



DIVERSITY OF WHITE GRUBS (COLEOPTERA: SCARABAEIDAE) IN DAKSHINA KANNADA DISTRICT, KARNATAKA, INDIA

R NAVEENA, B K SHIVANNA, K SREEDEVI^{1*}, C M KALLESHWARA SWAMY AND SHARANABASAPPA

Department of Entomology; University of Agricultural and Horticultural Sciences, Shivamogga 577201, Karnataka, India

¹Division of Germplasm Collection and Characterisation, ICAR-National Bureau of Agricultural Insect Resources, Hebbal, Bengaluru 560024, Karnataka, India

*Email: kolla.sreedevi@gmail.com (corresponding author)

ABSTRACT

White grubs, also known as May or June beetles belong to the family Scarabaeidae of Coleoptera. A study assessed the species diversity and distribution of these in Dakshina Kannada district of Karnataka. Adult beetles were collected with light traps and manually from March to July, 2018 and 2019. The collection of 179 specimens resulted in 17 species belonging to nine genera of Melolonthinae and Rutelinae. Melolonthinae was slightly more speciose over Rutelinae with ten species under seven genera, whereas Rutelinae was represented by seven species under two genera. Overall, *Sophrops karschi* (Brenske) was the predominant species constituting 40.22% followed by *Anomalochela bicolor* subsp. *belgaumensis* Moser and *Apogonia* sp.1 (10.06% each). More number of species were documented in Belthangady region than Dharmasthala and Vittla. The data subjected to diversity indices revealed low species diversity in terms of evenness as species composition was skewed towards five species viz., *Sophrops karschi*, *Anomalochela bicolor* subsp. *belgaumensis*, *Apogonia* sp.1, *Miridiba excisa* and *Adoretus versutus*, which constituted nearly 79%.

Key words: Abundance, Melolonthinae, Rutelinae, white grub, genera, species, composition, evenness, *Sophrops karschi*, light traps, Western Ghats

White grubs also known as May or June beetles belong to the family Scarabaeidae of Coleoptera. Scarabaeidae is one of the largest families of superfamily Scarabaeoidea that comprises of 12 families, 43 subfamilies, 118 tribes and 94 subtribes (Smith, 2006). The family Scarabaeidae comprises of Laprosticti and Pleurosticti species that includes coprophagous and phytophagous groups, respectively. It is estimated that 27,800 species of Scarabaeidae occurs worldwide, of which Pleurosticti Scarabaeidae constitute nearly 25,000 described species and accounts more than two-thirds of all known species of Scarabaeoidea (Ratcliffe, 2002). In India, around 2500 species of Scarabaeidae were reported (Ali, 2001). Pleurosticti Scarabaeidae includes four major subfamilies, Melolonthinae, Rutelinae, Dynastinae and Cetoniinae of which Melolonthinae is the largest subfamily with 750 genera and 11000 described species worldwide (Houston and Weir, 1992) followed by Rutelinae. White grubs that form a rich and diverse group representing almost an estimated 10% of the beetle fauna worldwide are included primarily under subfamilies Melolonthinae and Rutelinae. White grubs' larvae feed on the roots and rootlets of the plants resulting in yellowing, wilting and drying symptoms initially and subsequently leading to the death of entire plant. These are serious pests

of several agricultural and horticultural crops and owing to the magnitude of economic impact, white grubs are considered as National pest (Ali, 2001). The diversity of white grubs are poorly documented in Dakshina Kannada district of Karnataka that falls in Western Ghats of India, which is also one of the biodiversity hotspot of the world. So, the present studies have been taken up with an objective to document an accurate baseline information on white grub species diversity and their distribution in Dakshina Kannada district.

MATERIALS AND METHODS

Surveys were conducted in three regions of Dakshina Kannada district viz., Belthangady (12°.98 'N, 75° 28 'E), Dharmasthala (12° 95 'N, 75° 38 'E) and Central Plantation Crop Research Institute (Regional station), Vittala (12° 15 'N, 75° 25 'E) for collection of adults. The light traps were installed with mercury bulb of 160w as light source and operated between 6 and 11 pm from March to July 2018 and 2019 at fortnightly intervals. Additionally, beetles were also collected through manual scouting on shrubs and trees with a help of hand torch. The adults attracted to light were collected, transferred to a container, brought to the laboratory and processed. Later the male and female specimens were identified

based on the shape of the hind tibial spurs and the abdomen structure and separated. The genitalia extracted from the male specimens were glued on a point and pinned along with the adults. Each specimen was then identified with available literature such as the Fauna of British India volumes on scarabs (Arrow, 1910; 1917) for Rutelinae and Dynastinae and Khan (1975), Khan and Ghai (1982) and Ahrens and Fabrizi (2016) literature for Melolonthinae. Information from web sources was also used (University of Nebraska- <http://museum.unl.edu>). Voucher specimens were deposited at the National insect museum of ICAR-NBAIR, Bengaluru. The species diversity was calculated using various diversity indices viz., Shannon's diversity index (H), Simpson's diversity index (D), Evenness (E), Margalef's diversity index (Dmg), and Menhinick's index (Dmn).

RESULTS AND DISCUSSION

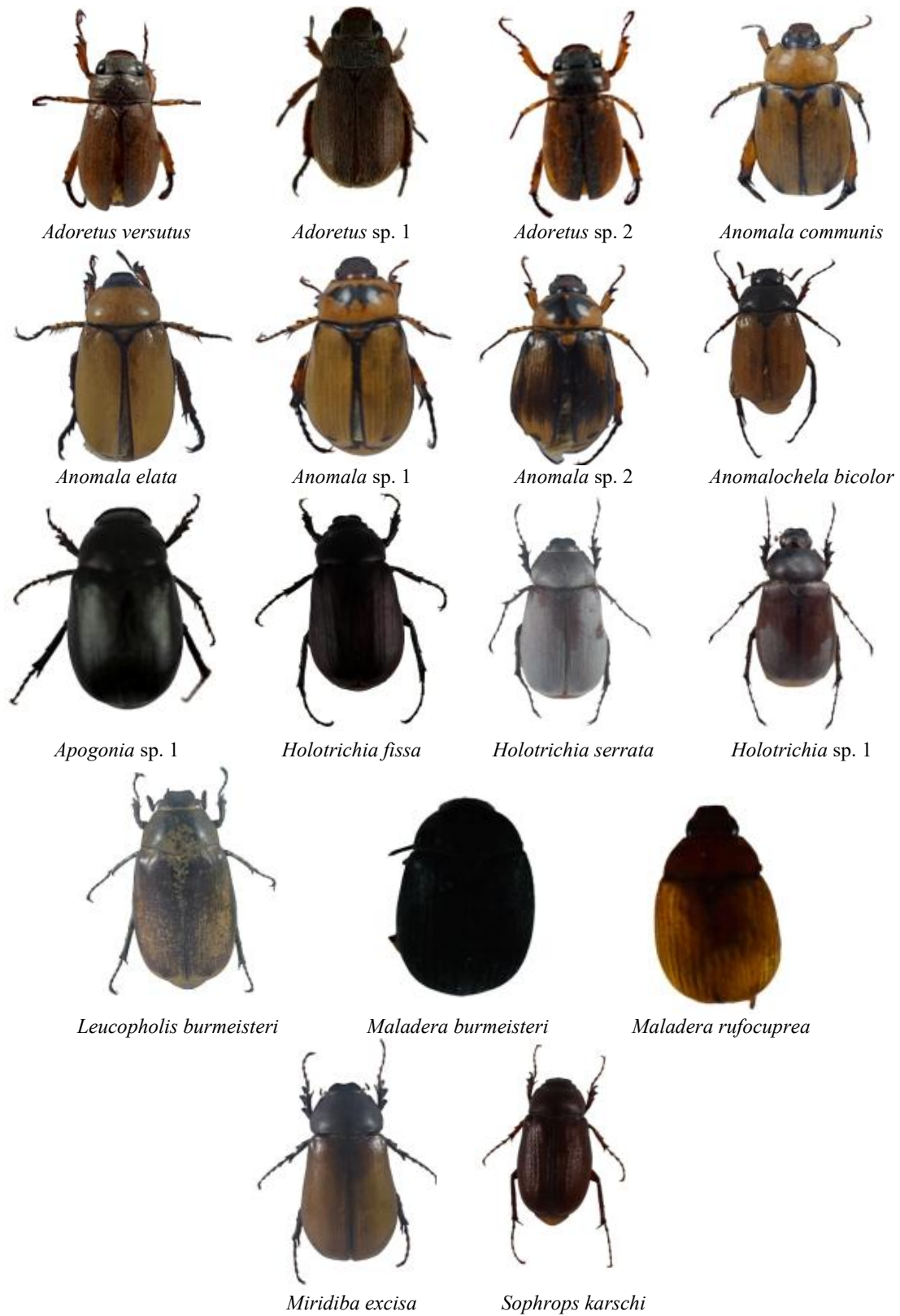
The collection of 179 beetle specimens resulted in 17 species belonging to nine genera of Melolonthinae and Rutelinae from surveyed areas of Dakshina Kannada (Figs. 1-17) Melolonthinae was slightly speciose over Rutelinae with ten species under seven genera, whereas Rutelinae was represented by seven species under two genera. The predominant species was *Sophrops karschi* (Brenske) (40.22%) followed by *Anomalochela bicolor* subsp. *belgaumensis* Moser and *Apogonia* sp.1 (10.06% each), *Miridiba excisa* Moser (9.50%) and *Adoretus versutus* Harold (8.94%), which together constituted 78.78% of the total population (Fig. 1). *Miridiba excisa* of Melolonthinae was predominant (26.67%) during

2018 but there was no sufficient catch during 2019. The predominant were of *Anomala* represented by four species followed by *Adoretus* and *Holotrichia*- three species each (Table 1). Of the total 17 species, 13 species representing nine genera are from Belthangady. The other two locations, Dharmasthala and Vittla were represented by five and eight species under four and five genera, respectively. The spatial distribution-wise *Anomala communis* Burmeister, *S. karschi* and *Apogonia* sp. 1 of 17 were common to all the three surveyed regions. *Adoretus versutus* was documented only in Vittla while *Adoretus* sp. 1 and *Anomala* sp. 1 were documented in Dharmasthala. *Holotrichia fissa* Brenske and was found predominant in both Belthangady and Vittla. *Anomala elata* F. was documented in Belthangady and Vittla while *M. excisa*, *Maladera rufocuprea* (Blanchard), *Holotrichia serrata* (Fabricius), *A. bicolor belgaumensis*, *Leucopholis burmeisteri* (Brenske) were documented in Belthangady alone. *Maladera burmeisteri* (Frey) was documented from Belthangady and Vittla regions and was in considerable numbers. The predominant species was found to be *A. bicolor* subsp. *belgaumensis* followed by *M. excisa* in Belthangady while *Adoretus* spp. was predominant in Dharmasthala. *Adoretus versutus* Harold and *Holotrichia fissa* Brenske were predominant in Vittla (Table 2).

Species diversity in terms of richness, evenness and abundance was calculated and compared using Shannon-Wiener index, Simpson dominance index, Margalef's diversity index, Menhinick's index and evenness.

Table 1. Species composition of white grubs in Dakshina Kannada district

Sl. No.	Name of the species	2018		2019		Pooled total	Pooled Relative abundance (%)
		Total	Relative abundance (%)	Total	Relative abundance (%)		
1.	<i>Adoretus versutus</i> Harold	0	0.00	16	13.45	16	8.94
2.	<i>Adoretus</i> sp.1	1	1.67	0	0.00	1	0.56
3.	<i>Adoretus</i> sp.2	0	0.00	1	0.84	1	0.56
4.	<i>Anomala communis</i> Burmeister	4	6.67	9	7.56	13	7.26
5.	<i>Anomala elata</i> F.	1	1.67	2	1.68	3	1.68
6.	<i>Anomala</i> sp.1	1	1.67	3	2.52	4	2.23
7.	<i>Anomala</i> sp.2	1	1.67	0	0.00	1	0.56
8.	<i>Anomalochela bicolor</i> subsp. <i>belgaumensis</i> Moser	5	8.33	13	10.92	18	10.06
9.	<i>Apogonia</i> sp.1	6	10.00	12	10.08	18	10.06
10.	<i>Holotrichia fissa</i> Brenske	2	3.33	2	1.68	4	2.23
11.	<i>Holotrichia serrata</i> (F.)	1	1.67	0	0.00	1	0.56
12.	<i>Holotrichia</i> sp.1	0	0.00	1	0.84	1	0.56
13.	<i>Leucopholis burmeisteri</i> Brenske	0	0.00	1	0.84	1	0.56
14.	<i>Maladera burmeisteri</i> (Frey)	2	3.33	4	3.36	6	3.35
15.	<i>Maladera rufocuprea</i> (Blanchard)	0	0	2	1.68	2	1.12
16.	<i>Miridiba excisa</i> Moser	16	26.67	1	0.84	17	9.50
17.	<i>Sophrops karschi</i> (Brenske)	20	33.33	52	43.70	72	40.22
	Total	60		119		179	



Figs. 1-17. White grub species documented in Dakshina Kannada district, Karnataka

Table 2. Species richness and distribution of white grubs in three regions of Dakshina Kannada during 2018-2019

Sl. No.	Name of the species	Belthangady	Dharmasthala	CPCRI vittla
1.	<i>Adoretus versutus</i>	-	-	+
2.	<i>Adoretus sp.1</i>	-	+	-
3.	<i>Adoretus sp.2</i>	+	-	-
4.	<i>Anomala communis</i>	+	+	+
5.	<i>Anomala elata</i>	+	-	+
6.	<i>Anomala sp.1</i>	+	-	-
7.	<i>Anomala sp.2</i>	-	+	-
8.	<i>Anomalochela varicolor subsp. belgaumensis</i>	+	-	-
9.	<i>Apogonia sp.1</i>	+	+	+
10.	<i>Holotrichia fissa</i>	+	-	+
11.	<i>Holotrichia serrata</i>	+	-	-
12.	<i>Holotrichia sp.1</i>	-	-	+
13.	<i>Leucopholis burmeisteri</i>	+	-	-
14.	<i>Maladera burmeisteri</i>	+	-	+
15.	<i>Maladera rufocuprea</i>	+	-	-
16.	<i>Miridiba excisa</i>	+	-	-
17.	<i>Sophrops karschi</i>	+	+	+

+ present; - absent

The species diversity was relatively high in Dakshina Kannada district during 2018 as evidenced by Shannon-Wiener index (1.90), Simpson dominance index (0.79), Margalef's index and Menhinick's index (2.68 and 1.54, respectively) while evenness was 0.55. In 2019, the diversity was low as exhibited by Shannon-Wiener index being 1.87, Simpson dominance index 0.76, Margalef's index and Menhinick's index being 2.72 and 1.28, respectively, while evenness was 0.46. The pooled data revealed that diversity is low in terms of evenness coupled with four dominant species in the composition (Shannon Wiener index as 2.03, Simpson dominance index as 0.77, Margalef's index and Menhinick's index as 3.08 and 1.27, respectively, evenness index as 0.44).

The review of literature reveals that distribution of scarab species in the Western Ghats region of Dakshina Kannada district is poorly studied. In the present study Melolonthinae was the predominant subfamily. The trap catches were considerably less owing to continuous heavy rains. Aparna et al. (2018) reported 34 phytophagous scarab species from the Coastal region

of Dakshina Kannada from six ecosystems during 2015. The present observations are in conformity with those of Aparna et al. (2018) on Melolonthinae being the dominant taxon. Similar results were known from other regions (Dadmal and Khadakkar, 2014; Pathania et al., 2015; Sreedevi et al., 2017). Observations revealed that five species could account to nearly 79% of the total faunistic diversity in the Dakshina Kannada.

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REFERENCES

- Ahrens D, Fabrizi S. 2016. A monograph of the Sericini of India (Coleoptera: Scarabaeidae). Bonn Zoological Bulletin 65: 1-355.
- Ali T M. 2001. Biosystematics of phytophagous Scarabaeidae an Indian over view. Indian Phytophagous Scarabaeidae and their Management. Agrobios India 5-47.
- Aparna S, Deepak N, Kumar A R V. 2018. Structural composition and diversity of scarab beetles communities in different ecosystem of South Karnataka. Journal of Entomology and Zoology Studies 6(5): 61-66.
- Arrow G J. 1910. The Fauna of British India (including Ceylon and Burma) : Lamellicornia I: Cetoniinae and Dynastinae. Thacker Spink and Co., Calcutta. p. 322.
- Arrow G J. 1917. The Fauna of British India (Including Ceylon and Burma): Lamellicornia II. (Rutelinae, Desmonycinae, and Euchirinae). Taylor and Francis. 387 pp.
- Dadmal S M, Khadakkar S. 2014. Revision of *Holotrichia* (Scarabaeidae: Melolonthinae) in different agroclimatic zones of Maharashtra, India. Journal of Entomology and Zoology Studies 2(3): 50-58.
- Houston W W K, Weir T A. 1992. Melolonthinae. Houston W W K (ed.). Zoological catalogue of Australia. Vol. 9. Coleoptera: Scarabaeoidea. AGPS, Canberra. pp. 174-358.
- Khan K M. 1975. Studies on Indian Melolonthinae. Doctoral Thesis. ICAR-Indian Agricultural Research Institute. Pusa, New Delhi, India.
- Khan K M, Ghai S. 1982. Taxonomic status of the genus *Holotrichia* Hope (Melolonthini: Melolonthinae: Scarabaeidae) with descriptions of five new species from India along with redescription of two poorly described species and a key to species. Bulletin of Entomology 23: 28-45.
- Pathania M, Chandel R S, Verma K S, Mehta P K. 2015. Studies on the preliminary ecology of invasive phytophagous Indian Scarabaeidae of north Western Himalaya Science, Technology and Arts Research Journal 4(2): 127-138.
- Ratcliffe B C. 2002. A checklist of the Scarabaeoidea (Coleoptera) of Panama. Zootaxa 32: 1-48.
- Smith A B T. 2006. A review of the family-group names for the superfamily Scarabaeoidea (Coleoptera) with corrections to nomenclature and a current classification. Coleopterists Society Monograph Number 5: 144-204.
- Sreedevi K, Sakshi T, Veena S. 2017. Species diversity of white grubs (Coleoptera: Scarabaeidae) in the Sub-Himalayan and Northern Plains of India. Current Science 113(2): 322-329.

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