatransversalis*	47	9.0733590	0.090733	0.0082325	0.217744
	Cheilomenessexmaculata	19	3.6679536	0.036679	0.0013454	0.121244
	Epilachnaseptima	11	2.1235521	0.021235	0.0004509	0.081799
	Epilachna sp.	16	3.0888030	0.030888	0.0009541	0.10741
Scarabaeidae	*Popillacomplanata*	9	1.7374517	0.017374	0.0003019	0.070413
	Oryctes rhinoceros	7	1.3513513	0.013513	0.0001826	0.058161
	Chrysinabayeri	2	0.3861003	0.003861	0.000015	0.021455
	Apogonia sp.	3	0.5791505	0.005791	0.0000335	0.029832
	Copris sp.	2	0.3861003	0.003861	0.000015	0.021455
Cerambycidae	*Apomecynasaltator*	0	0	0	0	0
	Nupserhamadurensis	5	0.9652509	0.009652	0.0000932	0.044791
	Aeolesthesholosericea	0	0	0	0	0
	Prionommaatratum	1	0.1930501	0.001930	0.0000037	0.012063
Curculionidae	*Cosmopolites sordidus*	1	0.1930501	0.001930	0.0000037	0.012063
	Myllocerus sp.	0	0	0	0	0
Elateridae		2	0.3861003	0.003861	0.000015	0.021455
Tenebrionidae	*Gonocephalum sp.*	2	0.3861003	0.003861	0.000015	0.021455
Lampyridae		14	2.7027027	0.027027	0.0007305	0.097592
Dytiscidae		3	0.5791505	0.005791	0.0000335	0.029832
Carabidae		1	0.1930501	0.001930	0.0000037	0.012063
Mordellidae		2	0.3861003	0.003861	0.000015	0.021455
Total		**518**	**100**	**1**		**2.642251**

TABLE 4: Diversity Indices Of Number Of Individuals Of Different Beetle Species In Site 2:-

FAMILY	SPECIES	Total number	Percentage	Pi	Simpson index	Shannon index
Chrysomelidae	*Oidesdorsosignata*	5	2.1929824	0.02193	0.000481	0.08377
	Dicladispaarmigera	6	2.6315789	0.026316	0.000692	0.095727
	Platycorynusperegrinus	0	0	0	0	0
	Cassidacircumdata	2	0.8771929	0.008772	0.000077	0.041546
	Aulacophoracincta	9	3.9473684	0.039474	0.001558	0.127584
	Aspidimorphamiliaris	0	0	0	0	0
	Coptocephala sp.	0	0	0	0	0
	Lilioceris sp.	3	1.3157895	0.013158	0.000173	0.056984
	Altica sp.	31	13.596491	0.135965	0.018486	0.271299
	Monolepta sp.	9	3.9473684	0.039474	0.001558	0.127584
	Aulacophora sp.	50	21.929824	0.219298	0.048091	0.332746
	Aspidimorpha sp.	8	3.5087719	0.035088	0.001231	0.117541
	Chiridopsis sp.	0	0	0	0	0
	Aulacophora sp.	20	8.7719298	0.087719	0.007695	0.213474
	Cassida sp.	7	3.0701754	0.030702	0.000942	0.106948
Coccinellidae	*Coccinellatransversalis*	5	2.1929824	0.02193	0.000481	0.08377
	Cheilomenessexmaculata	3	1.3157895	0.013158	0.000173	0.056984
	Epilachnaseptima	10	4.3859649	0.04386	0.001924	0.137139
	Epilachna sp.	15	6.5789474	0.065789	0.004328	0.179032
Scarabaeidae	*Popillacomplanata*	6	2.6315789	0.026316	0.000692	0.095727
	Oryctes rhinoceros	0	0	0	0	0
	Chrysinabayeri	2	0.8771929	0.008772	0.000077	0.041546
	Apogonia sp.	3	1.3157895	0.013158	0.000173	0.056984
	Copris sp.	3	1.3157895	0.013158	0.000173	0.056984
Cerambycidae	*Apomecynasaltator*	4	1.7543859	0.017544	0.000308	0.070931
	Nupserhamadurensis	0	0	0	0	0
	Aeolesthesholosericea	1	0.4385965	0.004386	0.000019	0.023813
	Prionommaatratum	0	0	0	0	0
Curculionidae	*Cosmopolites sordidus*	0	0	0	0	0
	Myllocerus sp.	18	7.8947368	0.078947	0.006233	0.200445
Elateridae		0	0	0	0	0
Tenebrionidae	*Gonocephalum sp.*	3	1.3157895	0.013158	0.000173	0.056984
Lampyridae		0	0	0	0	0
Dytiscidae		0	0	0	0	0
Carabidae		0	0	0	0	0
Mordellidae		5	2.1929824	0.02193	0.000481	0.08377
TOTAL		**228**	**100**	**1**		**2.719312**

Shannon's equitability (E_H) can be calculated by dividing H by H_{MAX}(Here H_{MAX}=lnS).

Site 1:

Total number of species(s)=32

ln(s)=3.465736

H=2.642251

$E_H=H/H_{MAX}$

=2.642251/3

=0.762392

Site 2:

Total number of species(s)=24

ln(s)=3.178054

H=2.719312

$E_H=H/H_{MAX}$

=2.719312/3.178054

=0.855653

Using Simpson's equation (index of dominance), a value of 0.103 and 0.096 were obtained for site 1 and site 2 respectively. From site 1, *Oides dorsosignata* was the dominant species of beetles (Simpson's index=0.0343).From site 2, *Aulacophora sp.*(Simpson's index=.0481) was found to be the dominant one. Shannon index of diversity was used to characterize species diversity in the community. From the results, the diversity and evenness is a bit higher in site2 than site1.Eventhough the number of species is much higher in site1,around 58% of them belongs to four dominant species of the site namely, *Oidesorsosignata, Alticasp.,* two different *Aulacophorasp.* Coleopterans are more evenly distributed in site2.(table 3 and table 4).Shannon's index(H) was used to analyze the beetle species diversity of the area. It accounts for both abundance and evenness of the species present. Coleopteran diversity and evenness were higher in site2 than in site1.Since site1 was dominated by four species particularly, the evenness get reduced considerably. Evenness value of 1 is equal to complete evenness. According to Mohan.K and A.M.Patmanabhan(2013),some habitat factors that influence the patterns of coleopteran diversity are vegetation including host plants, food availability, temperature and wind exposure. But, most of these habitat factors were much higher in site 1, even though diversity was a little bit more in site 2.This observation may be due to the environmental changes like pesticide and insecticide applications in site 1.

On a monthly scale, beetles were more abundant in December. From the analysis of temperature and relative humidity during the study period, December and April showed low temperature and high relative humidity. So these two climatic factors influence the abundance and diversity of coleopterans in the area. According to Mohan.k and A.M Patmanabhan(2013), Temperature plays a major role in distribution of coleopteran insects which is true I this case also. But Namwanda Patricia and NgaboyamahinaTheogene(2005) reported that environmental measures like relative humidity and percentage shade was not influencing the beetle species abundance. This study indicates that there is a relation between relative humidity and beetle abundance in the study area.

Many environmental factors affect diversity of species (Rosenzweig,1995).The composition of beetles in each environment differs due to the needs,trophic level and behavior of each group(Nouhuys,2005).There is always correlation between structural complexities of habitats and diversity of species(Hawksworth and Kalin Arroyo,1995).More diversity is observed at the region with availability of variety of habitats(Ried and Miller,1989).Likewise, Uetz in 1991 stated that good beetle diversity is seen on structurally complex shrubs. So, site 2 may have a variety of habitats which favored a high diversity there than site 1.

Coleoptera is the most diverse order of class insecta. They play an important role in most ecosystems and are well represented in all terrestrial habitats. It is specific in habitat preference and thus can be used as an indicator of environmental change(Forsythe,1987;Lovei and Sunderland,1996).If our goal is to preserve biodiversity in a given area,we need to be able to understand how diversity is impacted by different management strategies.

References:

- D,J.Borer.,D,M.Delong,and C,A.Triplehorn.1984:An introduction to the study of insects; *Saunders college publishing*5:356-389.
- D,L.Hawksworth. and M,T.Kalin.Arroyo.1995:Magnitude and distribution of biodiversity: *Global biodiversity assessment, Heywood,V.H(*Ed):107-191.
- G,W.Uetz.1991: Habitat structure and spider foraging. In: Habitat structure: The physical arrangement of objects in space,McCoy,E.D.,S.S.Bell and H.R.Mushinsky(Eds).Chapman and Hall,London,UK:325-348
- J,R.Henschel.,C,Grohmann.,V,Siteketa. and K,D.Linsenmair.2010:Monitoring Tenebrionid beetle biodiversity in Namibia; *African study Monographs suppl.,:91-102.*
- M,L.Rosenzweig.1995: Species diversity in space and time1;Cambridge university press,NewYork,USA:234.
- M,Ohsawa. and T,Nagaike.2006:Influence of forest types and effects of forestry activities on species richness and composition of chrysomelidae in the central mountainous region of Japan; *Biodiversity and conservation* **15**:1179-1191.
- W,V.Ried.and K,R.Miller1989.Keeping options alive: A scientific basis for conserving biodiversity. World resources institute.,Washington DC,USA.