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FURTHER REVISION OF THE SPECIES OF THE SUBGENUS *DROSOPHILA (DROSOPHILA)* OF KUMAON REGION, INDIA (INSECTA, DIPTERA, DROSOPHILIDAE)

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ABSTRACT

An account of twenty seven species belonging to the subgenus *Drosophila* of the genus *Drosophila* collected from Kumaon region, India, since July 2003 to July 2005.

Key Words: *Drosophilidae, Diptera, India, Kumaon, New Records and New Species*

INTRODUCTION

The study of systematics of Drosophilidae in Kumaon region was started in 1988 by Singh and Bhatt. Since then a number of Drosophilid species has been described and recorded from this region (Singh and Negi, 1989, 1992, 1995; Singh and Dash, 1993, 1998; Singh *et al.*, 2000, 2004; Singh and Fartyal, 2002; Fartyal *et al.*, 2005 and Joshi *et al.*, 2005). The Kumaon region includes six border districts of the state Uttaranchal, viz., Nainital, Almora, Pithoragarh, Bageshwar, Champawat and Udham Singh Nagar. This area is characterized by having dense evergreen coniferous forest with medium to very steep slopes and extremely moist condition due to heavy rainfall. The present paper deals with the results of Drosophilid survey undertaken in the still unexplored region of Kumaon in Uttaranchal.

MATERIALS AND METHODS

The collections were largely made by net sweeping over wild vegetation and by trap bait method. The flies were then preserved in 70% alcohol and observed under the microscope. In this paper we adopted the revised classification and terminology by Grimaldi (1990), Zhang and Toda (1992) respectively. Figure 1 shows collection localities.

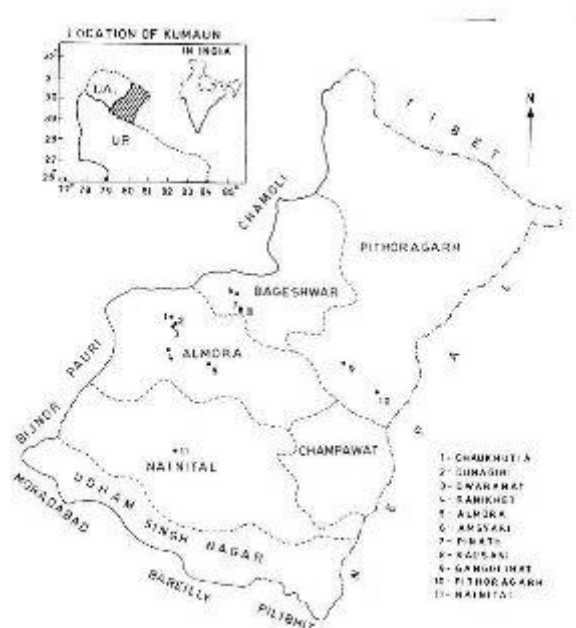


Figure 1: Map of Kumaon region showing collection sites of Drosophilidae

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Key to the Identification of the Species of the Subgenus *Drosophila* of the Kumaon Region

1. Scutum gray, with many dark brown spots -----
 -----*repleta* Wollaston
 -Scutum not gray and not with dark brown spots -----2
2. Tips of longitudinal veins black, male foreleg 1st tarsomere with a dense cluster of fine hair -----
 -----*immigrans* Sturtevant
 -Tips of longitudinal veins not black. Male foreleg 1st tarsomere without a dense cluster of fine hair -----3
3. Surstylus with 6-7 small black prensisetae -----
 -----*sulfurigaster* Duda
 -Surstylus not with 6-7 small black prensisetae -----4
4. Aedeagus club-shaped and trilobed -----
 -----*nainitalensis* Singh and Bhatt
 -Aedeagus not club-shaped and trilobed-----5
5. Cercus with a large black teeth -----
 -----*analspina* Singh and Negi
 -Cercus without large black teeth -----6
6. Aedeagus small and bifid -----
 -----*bishti* Singh and Negi
 -Aedeagus not small and bifid -----7
7. Surstylus with about 15 stout black prensisetae-----
 -----*painai* Singh and Negi
 -Surstylus not with about 15 stout black prensisetae -----8
8. Body large and black -----
 -----*lacertosa* Okada
 -Body not large and black -----9
9. Surstylus with about 6 black prensisetae arranged on outer margin -----
 -----*paunai* Singh and Negi
 -Surstylus not with about 6 black prensisetae arranged on outer margin -----10
10. Gonopod forming a large distal bow -----
 -----*trizonata* Okada
 -Gonopod not forming a large distal bow -----11
11. Tips of longitudinal veins not black, male foreleg 1st tarsomere without a dense cluster of fine hair -----
 -----*nasuta* Lamb
 - Cercus separated from epandrium, with numerous large setae-----12
12. Aedeagus large and trilobed -----
 -----*elongata* Singh, Dash and Fartyal
 - Aedeagus not large and trilobed -----13
13. Aedeagus small and serrated -----
 -----*serrata* Singh, Dash and Fartyal
 -Aedeagus not small and serrated -----14
14. Cercus quadrangular and separated from the epandrium -----
 -----*paharpaniensis* Singh, Dash and Fartyal
 - Cercus not quadrangular and separated from epandrium -----15
15. Paramere with about 6 black sensilla -----
 -----*hexaspina* Singh, Dash and Fartyal
 - Paramere not with about 6 black sensilla -----16

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16. Surstylus with about 21-22 small black prensisetae -----
 -----*khansuensis* Singh, Dash and Fartyal
 -Surstylus not with about 21-22 small black prensisetae -----17
17. Hypandrium S-shaped -----
 -----*paramarginata* Singh, Dash and Fartyal
 Hypandrium not S-shaped -----18
18. Male foreleg with a tuft of hair on 1st tarsomere -----
 -----*surangensis* Singh, Dash and Fartyal
 - Male foreleg not with a tuft of hair on 1st tarsomere -----19
19. Epandrium bow shaped -----
 -----*bagehwarensis* Singh, Dash and Fartyal
 -Epandrium not bow shaped -----20
20. Aedeagus long, pointed at the tip -----
 -----*bizonata* Kikkawa and Peng
 - Aedeagus not long and pointed at the tip-----21
21. Aedeagus short and rounded at the tip -----
 -----*parazonata* Dwivedi and Gupta
 - Aedeagus not short and rounded at the tip -----22
22. Cerci with 7 short teeth on the lower margin -----
 -----*muktesharensis* Joshi, Fartyal and Singh
 -Cerci without 7 short teeth on the lower margin-----23
23. Cercus separated from epandrium. Surstylus with about 14 small black prensistae-----
 -----*actinia* Okada
 -Cercus not separated from epandrium. Surstylus without 14 small black prensisetae-----
 -----24
24. Gonopod small and club shaped with a small prensisetae-----
 -----*hydei* Sturtevant
 -Gonopod not small and club shaped without a small prensisetae-----25
25. Surstylus small, elongate, fused with epandrium with 2 large black setulae-----
 -----*repletoides* Hsu
 -Surstylus not small, elongate and without 2 large black setulae-----26
26. Aedeagus small conical with a number of small sensilla-----
 -----*dwarahatensis* Upadhyay and Singh
 - Aedeagus not small conical without small sensilla-----27
27. Aedeagus long, curved with a number of small sensilla-----
 -----*tetradentata* Singh and Gupta

Systematic Section

Subgenus ***Drosophila*** Fallén (1823)

Drosophila Fallén (1823. Diptera, Sveciae Geomyz. 2: 4).Type species: *Musca funebris* Fabricious 1787: 345.

Gena often broad; subvibrissal setae large; prescutellar setae not, or barely, enlarged; propleural bristles absent; apical bands on anterior abdominal tergites when present, usually interrupted in the middle; usually rather large species.

1. *Drosophila (Drosophila) repleta* Wollaston

Drosophila repleta Wollaston (1858). Ann. Mag. Nat. Hist. 41: 107. Holotype: Madeira.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 11 ♂, 08 ♀, 8. VII. 2004: Almora district, Dwarahat, 50 ♂, 60 ♀, 21. IX. 2003; Dunagiri, 05 ♂, 07 ♀, 8.VIII. 2003; Ranikhet, 07 ♂, 06 ♀, 18. VI. 2005: Bageshwar district, Kausani, 26 ♂, 28 ♀, 14. IX. 2003. Coll. Upadhyay and Singh.

Distribution: Cosmopolitan.

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2. *Drosophila (Drosophila) immigrans* Sturtevant

Drosophila immigrans Sturtevant (1921) Carn-Inst. Wash. Publ. 301: 83. Holotype: New York U.S.A.

Drosophila (Drosophila) flexipilosa Pipkin (1964) Ent. Soc. Waaashington, 66: 283.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 65 ♂, 92 ♀, 7.VI. 2004: Almora, 45 ♂, 62 ♀, 14. VI. 2005; Ranikhet, 55 ♂, 88 ♀, 12. VI. 2005; Dwarahat, 118 ♂, 220 ♀, 12. V.2004; Dunagiri, 83 ♂, 62 ♀, 17. VI. 2004; Chaukhutia, 99 ♂, 125 ♀, 24. VI. 2005; Pithoragarh, 110 ♂, 111 ♀, 16. V. 2005; Gangolihat, 100 ♂, 91 ♀, 22. VI. 2005; Bageshwar district, Amsyari, 109 ♂, 125 ♀, 6. IV. 2005; Kausani, 131 ♂, 130 ♀, 21. IV. 2005; Pinath, 71 ♂, 100 ♀, 27. IV. 2005. Coll. Upadhyay and Singh.

Distribution: Cosmopolitan.

3. *Drosophila (Drosophila) sulfurigaster* Duda

Drosophila sulfurigaster Duda (1923). Ann. Hist. Nat. Mus. Hung. 20: 48. Holotype: New Guinea.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 19 ♂, 20 ♀, 10. VI. 2005. Coll. Upadhyay and Singh.

Distribution: Nepal, Burma, Pyin Oo Lwin, Mandalay, India.

4. *Drosophila (Drosophila) nainitalensis* Singh & Bhatt

Drosophila nainitalensis Singh and Bhatt (1988). Oriental Insects, U.S.A., Vol. 22: 147-161. Holotype: Nainital (U.P.) India.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 01 ♂, 01 ♀, 10. VI. 2005. Coll. Upadhyay and Singh.

Distribution: India.

5. *Drosophila (Drosophila) analspina* Singh & Negi

Drosophila (Drosophila) analspina Singh and Negi (1995). Entomol. Z. 105 (21) pp. 428-435. Holotype: Barapathar, Nainital district, Kumaon (Uttaranchal).

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 01 ♂, 01 ♀, 08.VII. 2004: Bageshwar district, Kausani, 02 ♂, 01 ♀, 14. IX. 2004. Coll. Upadhyay and Singh.

Distribution: India (Uttaranchal, Kumaon, Nainital, Chaubattia garden).

6. *Drosophila (Drosophila) bishti* Singh & Negi

Drosophila bishti Singh & Negi (1995), Entomol. Z. 105 (21). 428-435. Holotype: Sleepy Hollow, Nainital district., Uttaranchal, India.

Specimens examined: India:Uttaranchal, Kumaon, Nainital, 03 ♂, 01 ♀, 07. VII. 2004. Coll. Upadhyay and Singh.

Distribution: India: (Uttaranchal, Kumaon, Nainital, Ranikhet, Okhalkanda).

7. *Drosophila (Drosophila) painai* Singh & Negi

Drosophila painai Singh & Negi (1995). Entomol. Z. 105 (21). Pp. 428-435. Holotype: Pines, Nainital district, Uttaranchal, India.

Specimens examined: India:Uttaranchal, Kumaon, Nainital, 05 ♂, 08 ♀, 07. VII. 2004: Almora district, Dunagiri, 02 ♂, 04 ♀, 17. VI. 2004: Bageshwar district, Kausani, 04 ♂, 10 ♀, 20. VI. 2005.Coll. Upadhyay and Singh.

Distribution: India: (Nainital, Almora).

8. *Drosophila (Drosophila) lacertosa* Okada

Drosophila lacertosa Okada (1956), Syst. St. Drosophilidae allied Fauna- Japan: 158.

Drosophila lacertosa Okada; Takada and Lee, 1958: 144: Korea.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 56 ♂, 47 ♀, 26. VIII. 2004: Almora, 25 ♂, 35 ♀, 10. VI. 2005; Ranikhet, 20 ♂, 30 ♀, 22. VII. 2004; Dwarahat, 115 ♂, 130 ♀, 10. VI.2004; Dunagiri, 50 ♂, 55 ♀, 5. V. 2005; Chaukhutia, 95 ♂, 110 ♀, 24. V. 2005; Pithoragarh, 116 ♂, 135 ♀, 13. VII. 2004, Gangolihat, 45 ♂, 55 ♀, 09. IV. 2005; Bageshwar district, Amsyari, 110 ♂, 98 ♀, 6. IV. 2005; Kausani, 109 ♂, 110 ♀, 14. IX. 2004. Coll. Upadhyay and Singh.

Distribution: Japan, Korea, China, Ryukyu Is., Taiwan, Burma, Nepal, India, Russia (Kuril Is., Far East).

9. *Drosophila (Drosophila) paunai* Singh & Negi

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Drosophila paunai Singh & Negi (1989), Proc. Zool. Soc., Calcutta. 40: 19-26. Holotype: Pauna, Chamoli district, Garhwal.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 03 ♂, 02 ♀, 10. VIII.2004: Bageshwar district, Kausani, 01 ♂, 03 ♀, 21. IV. 2005. Coll. Upadhyay and Singh.

Distribution: India: (Kumaon, Garhwal).

10. *Drosophila (Drosophila) trizonata* Okada

Drosophila trizonata Okada (1966). Bull. Brit. Mus. (Naat. Hist.), (Ent. Suppl), 6: 97. Holotype: Nepal.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 19 ♂, 20 ♀, 10. VI. 2005. Coll. Upadhyay and Singh.

Distribution: Nepal, Burma, Pyin Oo Lwin, Mandalay, India.

11. *Drosophila (Drosophila) nasuta* Lamb

Drosophila nasuta Lamb (1914). Trans. Linn. Soc. 16: 346.

Drosophila (Spinulophila) salfurigaster Duda (1923). Ann. Mus. Nat. Hung. 20:28.

Drosophila (Spinulophila) albomicans Duda (1924). Arch. Nat. 90 A (2): 209; (3): 245.

Drosophila (Acanthophila) albovittata Duda (1926). Suppl. Ent. 14:87 (improper replacement name for *sulfurigaster* Duda).

Drosophila nasuta Mollach (1934). Insects of Samoa 6 (8): 311.

Drosophila (Acanthophila) nasuta Duda (1940). Ann. Mus. Nat. Hung., 33:23.

Drosophila spinofemora Patterson and Wheeler (1942). Univ. Texas. Publ. 4213: 104.

Drosophila nasuta Harrison (1954). Roy. Ent. Soc. London. Trans. 105 (6): 107; Okada, (1964b). Nature and life in South East Asia, 3: 463; Wheeler and Takada (1964). Ins. Micronesia, 14 (6): 180.

Specimens examined: India:Uttaranchal, Kumaon, Nainital, 25 ♂, 15 ♀, 18.V. 2004.Coll. Upadhyay and Singh.

Distribution: Borneo, Sumatra, Formosa, Molluccas, New Guinea, Samoa, Fiji, Hawaii, Micronesia, Seychelles, India.

12. *Drosophila (Drosophila) elongata* Singh, Dash & Fartyal

Drosophila elongata Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176. Holotype: Kulouri, Nainital, Uttaranchal, India.

Specimens examined: India:Uttaranchal, Kumaon, Nainital district, Kailakhan, 02 ♂, 02 ♀, 14. IV. 2004. Coll. Upadhyay and Singh.

Distribution: India (Kulouri,Nainital, Kumaon).

13. *Drosophila (Drosophila) serrata* Singh, Dash & Fartyal

Drosophila serrata Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176. Holotype: Sat-Tal Nainital, Uttaranchal, India.

Specimens examined: India: Uttaranchal, Kumaon, Nainital district, near Raj Bhawan, 07 ♂, 12 ♀, 07. VI. 2004: Almora district, Ranikhet, 02 ♂, 05 ♀,22. VII. 2004. Coll. Upadhyay and Singh.

Distribution: India: (Nainital, Chaubattia garden, Ranikhet).

14. *Drosophila (Drosophila) paharpaniensis* Singh, Dash & Fartyal

Drosophila paharpaniensis Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176.. Holotype: Paharpani, Nainital, Uttaranchal, India.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 02 ♂, 01 ♀, 21. VIII. 2004: Almora district, Ranikhet, 02 ♂, 18. VI. 2005. Coll. Upadhyay and Singh.

Distribution: India (Uttaranchal).

15. *Drosophila (Drosophila) hexaspina* Singh, Dash & Fartyal

Drosophila hexaspina Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176. Holotype: Jhargaon, Nainital, Uttaranchal, India.

Specimens examined: India: Uttaranchal, Kumaon, Nainital, 01 ♂, 7. VII. 2004. Coll. Upadhyay and Singh.

Distribution: India: (Nainital, Kumaon).

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16. *Drosophila (Drosophila) khansuensis* Singh, Dash & Fartyal

Drosophila khansuensis Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176. Holotype: Khansu, Nainital, Uttarakhand, India.

Specimens examined: India: Uttarakhand, Kumaon, Nainital, 02 ♂, 07 ♀, 21. VIII. 2004: Almora district, Chaukhutia, 02 ♂, 01 ♀, 19. IV. 2004: Bageshwar district, Kausani, 02 ♂, 03 ♀, 18. VIII. 2003. Coll. Upadhyay and Singh.

Distribution: India (Uttarakhand).

17. *Drosophila (Drosophila) paramarginata* Singh, Dash & Fartyal

Drosophila paramarginata Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176. Holotype: Kulouri, Nainital, Uttarakhand, India.

Specimens examined: India: Uttarakhand, Kumaon, Nainital district, Barapathar, 05 ♂, 02 ♀, 18. XI. 2004. Coll. Upadhyay and Singh.

Distribution: India (Kumaon).

18. *Drosophila (Drosophila) surangensis* Singh, Dash & Fartyal

Drosophila surangensis Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176.. Holotype: Surang, Nainital district, Nainital, Uttarakhand.

Specimens examined: India: Uttarakhand, Kumaon, Nainital, 01 ♂, 01 ♀, 21. VIII. 2004. Coll. Upadhyay and Singh.

Distribution: India (Uttarakhand).

19. *Drosophila (Drosophila) bagesharensis* Singh, Dash & Fartyal

Drosophila bagesharensis Singh, Dash & Fartyal (2004). Senckenbergiana biol. Vol. 83 (2): 163-176. Holotype: Bageshwar, Uttarakhand, India.

Specimens examined: India: Uttarakhand, Kumaon, Nainital, 03 ♂, 05 ♀, 26. VIII. 2004: Almora district, Ranikhet, 02 ♂, 10 ♀, 22. VI. 2005: Pithoragarh, 01 ♂, 04 ♀, 13. VII. 2003: Bageshwar district, Amsyari, 01 ♂, 01 ♀, 28. VI. 2005. Coll. Upadhyay and Singh.

Distribution: India: (Uttarakhand).

20. *Drosophila (Drosophila) bizonata* Kikkawa & Peng

Drosophila bizonata Kikkawa and Peng (1938). Jpn. J. Zool., 7: 532. *Drosophila (Drosophila) bizonata*: Wheeler, 1949, Univ. Texas Publ., (4920): Okada, 1955, Kontyu, Tokyo, 23: 98; 1956, Syst. Study, 135.

Specimens examined: India: Uttarakhand, Kumaon, Nainital, 02 ♂, 27. IV. 2005: Bageshwar district, Kausani, 02 ♂, 01 ♀, 21. VI. 2005. Coll. Upadhyay and Singh.

Distribution: Korea, Ryukyu, Nepal, Myanmar, Mandalay, Rangoon, India.

21. *Drosophila (Drosophila) parazonata* Dwivedi & Gupta

Drosophila parazonata Dwivedi & Gupta (1980). Entomon, Vol. 5, No. 2, pp. 129-134.

Specimens examined: India: Uttarakhand, Kumaon, Nainital, 02 ♂, 02 ♀, 19. IV. 2004. Coll. Upadhyay and Singh.

Distribution: India: (West Bengal, Kumaon).

22. *Drosophila (Drosophila) muktesharensis* Joshi, Fartyal & Singh

Drosophila muktesharensis Joshi, Fartyal & Singh (2005). Entomon. Vol. 30 (1): 75-84. Holotype: Mukteshwar, Nainital, Uttarakhand, India.

Specimens examined: India: Uttarakhand, Kumaon, Nainital, 01 ♂, 14. IV. VIII. 2004. Coll. Upadhyay and Singh.

Distribution: India.

23. *Drosophila (Drosophila) actinia* Okada

Drosophila actinia Okada (1991). Jpn J. Ent. Vol. 59: 473-489.

Specimens examined: India: Uttarakhand, Kumaon, Nainital, 04 ♂, 07 ♀, 8. VI. 2005: Bageshwar district, Amsyari, 01 ♂, 02 ♀, 06. IV. 2005. Coll. Upadhyay and Singh.

Distribution: Japan, India.

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24. *Drosophila (Drosophila) hydei* Sturtevant

Drosophila hydei Sturtevant (1921) p. 101. (Holotype in Washington; type locality Florida, U.S.A.)

Specimens Examined: India: Uttaranchal, Kumaon, Bageshwar district, Kausani, 15 ♂, 10 ♀, 19. VIII. 2003: Almora district, Dwarahat, 05 ♂, 08 ♀, 12. VII. 2004: Nainital 30 ♂, 10 ♀, 07. VII. 2004 Coll. Upadhyay and Singh.

Distribution: Formosa; Africa, Hawaii, Micronesia, Nearctic, Neotropical, Palaearctic and India (Kumaon, Uttaranchal).

Drosophila (Drosophila) repletoides Hsu

Drosophila (Drosophila) repletoides Hsu (1943). Kwangsi Agric. 4: 155-160.

Specimens Examined: India: Uttaranchal, Kumaon, Almora district, Dwarahat, 01 ♂, 10. VI. 2004. Coll. Upadhyay and Singh.

Distribution: China, Japan and India (Dwarahat, Almora, Kumaon).

26. *Drosophila (Drosophila) dwarahatensis* Upadhyay & Singh

Drosophila (Drosophila) dwarahatensis Upadhyay & Singh (2006). India. Proc. Zool. Soc. Cal. Vol. 59 (2): 195-202.

Specimens Examined: India: Uttaranchal, Kumaon, Almora district, Dwarahat, 01 ♂, 21. IX. 2003. Coll. Upadhyay and Singh

Distribution: India (Dwarahat, Almora, Kumaon, Uttaranchal).

25. *Drosophila (Drosophila) tetradentata* Singh & Gupta

Drosophila (Drosophila) tetradentata Singh & Gupta (1980). "Descriptions of three new species of *Drosophila* (Drosophilidae) from Northeast India". Oriental Insects, Vol. 14(4): 503-509.

Specimens Examined: India: Uttaranchal, Kumaon, Almora district, Dunagiri, 01 ♂, 01 ♀, 8. VIII. 2003: Bageshwar district, Kausani, 01 ♂, 01 ♀, 18. VIII. 2003. Coll. Upadhyay and Singh.

Distribution: India (West Bengal, Uttaranchal).

RESULTS AND DISCUSSION

The systematics is the study of biological diversity which is sometimes only portrayed as the classification of organisms, but in reality it has a wide scope in biology. Even today we do not know that how many species are there in the world. The genus *Drosophila* of the family Drosophilidae occupies a very important position among the organisms which are used as a material for genetic studies. Most of the species of the genus *Drosophila* can be easily and cheaply maintained in the laboratory culture. The important aspect of the study of *Drosophila* is that most of the insects belonging to this genus are suitable to the methods of investigation. The subgenus *Drosophila* showed entirely different distribution pattern in comparison to subgenus *Sophophora*. A total of 28 species of this subgenus were collected from different geographical localities in Kumaon region. Out of the 28 species *Drosophila dwarahatensis* was described as new to science while as *Drosophila hydei* Sturtevant and *Drosophila repletoides* Hsu was recorded for the first time from India, *Drosophila tetradentata* was recorded for the first time from Uttaranchal. *Drosophila immigrans* and *Drosophila nasuta* were cosmopolitan. Besides the above species *Drosophila actinia*, *Drosophila analspina*, *Drosophila bageshwarensis*, *Drosophila bizonata*, *Drosophila bishti*, *Drosophila elongata*, *Drosophila hexaspina*, *Drosophila immigrans*, *Drosophila khansuensis*, *Drosophila lacertosa*, *Drosophila mukteshwarensis*, *Drosophila nasuta*, *Drosophila nainitalensis*, *Drosophila notrostriata*, *Drosophila paramarginata*, *Drosophila parazonata*, *Drosophila paunai*, *Drosophila repleta*, *Drosophila serrata*, *Drosophila sulfurigaster*, *Drosophila surangensis* and *Drosophila trizonata* were also examined. *Drosophila immigrans* is the most wide spread member of the *nasuta* subgroup of the *immigrans* species group which is the largest species group and centred in south-east Asia (Wilson *et al.*, 1969). *Drosophila immigrans* was collected in all the seasons but was more in number in the rainy season. *Drosophila sulfurigaster* is the only species in which three subspecies has been recorded. *Drosophila sulfurigaster bilimbata* Bezzi extends from Fizi through Palmyra and Hawaii to Guan, *Drosophila sulfurigaster albostrigata* Wheeler occurs in Southeast Asia in Borneo, continental Malaysia,

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Thailand and eastwards to the Philippine Islands. *Drosophila sulfurigaster sulfurigaster* is unknown from the New Guinea, New Ireland and Northern Queensland (Wilson *et al.*, 1969). *Drosophila sulfurigaster* was also collected from some localities in Kumaon region, but regarding its subspecies more detailed study is required. Regarding *Drosophila lacertosa* it was observed that they were collected only during the peak rainy seasons showing its preference to high humidity. It is evident from the present studies that the Kumaon region is fairly rich in the subgenus *Drosophila* and more extensive survey will yield further interesting results. The present survey studies of the Kumaon region shows that the members of the genus *Drosophila* and other genera of the family Drosophilidae are fairly distributed throughout the Kumaon region. In comparison to the Drosophilid fauna of other countries of the world, the Indian fauna is still poorly known. The survey of the Drosophilid fauna of Kumaon region is also far from complete and it is believed that further surveying studies of this region will yield very interesting results.

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REFERENCES

- Fartyal RS, Singh BK and Toda MJ (2005).** Review of the genus *Leucophenga* Mik (Diptera: Drosophilidae) in India, with descriptions of five new species from northern India. *Entomological Science* **8** 405-417.
- Grimaldi DA (1990).** A phylogenetic, revised classification of genera in the Drosophilidae (Diptera). *Bulletin of the American Museum of Natural History* **197** 1-139.
- Joshi M, Fartyal RS and Singh BK (2005).** A report on two new and two unrecorded species of *Drosophila* from Mukteshwar, Kumaon, India (Diptera: Drosophilidae). *Entomon* **30**(1) 75-84.
- Okada T (1966).** Diptera from Nepal, Cryptochaetidae, Riastatidae and Drosophilidae. *Bulletin British Museum* 105.
- Singh BK and Bhatt M (1988).** The Drosophilidae of Kumaon region with the description of two new species and three new record. *Oriental Insects* **22** 147-161.
- Singh BK and Negi NS (1989).** A preliminary report on the Drosophilidae of Garhwal region with the description of one new species. *Proceeding Zoological Society, Calcutta, India* **40** 19-24.
- Singh BK and Negi NS (1992).** Two new and one unrecorded species of Drosophilidae from Uttarakhand, India (Insecta: Diptera). *Senckenbergiana Biology* **72** 321-327.
- Singh BK and Negi NS (1995).** Further addition to the Drosophilid fauna of Uttarakhand, India (Diptera: Drosophilidae). *Entomologische Zeitschrift* (Germany) **105**(21) 421-440.
- Singh BK and Dash S (1993).** Drosophilidae of Uttarakhand region with the description of one new species (Insecta: Diptera). *Proceeding Zoological Society Calcutta, India* **46**(2)131-140.
- Singh BK and Dash S (1998).** Drosophilidae of Kumaon region India with the description of four new species (Insecta: Diptera). *Proceeding Zoological Society, Calcutta, India* **51**(1) 45-56.
- Singh BK, Dash S and Fartyal RS (2000).** Further addition to the genus *Leucophenga* from Kumaon, India (Insecta: Diptera: Drosophilidae). *Senckenbergiana Biology* **80**(1 and 2) 149-154.
- Singh BK and Fartyal RS (2002).** Family Drosophilidae (Insecta:Diptera) in Kumaon region, India, with the description of one new species and three new records. *Proceeding Zoological Society, Calcutta* (India) **55**(1) 11-18.
- Singh BK, Dash S and Fartyal RS (2004).** Revision of the species of the subgenus *Drosophila* (*Drosophila*) of the Kumaon region, India, with the description of eight new species (Insecta, Diptera, Drosophilidae). *Senckenbergiana Biology* **83**(2) 163-176.

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Upadhyay K and Singh BK (2006). One new species and two new records of the subgenus *Drosophila* (Insecta: Diptera: Drosophilidae) from Kumaon Region, Uttaranchal, India. *Proceeding Zoological Society Calcutta* **59**(2) 195-202.

Wilson FD, Wheeler MR, Harget M and Kambysellis M (1969). Cytogenetic relations in the *Drosophila, nasuta* subgroup of the *immigrans* group of species. *University of Texas Publication* **6918** 207-253.

Zhang WX and Toda MJ (1992). A new species-subgroup of the *Drosophila immigrans* species- group (Diptera: Drosophilidae) with description of two new species from China and revision of taxonomic terminology. *Japan Journal Entomology* **60** 839-850.