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Biodiversity and Annotated Checklist of Coleopteran-Fauna (Insecta) Associated with Agricultural Crops (Cereals, Vegetables) and Medicinal Plants of Jammu & Kashmir State (India)

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Abstract

This paper deals with a total of 44 species of Coleopterans (Insecta), under 35 genera, belonging to 9 families. These insect species are associated with 7 spp. of cereal crops (of 2 families), 10 spp. of vegetable crops (5 families) and 35 spp. of medicinal plants (14 families), occurring in diverse habitats in vast localities of Jammu, Kashmir and Ladakh regions of J & K State. The Coleopteran species, infesting cereal crops, vegetable crops and medicinal plants accounts for 25%, 36.36% and 50 % respectively of the total Coleopteran- fauna associated with crops and medicinal plants studied. The highest number of species of Coleopterans i.e. 14, pertaining to the family Curculionidae, is associated with host crops (cereals, vegetables) and medicinal plant species. This is followed by family Chrysomelidae and Scarabaeidae, with 11 spp. and 9 spp. respectively. Rest of the Coleopteran families show number of species either 2 spp. or 1 sp., associated with the vegetable crops and medicinal plant species. The family Solanaceae, including vegetable crops and medicinal plants, is affected by highest number of Coleopteran species, 13 (29.54 %). This is followed by cereal crop families, Fabaceae and Poaceae, affected by 6 spp. (13.63 %) each of Coleopteran. An updated systematic checklist of Coleopteran-fauna associated with host cereal and vegetable crops, and medicinal plant species has been given. Apart from this, a Catalogue on Host species -Coleopteran species complex, has been added.

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Introduction

In Jammu and Kashmir State, various families of order Coleoptera associated with agricultural crops (cereals, vegetables) and medicinal plants include Anobiidae, Bruchidae, Chrysomelidae, Coccinellidae, Curculionidae, Dermestidae, Elateridae, Meloidae and Scarabaeidae. The Anobiidae is represented by two species, feeding on roots and other dried parts of medicinal plants. The grubs of Bruchidae (*Callosobruchus chinensis*) feed on seeds of common bean.The adults as well as larval stages of Chrysomelids or leaf beetles, including 11 species, are associated with crops and medicinal plants, feeding on tissues of cereal crops (maize, beans), vegetables (brassicas, potato) and 10 species of medicinal plants of this region.

The family Coccinellidae, also known as lady-bird beetles, represented by two species of Epilachninds, are found to feed on the leaves of vegetables and medicinal plants. The family Curculionidae or true weevils show diversity of form, size, colour and host crops and medicinal plants. 14 species of Curculionids are known to infest agricultural crops (6 spp.) and medicinal plants (11 spp.). Dermestid (*Anthrenus*), is reported to be associated with medicinal plant (*Chaerophyllum reflexum*). The Elaterids, including

2 species, belonging to genus *Melanotus*, attack seed, seedlings, tubers of maize and potato. The family Meloidae or blister beetles, is represented by two species affecting crops – maize and beans.

The family Scarabaeids includes as many as 9 species. These are polyphagous, both larvae, commonly known as "white grubs" and adults render heavy losses to cereal crops (3 spp.), vegetables (4 spp.) and medicinal plant (*Rosa* sp.). *Anomala* sp. (Rutelinae), *Brahmina* spp.and *Holotrachia* spp. (Melolonthinae), *Protaetia alboguttata* (Cetoninae), are responsible for causing extensive damage to these crops. In Kashmir region, *B.coriacea*, B. *poonensis* and *H. longipennis*, are serious soil pests of tubers of potato crops (Misra and Chandel, 2003; Zaki et al., 2007).

Materials and methods

The database incorporated in this paper pertains to 44 Coleopteran species, under nine families, associated with 57 species of 20 families of agricultural crops (cereals, vegetables) and medicinal plants, occurring in diverse habitats in vast localities of Jammu and Kashmir State. This State is located in the northern part of the Indian sub-continent, in the vicinity of Karakorum and western Himalayan ranges. It is bounded by: Indian States, *viz*. Himachal Pradesh and Punjab; China and China-administered part of Kashmir; Pakistan and Pakistan-administered portion of Kashmir. Jammu and Kashmir State is divided into three geographically and climatically different Provinces, *viz*., Ladakh (cold desert), Kashmir (temperate) and Jammu (sub-tropical). This State is of great zoo-geographical importance as well as in rich in biodiversity.

The Coleopteran-fauna associated with agricultural crops and medicinal plants, with biodiversity of J & K State has been updated in the light of latest published data and systematic changes. For this purpose, relevant published works (national and international) besides, online data on taxonomic surveys, systematic checklists/ catalogues, have been consulted. The faunal records of valid species and genera, with host crop and medicinal plant species, and the synonymies of the faunal taxa are given in the annotated systematic checklist. Apart from this, an updated catalogue of cereal / vegetable crops and medicinal plant species, infested by Coleopteran species has been provided. In this Catalogue, the author (s) recording Coleopteran species and their host species, are in the form of code numbers. The keys to the code numbers are cited at the end of the Catalogue.

Results and discussion

Systematic checklist

I. Family: Anobiidae

1. *Lasioderma serricorne* (Fabricius)
   Hosts: *Acorus calamus* Linnaeus, *Colchium luteum* Baker and *Pergularia daemia* (Farssk).
2. *Stegobium paniceum* (Linnaeus)
   Hosts: *Atropa acuminate* Royle ex Lindl, *Colchium luteum* Baker, *Fagopyrum tataricum* Gaertn and *Rheum emodi* Wall.

II. Family: Bruchidae

3. *Callosobruchus chinensis* (Linnaeus)
   Hosts: *Phaseolus vulgaris* Linn.

III. Family: **Chrysomelidae**

4. *Chaetocnema* sp.
   Host: *Solanum tuberosum* Linn.
5. *Chrysolina exanthematica* (Wiedmann)
   Host: *Mentha piperata* Linn.
6. *Colasposoma semicostatum* Jacoby
   Host: *Xanthoxylum armatum* DC
7. *Galerucella placida* Baly
   Hosts: *Polygonum hydropiper* Linn., *Polygonum serrulatum* Lag and *Rumex nepalensis* Sprengel
8. *Haltica* sp.
   Hosts: *Artemisis absinthium* Linn., *Rheum* sp.
9. *Lilioceris impressa* (Fabricius)
   Host: *Dioscorea bulbifera* Linn.
   Taxonomic note: *Crioceris impressa* Fabricius as reported by Srivastava and Bhagat (1966) is synonym of *Lilioceris impressa* Fabricius (Tisheckin et al., 2011)
10. *Luperomorpha nigripennis* Duvivier
    Host: *Phaseolus* sp. and *Zea mays*
11. *Monolepta signata* Olivier Linn.
    Host: *Xanthoxylum armatum* DC
12. *Phyllotreta cruciferae* (Goeze)
    Hosts: *Brassica oleracea* var. *capitata*, *B. oleracea* var. *acephala*, *B. oleracea* var. *gongylodes* and *Brassica rapa*
13. *Phyllotreta* sp.
    Host: *Zea mays* L
14. *Platycorynus peregrinus* Herbst
    Hosts: *Asclepias curassavica* Linn., *Calotropis gigantea* (L) W.T.Aiton
    Taxonomic note: *Corynodes peregrinus* Marshall) is reported by Mathur and Srivastava (1967) which is synonym of *P. peregrinus* Herbts (Lobl and Smetana, 2010)

IV. Family: Coccinellidae

15. *Epilachna vigintioctopunctata* (Fabricius)
    Hosts: *Datura inoxia* Mill, *Datura metel* Linn., *Datura stramonium* Linn., *Luffa acutangula* (Linn.), *Momordica charantia* Linn., *Physalis minima* Linn., *Solanum aviculare* Forst., *Solanum lycopersicum* (= *Solanum esculentum)*, *Solanum melongena* Linn., *Solanum nigrum*, *Solanum surrattense* Burm., *Solanum tuberosum* Linn. and *Withania somnifera* (Linn.)
16. *Henosepilachna vigintioctopunctata* (Fabricius)
    Hosts: *Solanum melongena* (Linn.) and *Solanum nigrum* (Linn.)
    Taxonomic note: Many authors regard *H. vigintioctopunctata* as synonym of *Epilachna vigintioctopunctata*, however, according to authors like Li (1993) and Szawaryn (2011), *Henosepilachna* is a valid genus in Asia and Australia.

V. Family: Curculionidae

17. *Alcides affaber* (Aurivillius
    Host: *Abelmoschus esculentus*, *Abelmoschus moschatus* Medik and *Althea rosae* (Linn.)
18. *Alcidodes collaris* (Pasoe)
    Host: *Abelmoschus esculentus*, *Capsicum*
19. *Alcidodes pictus* Boheman
    Host: *Vigna* sp.
20. *Alcidodes signatus* Boheman
    Host: *Phaseolus vulgaris*
21. *Ceratapion* (*Ceratapion*) *gibbirostre* (Gyllenhalin)
    Host: *Vigna radiata*
    Taxonomic note: Kotwal and Abrol (2002), recorded *Apion tumidum* Stephens from Jammu region of J & K State and according to Lobl and Smetana (2011) and Zarazaga-Alomosa (2016), *A. tumidum* is synonym of *Ceratapion (C.) gibbirostre* (Gyllenhel).
22. *Cionus hortulanus* (Fourcroy)
    Host*: Verbascum Thapsus* Linn.
23. *Cionus* sp.
    Host: *Verbascum chinense* (Linn.)
    Taxonomic note: Mathur and Srivastava (1967) recorded *Cionus* sp. on medicinal plant, *Verbascum coromandelianum* (Vahl.) (Kuntze), the same species according to Chen et al. (2015) is synonym of *Verbascum chinense* (Linn.)
24. *Cylas formicarius* (Fabricius)
    Host: *Abelmoschus esculentus*, *Capsicum* sp. and *Ipomoea batatas* (Linn.)
25. *Hypolixus truncatulus* (Fabricius)
    Host: *Amaranthus caudatus* Linn.
26. *Lixus truncatulus* (Fabricius)
    Host: *Amaranthus* sp.
27. *Myllocerus discolor* Boheman
    Host: *Tridex procumbens* (Linn.).
28. *Paramecops farinosa* (Gyllenhalin)
    Host: *Calotropis procera* (Aiton)
29. *Platymycterus himalayanus* Marshall
    Host: *Xanthoxylum armatum* DC
30. *Xanthochelus faunus* (Olivier
    Hosts: *Cirsium falconeri* (Hook. f.), *Saussurea heteromella* (D.Dom) -Hand-Mazz

VI. Family: Dermestidae

31. *Anthrenus* sp.
    Host: *Chaerophyllum reflexum* Lindl,

VII. Family: **Elateridae**

32. *Melanotus communis* Gyllenhal
    Host: *Zea mays* Linn.
33. *Melanotus horticornis* Blyth
    Host: *Solanum tuberosum*

VIII Family: Meloidae

34. *Cyaneolytta coerulea* (Pfaff)
    Host: *Phaseolus vulgaris*
35. *Mylabris pustulata* (Mylbpu)
    Host: *Zea mays* Linn.

IX Family: Scarabaeidae

36. *Adoretus simplex* Sharp
    Host: *Rosa* sp.
37. *Adoretus* sp.
    Hosts: *Albelmoschus esculentus*, *Brassica oleracea* var.*capitata*, *Capsicum*, *Solanum lycopersicum* (=*Lycopersicon esculentum*), *Solanum melanogena*
38. *Anomala* sp.
    Host: *Solanum lycopersicum*
39. *Brahmina coriacea* (Hope)
    Host: *Solanum tuberosum*
40. *Brahmina poonensis* Frey
    Host: *Solanum tuberosum* Linn.
41. *Holotrichia consanguinea* (Blanchard)
    Hosts: *Abelmoschus esculentus*, *Brassica oleracea* var. *capitata*, *Capsicum*, *Hordeum vulgare* Linn., *Solanum tuberosum* Linn., *Triticum aestivum* Linn., *Zea mays* Linn.
42. *Holotrachia longipennis* (Blanchard)
    Host: *Solanum tuberosum*

43. *Holotrachia* spp.
    Hosts: *Brassica oleracea* var. *capitata* Linn., *Brassica oleracea* var. *botrytis* Linn. and *Capsicum.*
44. *Protaetia alboguttata* (Vigors)
    Host: *Zea mays* Linn.

From the above given checklist, it is evident that in Jammu and Kashmir State a total of 44 species of Coleopterans, belonging to 35 genera, under 9 families show their prevalence in diverse areas and localities. The Coleopteran- fauna is associated with 7 spp. off cereal crops, under 2 families, 10 spp. of vegetable crops (5 families) and 36 spp. of medicinal plants (14 families). The total number of Coleopteran species infesting cereal crops: *Hordeum vulgare* (barley), *Phaseolus* spp. (beans), *Vigna* spp.(grams), *Zea mays* (maize)and *Triticum aestivum* (wheat), belonging to families Fabaceae and Poaceae, has been found to be as 11 species. The vegetable crops: *Momordica charantia* (bitter gourd), Brassicas vegetables, *Solanum melanogena* (brinjal), *Capsicum*, *Abelmoschus esculentus* (okra), *Luffa acutangula* (sponge gourd), *Ipomaea batatas* (sweet potato), *Solanum lycospersicum* (tomato) and *Solanum tuberosum* (potato), are associated with 16 spp. of Coleopterans. The medicinal plant species (36), are found to be associated with 22 spp. of Coleopterans (see also Table 1).

Table 1. Catalogue of Host agricultural crops (cereals, vegetables) and Medicinal plants species complex of Coleopteran species in Jammu and Kashmir State (MP: Medicinal plant; VC: Vegetable crop; CC: Cereal crop).

Family/Crop/Plant Species [Kind]	Coleopteran Species [Family]	References
ACORANCEAE		
Acorus calamus [MP]	*Lasioderma serricorne* [AN]	**23**
APIACEAE		
Chaerophyllum reflexum[MP]	*Anthrenus sp.* [DE]	**09**
AMARANTHACEAE		
Amaranthus caudatus [MP]	*Hypolixus truncatulus* [CU]	**27**
Amaranthus sp. [MP]	*Lixus truncatulus* [CU]	**03, 30**
APOCYNACEAE		
Asclepias curassavica [MP]	*Platycorynus peregrinus* [CH]	**14**
Calotropis gigantea [MP]	*Platycorynus peregrinus* [CH]	**14**
Calotropis procera [MP]	*Platycorynus farinosa* [CU]	**26, 28**
Pergularia daemia [MP]	*Lasioderma serricorne* [AN]	**14**
ASTERACEAE		
Artemisia absinthium [MP]	*Haltica* sp. [CH]	**14**
Cirsium falconeri [MP]	*Xanthochelus faunus* [CU]	**04**
Tridax pracumbens [MP]	*Mylloceris discolour* [CU]	**30**
Saussurea heteromella [MP]	*Xanthochelus faunus* [CU]	**04**
BRASSICACEAE		
Brassica oleracea acephala [VC]	*Phyllotreta cruciferae* [CH]	**05**
B. o. botrytis [VC]	*Holotrichia* sp. [SC]	**19**
B. o. capitata [VC]	*Adoretus sp.* [SC]	**18, 19**
B. o. capitata [VC]	*Holotrichia consanguinea* [SC]	**18**
B. o. capitata [VC]	*Holotrichia* sp. [SC]	**19**
B.o. capitata [VC]	*Phyllotreta cruciferae* [CH]	**05**
B. o. gongylodes [VC]	*Phyllotreta cruciferae* [CH]	**05**
B. o. rapa [VC]	*Phyllotreta cruciferae* [CH]	**05**
Brassica spp. [VC]	*Phyllotreta* sp. [CH]	**19**
COLCHIACEAE		
Colchium luteum [MP]	*Lasioderma serricorne* [AN]	**23**
C. luteum [MP]	*Stegobium paniceum* [AN]	**23**
CONVOLVULACEAE		
Ipomaea batatas [VC]	*Cylas formicarius* [CU]	**30**
CUCURBITACEAE		
Luffa acutangula [VC]	*Epilachna vigintioctopunctata* [CO]	**10**
Momordica charantia [VC]	*E. vigintioctopunctata* [CO]	**10**
DIOSCOREACEAE		
Dioscorea bulbifera [MP]	*Lilioceris impressa* [CH]	**22, 14**

Family/Crop/Plant Species [Kind]	Coleopteran Species [Family]	References
FABACEAE		
Phaseolus vulgaris [CC]	*Alcidodes signatus* [CU]	**01**
P. vulgaris [CC]	*Callosobruchus chinensis* [BR]	**01**
P. vulgaris [CC]	*Cyaneolytta coerulea* [ME]	**01**
Physeolus sp. [CC]	*Luperomorpha nigripennis* [CH]	**07**
Vigna radiata [CC]	*Ceratapion gibbirostre* [CU]	**02**
Vigna sp. [CC]	*Alcidodes pictus* [CU]	**03, 30**
LAMIACEAE		
Mentha piperata [MP]	*Chrysolina exanthematica* [CH]	**14**
MALVACEAE		
Abelmoschus esculentus [VC]	*Adoretus* sp. [SC]	**18, 19**
A.esculentus [VC]	*Alcides affaber* [CU]	**21**
A.esculentus [VC]	*Alcidodes collaris* [CU]	**03**
A. esculentus [VC]	*Cylas formicarius* [CU]	**30**
Abelmoschus moschatus [MP]	*Alcides affaber* [CU]	**14**
Althea rosae [MP]	*Alcides affaber* [CU]	**14**
POACEAE		
Hordeum vulgare [CC]	*Holotrichia consanguinea* [SC]	**18**
Triticum aestivum [CC]	*H. consanguinea* [SC]	**08**
Zea mays [CC]	*H. consanguinea* [SC]	**02**
Z. mays [CC]	*Luperomorpha nigripennis* [CH]	**07**
Z. mays [CC]	*Melanotus communis* [EL]	**02**
Z.mays [CC]	*Mylabris pustulata* [ME]	**02**
Z. mays [CC]	*Protaetia alboguttata* [SC]	**02**
Z. mays [CC]	*Phyllotreta* sp. [CH]	**02**
POLYGONACEAE		
Fagopyrum tataricum [MP]	*Stegobium paniceum* [AN]	**23**
Polygonum hydropiper [MP]	*Galerucella placida* [CH]	**14, 25**
Polygonum serrulatum [MP]	*Galerucella placida* [CH]	**14, 25**
Rheum emodi[MP]	*Stegobium paniceum* [AN]	**23**
Rehum sp.[MP]	*Haltica* sp. [CH]	**14**
Rumex nepalensis [MP]	*Galerucella placida* [CH]	**14, 22**
ROSACEAE		
Rosa sp. [MP]	*Adoretus simplex* [SC]	**31**
RUTACEAE		
Xanthoxylum armatum [MP]	*Colasposoma semicostatum* [CH]	**29**
X. armatum [MP]	*Monolepta signata* [CH]	**29**
X. armatum [MP]	*Platymycterus himalayanus* [CU]	**29**
SCROPHULARIACEAE		
Verbascum chinense [MP]	*Cionus* sp. [CU]	**14**
Verbascum thapsus [MP]	*Cionus* sp. [CU]	**14**
V. thapsus [MP]	*Cionus hortulanus* [CU]	**04**
SOLANACEAE		
Atropa accminuta [MP]	*Stegobium paniceum* [AN]	**23**
Capsicum sp. [VC]	*Adoretus* sp .[SC]	**18, 19**
Capsicum sp. [VC]	*Alcidodes collaris* [CU]	**03, 30**
Capsicum sp. [VC]	*Cylas formicarius* [CU]	**30**
Capsicum sp. [VC]	*Holotrichia cousanguinea* [SC]	**18**
Capsicum sp. [VC]	*Holotrichia* sp. [SC]	**19**
Datura inoxia [MP]	*Epilachna vigintioctopunctata* [CO]	**13**
Datura metel [MP]	*E. vigintioctopunctata* [CO]	**13**
Datura stramonium [MP]	*E. vignitioctopunctata* [CO]	**13**
Physalis minima [MP]	*E. vignitioctopunctata* [CO]	**10**
Solanum aviculare [MP]	*E. vignitioctopunctata* [CO]	**13, 24**
Solanum lycospersicum [VC]	*Adoretus* sp. [SC]	**08**
S. lycospersicum [VC]	*Anomala* sp. [SC]	**08**

Family/Crop/Plant Species [Kind]	Coleopteran Species [Family]	References
S. lycopersicum [VC]	*E. vignitioctopunctata* [CO]	**10**
Solanum melanogena [VC]	*Adoretus* sp. [SC]	**18, 19**
S. melongena [VC]	*E. vignitioctopuncata* [CO]	**10**
S. melongena [VC]	*Henospilachna vignitioctopunctata* [CO]	**06**
S. melongena [VC]	*Holotrichia consanguinea* [SC]	**18**
Solanum nigrum[MP]	*E. vignitioctopunctata* [SC]	**10**
S. nigrum [MP]	*H. vignitioctopunctata* [CO]	**20**
Solanum surattense [MP]	*E. vignitioctopunctata* [CO]	**24**
Solanum tuberosum [VC]	*Brahmina coriacea* [SC]	**15, 16, 32**
S. tuberosum [VC]	*Brahmina poonensis* [SC]	**17**
S. tuberosum [VC]	*Chaetocnema* sp. [CH]	**17**
S. tuberosum [VC]	*E. vignitioctopunctata* [CO]	**10**
S. tuberosum [VC]	*Holotrachia longipennis* [SC]	**11, 16**
S. tuberosum [VC]	*Melanotus horticornis* [EL]	**17**
Withania somnifera [MP]	*E. vignitioctopunctata* [CO]	**14**

AN =Anobiidae; BR= Bruchidae; CH= Chrysomelidae; CO= Coccinellidae; CU= Curculionidae; DE= Dermestidae; EL= Elateridae; ME= Meloidae; SC= Scarabaeidae;

1 = Abrol et al. (2006); **2**= Ahad et al. (2011); **3**= Azam (2007); **4**= Azam et al. (2009); **5**= Bhat et al. (2011); **6=** Bhagat and Munshi (2004); **7=** Bhat (1987); **8**= Bhat et al. (1994); **9**= Feroz et al. (2015); **10**= Jamwal et al. (2013) ; **11**= Khan et al. (2009); **12**= Kotwal and Abrol (2002); **13**= Mathur and Srivastava (1964); **14**= Mathur and Srivastava (1967); **15**= Misra (2000); **16** = Misra and Chandel (2003); **17**= Munib et al (2016); **18**= Pandey and Dwivedi (2005); **19**= Pandey et al. (2006); **20**= Sharma et al. (2010); **21**= Sharma et al (2012); **22**= Srivastava and Bhagat (1966); **23**= Srivastava and Saxena (1975); **24**= Srivastava and Saxena (1976); **25**= Srivastava et al. (1966); **26**= Sudan et al. (2013); **27=** Tara et al. (2009); **28**= Tara and Sudan (2011); **29**= Tara et al. (2011); **30**= Tara et al. (2010); **31**=Wani (2009); **32**= Zaki et al. (2007).

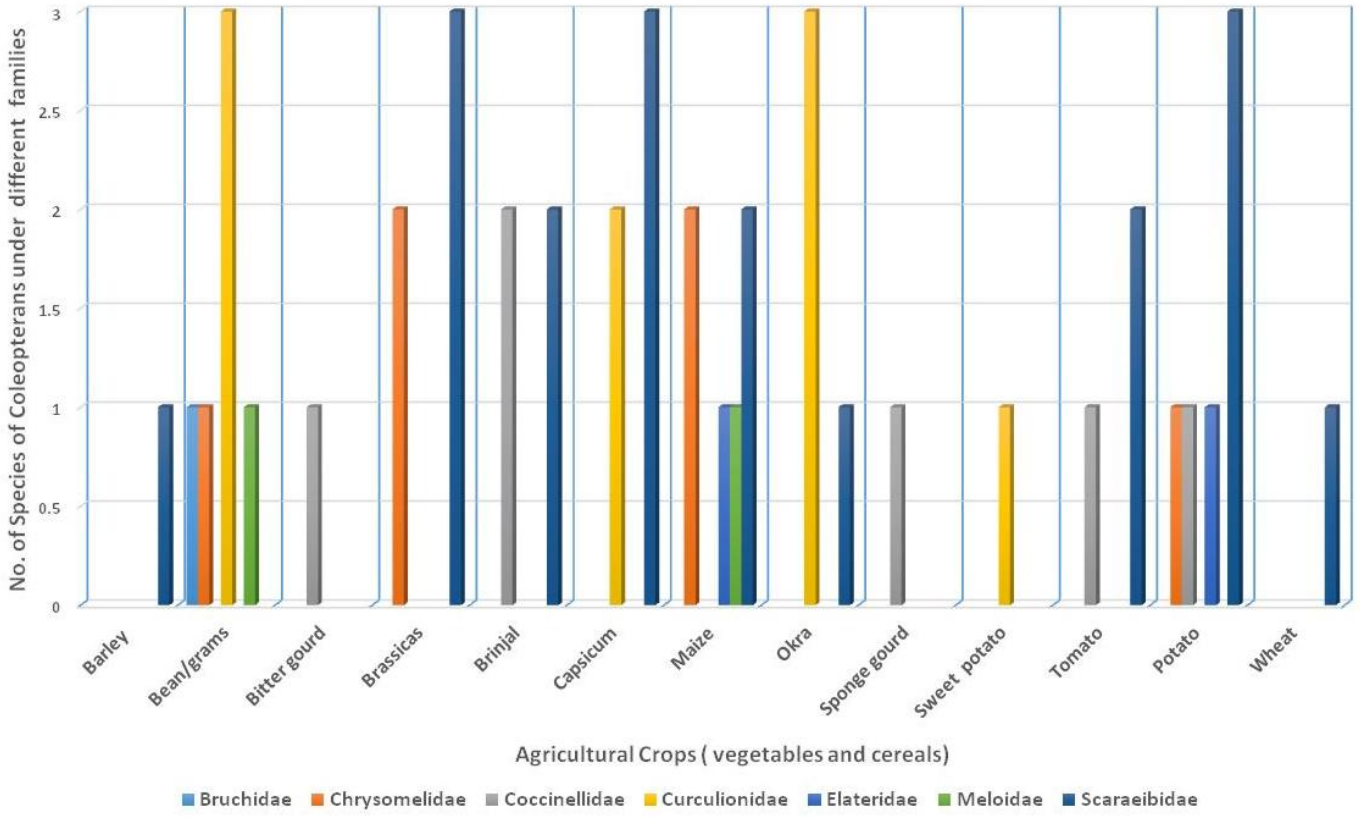

Fig. 1: Family-wise species diversity of Coleopterans affecting vegetable and cereal crops in Jammu and Kashmir State.

Table 2. Relative percentage of Coleopteran species associated with crop families (cereals, vegetables) and medicinal plant species in Jammu and Kashmir State (CC = Cereal Crop, VC = Vegetable Crop, MP = Medicinal Plant).

Crop / Plant Families (Number of species)	CC species	VC species	MP species	Coleopteran species	Percentage (%) of Coleopteran
Acoraceae (1 sp.)	--	--	01	01	2.27
Apiaceae (1 sp.)	--	--	01	01	2.27
Amaranthaceae (2 spp.)	--	--	02	02	4.54
Apocynaceae (4 spp.)	--	--	04	03	6.81
Asteraceae (4 spp.)	--	--	04	03	6.81
Brassicaceae (3 spp.)	--	03	--	05	11.36
Colchiaceae (1 sp.)	--	--	01	02	4.54
Convolvulaceae (1 sp.)	--	01	--	01	2.27
Cucurbitaceae (2 spp.)	--	02	--	01	2.27
Dioscoreaceae (1 sp.)	--	--	01	01	2.27
Fabaceae (4 spp.)	04	--	--	06	13.63
Lamiaceae (1 sp.)	--	--	01	01	2.27
Malvaceae (3 spp.)	--	01	02	04	9.09
Poaceae (3 spp.)	03	--	--	06	13.63
Polygonaceae (6 spp.)	--	--	06	03	6.81
Rosaceae (1 sp.)	--	--	01	01	2.27
Rutaceae (1 sp.)	--	--	01	03	6.81
Scrophulariaceae (2 spp.)	--	--	02	02	4.54
Solanaceae (13 spp.)	--	04	09	13	29.54

The highest number of species of Coleopteran i.e. 14, pertaining to the family Curculionidae is found to be associated with host crops (cereals, vegetables) and medicinal plant species. This family is followed by the family Chrysomelidae and Scarabaeidae, with 11 spp. and 9 spp. respectively. Rest of the 6 families show the number of species either 2 or 1, associated with various vegetable and medicinal plant species (see Checklist and Table 1).

The relative percentage of Coleopteran species, associated 20 families of crops (cereals, vegetables) and medicinal plant species, is presented in Table 2. The highest percentage of Coleopterans i.e. 29.54 % of the total fauna of crops and medicinal plants studied, is seen associated with the family Solanaceae, including vegetable crops as well as medicinal plant species. This is followed by 13.36 % each of Coloeopteran species pertaining to cereal crop families, viz. Fabaceae and Poaceae. The lowest percentage i.e. 2.27 % of Coleopterans of the total species of agricultural crops and medicinal plant species, is found in case of seven families such as Acoraceae, Apiaceae, Compositae, Convolvulaceae, Cucurbitaceae, Lamiaceae and Rosaceae (Table 2).

The cereal crops under different families: beans (*Phaseolus* spp.), grams (*Vigna* spp.) barley, wheat and maize, are known to be infested with 4 spp., 2 spp. 1 sp., 1 sp., 1 sp. and 6 spp. of Coleopterans respectively (Table 1 and Fig. 1). The vegetable crops, under 5 different families: brassicas and their varieties, brinjal, bitter gourd, capsicum, okra, potato, sponge gourd, sweet potato and tomato, show their association with 5 spp., 4 spp. 1 sp., 5 spp.,4 spp. 6 spp., 1sp., 1 sp. and 3 spp. respectively (Table 1 and Fig. 1).

The medicinal plant families, with number of number of species, infested with Coleopteran species are given in Table 1. The highest number of Coleopterans i.e., 3 species each, affecting medicinal plant families are: Apocynaceae, Asteraceae, Polygonaceae, Rutelaceae and Solanaceae. This is followed by 2 spp. each in case of families like Amaranthaceae, Colchiaceae, Malvaceae and Scrophulariaceae. One species each is found in medicinal plant families, *viz*., Acoraceae, Apiaceae, Dioscoreaceae, Lamiaceae and Rosaceae (Table 1).

The family-wise diversity of Coleopteran species associated with agricultural crops (vegetables, cereals) is presented in Fig. 1. The Bruchid is a pest of bean and gram. Chrysomelids damage bean/ gram, brassicas vegetables, maize and potato. The Coccinellids have food host range as bitter gourd, brinjal, sponge gourd, tomato, and potato. The Curculinids affect bean / gram, capsicum, okra and sweet potato. The Elaterids have been found on maize and potato. Meloids showed their association with hosts as beans and maize. The Scarabaeids showed diverse food host crop range as barley, brassicas, brinjal, capsicum, maize, okra, tomato, potato and wheat (Fig. 1).

Conflict of interest statement

Authors declare that they have no conflict of interest.

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