Agricultural Reviews, 40(1) 2019: 59-64
Print ISSN:0253-1496 / Online ISSN:0976-0539

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

Termites (Insecta: Isoptera) of Haryana present state of knowledge- A review

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Received: 15-10-2017 Accepted: 04-03-2019 DOI: 10.18805/ag.R-1570

ABSTRACT

There are more than 2800 different species of termites recognised, till date in the world, out of which 300 are from Indian region. The termites (Isoptera) are important insects from a number of economic and ecological perspectives. Very little work has been done on termites of Haryana. Thirty seven species of Termites belonging to three families (Rhiotermitidae, Kalotermitidae, and Termitidae) have been reported till date from Haryana belonging to eleven genera (*Odontotermes, Microtermes, Microcerotermes, Heterotermes, Coptotermes, Trinervitermes, Bifiditermes, Neotermes, Speculitermes, Eremotermes* and *Angulitermes*). As geography of Haryana varies from hills, semi desert, sandy plains to river plains, more number of species should be present. Present study reviews the work done till date on identification of termites in Haryana.

Key words: Distribution, Haryana, Kalotermitidae, Rhiotermitidae, Termitidae, Termites.

Termites are terrestrial, eusocial insects, with differentiated castes. They have complex, coordinated group behaviours of nest construction and foraging. Due to their ecological and economic importance, termite identification is essential in urban and agricultural pest management, study of soil fauna, analysis of the diet of vertebrates, and for any ecological or biological study involving termites (Constantino, 2002; Jouquet *et al*., 2012). Economically, the damage termites cause to structures and buildings accounts for greater than US$20 billion annually worldwide (Su, 2002). Ecologically, termites fill important niches in natural ecosystems by their breaking down of cellulose and their role in the decomposition of organic matter (Sugimoto *et al*., 2000).

Study area: Haryana is a landlocked state in northern India. It lies between 27°39' to 30°35' N latitude and between 74°28' and 77°36' E longitude. The altitude of Haryana varies between 700 to 3600 ft (200 metres to 1200 metres) above sea level. Geography of Haryana has four main features- The Yamuna-Ghaggar plain forming the largest part of the state, Shivalik Hills to the northeast, Semi-desert sandy plain to the southwest and Aravalli Range in the south. The Haryana plains are flanked by the humid Himalayan front to the north, sub-humid Ganga plains in the east with Yamuna flowing along its eastern boundary, and arid Thar Desert to the south thus providing unique geomorphology to the area. A large part Haryana experience a semi-arid climate, except for the northern parts where conditions are sub-humid, and in the western part where they further deteriorate to arid (Saini and Mujtaba, 2012). The rainfall increases from <300 mm in west to >600 mm in east and north.

As moisture is an important factor for termites as they are weak and relatively fragile insects that need to stay moist to survive. They can be overpowered by ants and other predators when exposed. They avoid these perils by covering their trails with tubing made of feces, plant matter, saliva, and soil. Moreover, composition and activities of termite communities changes in relation to changing rainfall (Buxton, 1981).

Soil also shows a large variation in Haryana as there is an aeolian unit in the western and southern parts, an alluvial unit in the middle and northern parts, the Siwalik Ranges in the north, and linear ridges of the Aravalli Ranges in the southern parts. Micromorphological investigation of soil has showed the loss of soil fertility, micro-environment of carbonate precipitations, the alluvial development and monsoon variability (Courty and Federoff, 1985; Courty, 1990; Sharma *et al*., 2004; Gibling *et al*., 2005). Intermediate semi-arid sector between the Thar Desert and Ganga plains, is experiencing declining water tables, degeneration of streams, and overexploitation of soil resources, thus showing entirely different geomorphologic conditions.

Haryana is very hot in summer and cold in winters. The temperature falls to the lowest in January and reaches upto 55°C during the months of May and June. Winter months have average temperatures in the range 3°C to 9°C and the summer months temperatures are higher in the range of 35°C to 48°C. Rainfall is varied, with the Shivalik Hills region being the wettest and the Aravali Hills region being the driest. About 80% of the rainfall occurs in the monsoon season (July–September) and sometimes causes local flooding.There is no perennial river in Haryana, seasonal rivers include Ghaggar (enters in Panchkula Ambala and

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Hissar), Markanda (enters in Ambala later merges with Ghaggar), Sahibi along with three other rivulets in and around the Mewat hills – Indori, Dohan and Kasavati (Annonymous, 2013).

All these factors collectively lead to variation in geomorphology which may further lead to species biodiversity in different regions. Keeping this in view, an attempt has been made to know the current status of termite taxa of Haryana. A total of thirty one species belonging to three very important families of termites (Rhiotermitidae, Kalotermitidae, and Termitidae) are reported of eleven genera (*Odontotermes, Microtermes, Microcerotermes, Heterotermes, Coptotermes, Trinervitermes, Bifiditermes, Neotermes, Speculitermes, Eremotermes* and *Angulitermes*). Out of these, three genera *Odontotermes, Microtermes* and *Coptotermes* have unidentified species reported. A more comprehensive study is required to done to understand species composition of termites in Haryana.

Systematic Account:

Family1. Kalotermitidae

1. *Bifiditermes beesoni* (Gardner, 1945)

Kalotermes beesoni Gardner, 1945: 103 (soldier, nymph).

Distribution: India: Delhi, Haryana, Uttar Pradesh; Uttarakhand; Pakistan (Roonwal and Chhotani, 1989; Thakur, 2007; Kumar *et al*., 2013a).

2. *Neotermes fletcheri* (Holmgren and Holmgren, 1917)

Calotermes (*Neotermes*) *fletcheri* Holmgren and Holmgren, 1917: 139 (imago, soldier, worker)

Distribution: India: Gujarat, Kerala, Haryana, Tamil Nadu; Bangladesh; Sri Lanka (Roonwal and Chhotani, 1989; Thakur, 2007; Kumar *et al*., 2013a).

Family 2: Rhinotermitidae

Subfamily 1:Heterotermitinae

3. *Heterotermes indicola* (Wasmann, 1902)

Leucotermes indicola *Wasmann, 1902: 118–119 (soldier, pseudoworker)*

Distribution: India: Gujarat, Haryana, Himachal, Uttar Pradesh; Jammu and Kashmir, Maharashtra, Punjab, Rajasthan; Nepal; Pakistan. Afghanistan; Bangladesh, Iran; Pakistan: Baluchistan (Kumar *et al*., 2013b).

Subfamily 2: Coptotermitinae

4. *Coptotermes heimi* (Wasmann, 1902)

Arrhinotermes heimi Wasmann, 1902: 104 (imago), [described as "*Heimi*"; synonym of *gestroi* fide Yeap *et al*., 2010].

Distribution: India: Andaman Islands, Rajasthan, Andhra Pradesh, Jammu and Kashmir, Assam, Bihar, Daman, Delhi, Gujarat, Haryana, Uttar Pradesh, Himachal, Karnataka, Punjab, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, West Bengal; Oman; Bangladesh; Bhutan; Pakistan; Indonesia: Java; Nepal; Pakistan Baluchistan (Kumar *et al*., 2013b).

5. *Coptotermes kishori* Roonwal and Chhotani, 1962

Coptotermes kishori *Roonwal and Chhotani, 1962a: 57–61 (soldier, pseudoworker)*

Distribution: India: Assam, Gujarat, Tripura, Haryana, Kerala, Rajasthan, West Bengal, Madhya Pradesh (Kumar *et al*., 2013b).

6. *Coptotermes* sp.

Coptotermes sp. *Asha, 2014: (soldier)*

The identification was done only upto generic level. Species level identification was not done.Three other specimens collected from Morni (Log of Wood), Khanak (Mound) and Kaithal.

Family 3: Termitidae

Subfamily1: Apicotermitinae

7. *Speculitermes cyclops* Wasmann, 1902

Speculitermes cyclops Wasmann, 1902: 161–162 (imago, worker).

Distribution: India: Andhra Pradesh, Maharashtra, Karnataka, Madhya Pradesh, Orissa, Punjab, Uttar Pradesh, Jammu and Kashmir, Gujarat, Rajasthan, Haryana, Uttarakhand; Pakistan; Bangladesh (Chhotani, 1997; Thakur, 2007).

8. *Trinervitermes biformis* (Wasmann, 1902)

Eutermes biformis Wasmann, 1902: 133–135 (imago, soldier, worker)

Distribution: India: Andhra Pradesh, Jammu and Kashmir, Bihar, Delhi, Haryana, Madhya Pradesh, Gujarat, Karnataka, Kerala, Rajasthan, Maharashtra, Orissa, Punjab,Tamil Nadu, Uttar Pradesh, West Bengal; Pakistan; Sri Lanka(Kumar *et al*., 2013c).

9. *Trinervitermes longinotus* (Snyder, 1934)

Nasutitermes (*Trinervitermes*) *longinotus* Snyder, 1934: 14–15 (imago).

Distribution: India: Andhra Pradesh, Madhya Pradesh, Bihar, Delhi, Haryana, Gujarat, Jammu and Kashmir, Punjab,Karnataka, Kerala, Maharashtra, Orissa, Uttar Pradesh, Rajasthan, Tamil Nadu, West Bengal; Pakistan; Sri Lanka (Kumar *et al*., 2013c).

Subfamily 2: Macrotermitinae

10. *Odontotermes obesus* (Rambur, 1842)

1842. *Termes obesus* Rambur, *Histoire nat. Insectes, Ne'vropte'res, Paris:* 304. Imago.

Distribution: India: Andhra Pradesh, Assam, Uttar Pradesh, Bihar, Delhi, Gujarat, Himachal Pradesh, Jammu and Kashmir, Haryana, Tripura, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Orissa, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, West Bengal; Bangladesh; Myanmar; Tibet; Pakistan; Bhutan; China (Kumar *et al*., 2013d).

11. *Odontotermes brunneus* (Hagen, 1858)

Termes (*Termes*) *brunneus* Hagen, 1858: 133–136, 240 (imago)

Distribution: India: Uttar Pradesh, Andra Pradesh, Bihar, Haryana, Karnataka, Maharashtra, Orissa, Gujarat, Rajasthan, Tamil Nadu, Kerala, West Bengal (Chhotani, 1997; Kumar *et al.*, 2013d).

12. *Odontotermes redemanni* (Wasmann, 1893)
Termes redemanni Wasmann, 1893: 239–242 (imago, soldier, worker)

Distribution: India: Andhra Pradesh, Bihar, West Bengal, Madhya Pradesh, Gujarat, Haryana, Jammu and Kashmir, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttarakhand, Himachal Pradesh, Orissa, Uttar Pradesh; Sri lanka; Bangladesh (Kumar *et al*., 2013d).

13. *Odontotermes feae* (Wasmann, 1896)
Termes feae Wasmann, 1896: 625–626 (soldier, worker)

Distribution: India: West Bengal, Andhra Pradesh, Arunachal Pradesh, Bihar, Madhya Pradesh, Daman, Goa, Gujarat, Haryana, Assam, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Himachal Pradesh, Nagaland, Orissa, Rajasthan, Tamil Nadu, Tripura, Punjab, Uttar Pradesh,; Myanmar (Burma); Nepal; Sri Lanka; Bangladesh; Bhutan; Thailand; Vietnam (Kumar *et al.*, 2013d).

14. *Odontotermes wallonensis* (Wasmann, 1902)
Termes obesus wallonensis Wasmann, 1902: 106–109 (imago, soldier, worker)

Distribution: India: Andhra Pradesh, Maharashtra,Bihar, Gujarat, Haryana, Karnataka, Delhi, Kerala, Madhya Pradesh, Orissa, Uttarakhand, Rajasthan, Tamil Nadu, Uttar Pradesh (Kumar *et al*., 2013d).

15. *Odontotermes assmuthi* (Holmgren, 1913)
Odontotermes (*Odontotermes*) *assmuthi* Holmgren, 1913: 112–113 (soldier, worker).

Distribution: India: Bihar, Gujarat, Jammu and Kashmir, Assam, Karnataka, Kerala, Madhya Pradesh, Manipur, Orrisa, Pradesh; Punjab, Maharashtra, Tamil Nadu, West Bengal, Uttar Bangladesh; Pakistan (Kumar *et al.*, 2013d).

16. *Odontotermes distans* (Holmgren and Holmgren, 1917)
Odontotermes (*Cyclotermes*) *distans* Holmgren and Holmgren, 1917: 153 (imago).

Distribution: India: Assam, Gujarat, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Jammu and Kashmir; Nepal (Kumar *et al.*, 2013d).

17. *Odontotermes guptai* (Roonwal and Bose, 1961)
Odontotermes bellahunisensis guptai Roonwal and Bose, 1961: 588–593 (soldier, worker)

Distribution: India: Bihar, Haryana, Himachal Pradesh, Assam, Gujarat, Jammu and Kashmir, Maharashtra, Madhya Pradesh, Orrisa, Kerala, Punjab, Rajasthan, Uttar Pradesh; Pakistan, Bangladesh (Kumar *et al*., 2013d).

18. *Odontotermes bellahunisensis* Holmgren and Holmgren, 1917
Odontotermes (*Cyclotermes*) *bellahunisensis* Holmgren and Holmgren, 1917: 150–151 (imago, soldier, worker).

Distribution: India: Assam, Bihar, Uttar Pradesh, Gujarat, Haryana, Andhra Pradesh, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan, Orissa, Tamil Nadu, West Bengal (Kumar *et al.*, 2013d).

19. *Odontotermes gurdaspurensis* Holmgren and Holmgren, 1917
Odontotermes (*Cyclotermes*) *obesus gurdaspurensis* Holmgren and Holmgren, 1917: 149–150 (imago, soldier, worker)

Distribution: India: Himachal Pradesh, Jammu and Kashmir, Gujarat, Madhya Pradesh, Maharashtra, Haryana, Rajasthan; Utterakhand, Uttar Pradesh, Punjab, West Bengal; Pakistan (Kumar *et al*., 2013d).

20. *Odontotermes parvidens* Holmgren and Holmgren, 1917
Odontotermes (*Odontotermes*) *parvidens* Holmgren and Holmgren, 1917: 154 (soldier, worker).

Distribution: India: Harayana, Rajasthan, Himachal Pradesh, Assam, Jammu and Kashmir, Karnataka, Manipur, Uttar Pradesh, Punjab, Sikkim, Uttarakhand, West Bengal; Myanmar; Pakistan; Bhutan; Bangladesh (Chhotani, 1997;Kumar *et al.*, 2013d).

21. *Odontotermes microdentatus* Roonwal and Sen-Sarma, 1960

***Odontotermes microdentatus* Roonwal and Sen-Sarma, 1960: 33–39 (imago, soldier, worker)**

Distribution: Oriental Region—India: Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal
Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Orissa, Punjab, Uttarakhand, Uttar Pradesh (Kumar *et al*., 2013d).

22. *Odontotermes horai* Roonwal and Chhotani, 1962
Odontotermes horai Roonwal and Chhotani, 1962: 346–349 (soldier, worker)

Distribution: India: Gujarat, Haryana, Uttar Pradesh, Madhya Pradesh, Arunachal Pradesh, Meghalaya, Nagaland, Sikkim, West Bengal; Nepal; Pakistan (Kumar *et al*., 2013d).

23. *Odontotermes giriensis* Roonwal and Chhotani, 1962
Odontotermes giriensis Roonwal and Chhotani, 1962: 341–345 (soldier, worker)

Distribution: India: Assam, Delhi, Gujarat, Sikkim, Haryana, Jammu and Kashmir, Manipur, Meghalaya, Uttar Pradesh, Orissa, Arunachal Pradesh, Punjab, Rajasthan, Tripura,; Bangladesh; Bhutan; China; Tibet (Kumar *et al*., 2013d).

24. *Odontotermes bhagwatii* Chatterjee and Thakur, 1967
Odontotermes bhagwatii Chatterjee and Thakur, 1967: 33–35 (soldier, worker)

Distribution: India: Gujarat, Haryana, Punjab, Jammu and Kashmir, Delhi, Uttarakhand, Karnataka, Madhya Pradesh, Uttar Pradesh (Chhotani, 1997;Kumar *et al.*, 2013d).

25. *Odontotermes latiguloides* Roonwal and Verma, 1973
Odontotermes latiguloides Roonwal and Verma. 1973: 83–86 (soldier, worker)

Distribution: India: Karnataka, Gujarat, Haryana, Punjab, Rajasthan (Kumar *et al*., 2013d).

26. *Odontotermes feae* (Wasmann, 1896)
Termes feae Wasmann, 1896: 625–626 (soldier, worker)

Distribution: India: Assam, Bihar, Daman, Andhra Pradesh, Arunachal Pradesh, Goa, Gujarat, Haryana, Karnataka, Rajasthan, Punjab, Kerala, Meghalaya, Nagaland, Madhya Pradesh, Himachal Pradesh, Maharashtra, West Bengal, Manipur, Mizoram, Orissa, Tamil Nadu, Tripura, Uttar Pradesh,; Myanmar; Nepal; Sri Lanka; Thailand; Bangladesh; Bhutan; Vietnam (Kumar *et al*., 2013d).

27. *Odontotermes latigula* (Snyder, 1934)
Termes (*Cyclotermes*) *latigula* Snyder, 1934a: 9–10 (soldier, worker)

Distribution: India: Andaman and Nicobar Islands (Kumar *et al.*, 2013d).

28. *Odontotermes* sp.
***Odontotermes sp.* Asha, 2014: (soldier)**
The identification was done only upto generic level. Species level identification was not done. It did not fall into any key of identified species thus suggesting the presence of new species which require further work.

29. *Microtermes mycophagus* (Desneux, 1906)
Termes mycophagus Desneux, 1906: 348–352 (imago, soldier, worker)

Distribution: India: Rajasthan, Delhi, Gujarat, Haryana, Punjab; Pakistan; Iran; Pakistan: Baluchistan (Chhotani, 1997; Kumar *et al*., 2013d).

30. *Microtermes obesi* Holmgren, 1912
Microtermes obesi Holmgren, 1912a: 787–788 (imago).
Distribution: India: Assam, Bihar, Delhi, Gujarat, Haryana, Andhra Pradesh, Himachal Pradesh, Jammu and Kashmir, Karnataka, Gujarat, Tamil Nadu, Kerala, Madhya PradeshMeghalaya, Nagaland, Orissa, Punjab, , Maharashtra, Rajasthan, West Bengal, Sikkim, Tripura, Uttar Pradesh; Malaysia; Myanmar; Pakistan; Sri Lanka; Thailand; Vietnam.; Iran; Baluchistan; Sri Lanka, Bangladesh; Bhutan; Cambodia; Kampuchae (Kumar *et al*., 2013d).

31. *Microtermes unicolor* Snyder, 1933
***Microtermes unicolor* Snyder, 1933a: 92–93 (imago)**

Distribution: India: Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Punjab, Rajasthan, Uttarakhand, Uttar Pradesh; Bangladesh; Pakistan (Kumar *et al*., 2013d).

32. *Microtermes sp.*
***Microtermes sp.* Asha, 2014: (soldier)**
The identification was done only upto generic level. Species level identification was not done. It did not fall into any key of identified species thus suggesting the presence of new species which require further work.

Subfamily 4: Termitinae
33. *Angulitermes rathorai Kumar* and Thakur, 2010
***Angulitermes rathorai* Kumar and Thakur, 2010: 495–498 (soldier).**

Distribution: India: Haryana (Kumar and Thakur, 2010).
Subfamily 4: Amitermitinae

34. *Microcerotermes annandalei* Silvestri, 1923
***Microcerotermes annandalei* Silvestri, 1923: 225–228 (imago, soldier, worker)**

Distribution: India: Bihar, Nagaland, Orissa, Rajasthan, Haryana, Tripura; Myanmar;Malaysia: Mainland; Thailand (Kumar *et al*., 2013e).

35. *Microcerotermes beesoni* Snyder, 1933
***Microcerotermes beesoni* Snyder, 1933b: 12–14 (imago)**

Distribution: India: Assam, Delhi, Haryana, Madhya Pradesh, Gujarat,Orissa, Punjab, Sikkim, Uttarakhand, Uttar Pradesh, Kerala, West Bengal; Pakistan : Bangladesh; Bhutan (Kumar *et al*., 2013e).

36. *Microcerotermes cameroni* Snyder, 1934
Microcerotermes cameroni Snyder, 1934: 21–22 (imago, soldier, worker).
Distribution: India: Andhra PradeshGujarat, Karnataka, Kerala, Madhya Pradesh, Sikkim, Tamil Nadu, , Daman, West Bengal (Kumar *et al*., 2013e).

37. *Eremotermes paradoxalis* Holmgren, 1912
Eremotermes paradoxalis Holmgren, 1912: 95 (soldier)
Distribution: India: Andhra Pradesh, Madhya Pradesh, Bihar, Delhi, Gujarat, Karnataka, Punjab, Rajasthan, Tamil Nadu; Pakistan.

CONCLUSION

In the current study we summarized about distribution of 37 termite genus in Haryana. As evident from the geomorphology of Haryana, more number of species should be present. So, a more comprehensive study is required to be done in this matter to understand termite species composition of Haryana.

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