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Ant Diversity In Three Selected Localities of Thanjavur and Cuddalore Districts of Tamilnadu

KEYWORDS: ant diversity, all out search, formicidae, habitat, light trap

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ABSTRACT *A study tried to explore the distribution of ants in Reverine area, Cultivable lands and Industrial locatlities around Thanjavur and Cuddalore district. In this area, twenty one species of ants in fourteen genera were identified. These ant species belong to six Subfamilies;* Ponerinae, Dorylinae, Pseudomymicinae, Myrmicinae, Formicinae and Dolichoderinae. *The dominant genus was Camponoptus and Tetraponera. Among these three habitats, the similarity of ant species was highest between Riverine area and cultivable land. The dominance in Riverine area and cultivated area indicated that the genera Camponotus is most adapted genera in Riverine area and Cultivated area.*

Introduction

Biodiversity conservation and management is of world-wide concerns. Use of surrogate taxa, i.e. taxa that site, has become important in biodiversity studies. It is impossible to study all the communities available in a particular ecosystem, in light of the need for rapid, reliable and cost-effective assessments that can be used in conservation and monitoring programs. Traditionally, majority of studies used vascular plants and vertebrates as indicator taxa. However, recently the importance and appropriateness of using invertebrate groups was well recognized. Among invertebrates, ants are considered for monitoring due to number of reasons. They are abundant and ubiquitous in both intact habitat and disturbed areas and ants have proven to be sensitive and rapid responders to environmental variables.

Moreover, ants are functionally important at many different tropic levels and play critical ecological role in soil turnover, nutrient cycling. Hence it is worthwhile studying these important indicator taxa in industrial establishments whereas natural habitat is being manipulated by anthropogenic activities (Agosti et al, 2000). However, in India very little information is available on the biocenology of ants and in particular their diversity is comparatively unexplored in the southern part of India therefore, the present work was aimed to explore the diversity and habitat preference of ant assemblage in a heterogeneous ecosystem in some selected areas of Cuddalore and Thanjavur districts of Tamilnadu, India.

Materials and Methods

Study area

The present study was carried out in an attempt to understand and measure the status of ant diversity in selected areas (1) Riverine area, it includes two rivers viz., Cauvery and Arasalaru (Lat.1056´N; Long.7917´E) of Thanjavur district. (2) Cultivated land (Paddy field, Sugar cane, Groundnut) in Kondasamuthiram (Lat.11020´N; Long.7928´E) of Cuddalore district. (3) Industrial area consists of M.R.K Co-operative sugar mill (Lat.11026´N; Long.7932´E) and Rice mill in Cuddalore district of Tamilnadu. The data were collected for a period of 8 months from September 2011 to April 2012.

Sample collection

Ants were collected during morning and evening time using different method as described by Gadagkar et al., (1993). Four different methods were employed for collection of ant samples.

All- out search method

The most commonly used method is all-out search method. The ants were just picked up using brushes or forceps. Care should be taken to collect all castes from a colony in the case of polymorphic species, because the phenomenon of polymorphism can lead to major confusions, during sorting and identification.

Pit-fall trap method

A trap is a device by which insects are attracted to something, that is so arranged that once they get into it, they cannot get out from it. It consists of a 2.5 liter plastic jar with an opening of 9cm, diameter. A tripod stand was used to place plastic plate for protecting the jar from rain. In this study each jar was provided with 30ml of 0.5% methyl parathion solution.

Light trap method

This a portable light trap, which can be easily assembled and dismantled, which uses a 10-inch fluorescent light source powered by 1.5-volt battery cells. The main framework of the trap consists of 4 iron legs, an aluminium roof and two aluminium baffles, between which the light source is placed. Ants were attracted to light and were collected through a funnel in a cyanide jar that is placed below the light.

Scented trap method

A plastic jar of 2.5 litre capacity was used to fabricate a scented trap and the trap was baited with 200ml of saturated jaggery solution with two tables of baker's yeast, 0.05% methyl parathion emulsion and 0.5 ml of pineapple essence.

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Preservation of ant samples
Samples mixed with debris were separated from debris and were washed with alcohol before preserving them. Immediately after collection, all the specimens were sorted out based upon similar groups. Sorting is one of the very basic things, which needs to be done carefully. Most of the taxa can be sorted based on colour, size and some basic morphological features. Then they were sorted based upon different genera and each group was assigned names such as genus A, genus B etc. Following that, each of the genus were split into morphospecies and kept in separate vials with appropriate labels.

Wet preservation
The collected ants were directly put into 70% alcohol. All the vials were labeled properly by marking the details of the locality, date of collection, name of collector and information's about the species habitat, whether it is arboreal or ground dwelling.

Identification of Ant
The collected ants were identified up to genus and for few, species level identification was done with the help of keys given by Ali (1992); Bingham (1903); Bolton, B. (1994); Rastogi (1997); Tiwari (1999); Varghese et al (2002 &2003). The most complex specimens were sent to Centre for Ecological sciences, Indian institute of science at Bangalore to confirm their identity.

Results
Ant species composition
Based on the present preliminary investigation in three different study areas (Riverine, Cultivated and Industrial area) totally 21 species belonging to 14 genera, that spread over 6 subfamilies (Table 1) were recorded. Of the 6 subfamilies, The Myrmicinae was the most dominant subfamily in terms of species richness (7 Species) followed by Formicinae (5 species) Ponerinae and Pseudomyrmicinae 3 species each, Dolichoderinae (2 species) and the Dorylinae was represented by only one ant species in all the surveyed areas (Figure 1 and Table 2). Fifteen specimens could be identified to the species level. The Tetraponera and *Camponotus* were the most species rich Generas with 3 species followed by Monomorium with 2 species.

During the present investigation comparatively lower species diversity (No of species: 15) was observed in individual area (IA) and high diversity of species (No of species: 19) was noticed in cultivated area (CA) and moderate species diversity (No of species: 17) were recorded in riverine area (RA) (Table 3).

With reference to percentage of species distribution in three different collection sites, cultivated area (CA) harbored the maximum percentage (37.25%) than other two study sites. Followed by Riverine area (RA) recorded (33.33%) and lower percentage (29.41%) was noticed in Industrial area (IA) (Fig 2).

In the present study, Riverine study area consists of two major rivers like Cauvery River and Arasalaru river banks of which Cauvery river bank area recorded minimum number (8 species) of species (Fig 3) (Table 4). The other site, Arasalaru recorded 10 species in specific. Ant species richness find its high peak in groundnut field with 14 species and lower peak in sugarcane field with 10 species and moderate number of species (12 species) in paddy field (Fig 4 and Table 4). With regard to Industrial area (IA) maximum number of species (11 species) was observed in sugar mill area and rice mill area recorded lower number of species (8 species) (Fig 5 and Table 4).

Discussion
Collection of an ant fauna depends on the type of ant fauna (e.g. arboreal, leaf litter, ground dwelling etc.,) one would want to collect based on the needs of various investigations. Agosti et al., (2000) described the procedures for surveying the diversity of ground-dwelling ants. They introduced a standardized protocol for collecting ant samples in any part of world and for conducting repeated samplings over time, which enables researchers to analyze in a long- term patterns. From the literatures sited it has been suggested that Pitfall trap is the most effective method of collecting ants followed by Net sweep and Light traps. They recommend a combination of both trapping and All-out Search method to achieve best results.

Genera *Aphanogaster* and *Monomorium* of Myrmicinae, *Camponotus* of Formicinae and *Leptogenys* of Ponerinae were commonly found in all the area and more localities. The genus *Pheidole* and *Camponotus* were dominant in the cultivated and Riverine area (Aravind Chavhan and S.S.Pawar, 2011).

In riverine areas, most of plants are usually accompanied by sap feeders, including aphids, mealy bugs, tree hoppers and scale insects that may serve as a food resource for ant species and also the excretory honeydew produced by these plants is a major carbohydrate rich food for ants (Robinson, 1996). Palanichamy et al (1995) also reported that black ants (*Camponotus* spp.) play a more role in pollination of some flowering plants. Sunilkumar et al. (1997) reported that, ant species richness generally increased with increase in vegetation.

Rajagopal et al (2005) recorded a total of 25 species of ants belonging to 14 genera distributed in six subfamilies. It included Formicinae (9 species) followed by Myrmicinae (8 Species), Pseudomyrmicinae (4 species), Ponerinae (2 species), Dorylinae/ Dolichoderinae (1 species). The study revealed that more number of ant species were recorded in the riverine (24 species) and cultivated areas (20 species).

It is evident from the present investigation that more number of Camponotus species (4 spp.) was recorded in the riverine area and in cultivated areas. Camponotus ants are called as carpenter ants because of their "Nesting Behaviors". They dwell in the tree trunks for living and inside but do not feed on the wood. Tree hollow, tree holes and dead limbs are the most common nesting site for this species. The carpenter ants are most important insect pests causing damages in building. Ward, P.S. (2001) reported further detailed investigations are essential to understand the dominance of taxonomic hierarchy. The high proportion of Myrmicinae species that typically comprise the bulk of the cryptic species found in South East Asian leaf litter can be seen as an indication that the community was sampled evenly.

Douglas J.M & J. Sudd (1980) and Robinson (1996) reported that majority of carpenter ants (Camponotus spp.) normally feed on honeydew of aphids. The same observation was reported in North America in which Camponotus compressus and Camponotus sericeus were considered as serious pests of the largest and most heterogenous ant genera in tropical and neotropical regions (Robinson,

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1996). Ants are everywhere, but occasionally noticed. They run much of the terrestrial world as the premier soil turners, channelers of energy, dominatrices of the insect faun. One third of the entire animal biomass of the Amazonia terra firme rain forest is composed of ants and termites, with each hectare of soil containing in excess of 8 million ants and 1 million termites (Holldobler and Wilson, 1990).

Oecophylla smaragdina species was rich in the coconut field in cultivated areas. The same observation was reported by Kumaresan (1998). *Oecophylla samragdina* is considered as a major pest of Coconut, Portia, Moringa, Teakwood, Mango and Citrus spp. Weaver ants nest are formed basically of living leaves and stems bound together with larval silk. In this study, it was found at least of weaver ants nests hanging on the tree in Portia, Mango in summer season, because of being an aggressive predators and territory defense, they sometimes drop down their nest and tree branches on the ground for foraging and defense. Ramesh, T (2010) reported the community composition difference between these habitats was mainly due to the vegetation type. *Monomorium* species complex showed striking similarity because of their restricted distributions at sandy area and monoculture habitats. *Diacamma rugosum* and *Camoponotus variegates* were found to be more similar because of their predominance.

Bingham (1903) reported 443 species of ants from India, which comes under 5 subfamilies and 79 genera. His "Fauna of British India" – Hymenoptera includes descriptions of all the species, which were then available in various scattered publications. Donisthorpe (1942) has added ant species of Karnataka to the list. Ali (1991 and 1992) reported 125 species of ants from Karnataka, which come under 7 subfamilies and 30 genera. Gadagkar et.al., (1993) have sampled ants from 12 different localities in the Uttara Kannada district of Karnataka and reported 140 species of ants under 32 genera belonging to 6 subfamilies.

Some of the ant genera were recorded consistently with record of single species each from one or two species these were *Leptogenys* and *Solenopsis* from Cauvery River, *Diacamma* and *Camponotus* from Arasalaru River. One of the species viz., *Tetraponera nigra* of Pseudomyrmicinae was recorded from the tree trunk of cashew tree and millingtonia in the Kondasamuthiram area.

Lower diversity of ants was recorded in the industrial areas (15 species). This may be due to the pollutants like industrial effluents. Chemical waste materials and release of smoke was severely reducing the diversity of ant population. Odum (1997) reported that the species diversity was greatly reduced when ant communities were subjected to periodic perturbation by man in nature. The same observation on waste and sewage almost reduced the diversity of natural systems into which they are discharged. Relative abundance of predatory ants of subfamilies including Formicinae and Myrmicinae were found to be dominant in Cuddalore district.

Conclusion

Ants perform many ecological roles which are beneficial to humans being, including the suppression of pest populations and an erosion of the soil. Present study will yield valuable information of ant availability in the region. The environs of Cuddalore and Thanjavur district is rich in ant species deserve further study.

Acknowledgements

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Tables: Table 1. Subfamily wise distribution of ant genera and identified species.

Subfamily	Genera	Species found
Ponerinae	*Leptogenys*	*Leptogenys processionalis*
	Diacamma	*Diacamma ceylonense*
	Pachycondyla	*Pachycondyla crassa*
Dorylinae	*Dorylus*	*Dorylus labiatus*
Pseudomyrmicinae	*Tetraponera*	*Tetraponera allaborans*
		Tetraponera nigra
		Tetraponera rufonigra
	Aphaenogaster	
Myrmicinae	*Cardiocondyla*	*Aphaenogaster sp*
	Monomorium	*Cardiocondyla wroughtonii*
		Monomorium criniceps
	Pheidole	*Monomorium subopacum*
	Solenopsis	*Pheidole sp*
		Solenopsis invicta
Formicinae	*Camponotus*	*Solenopsis sp*
		Camponotus compressus
		Camponotus sericeus
		Camponotus parius
	Oecophylla	*Camponotus sp*
		Oecophylla smaragdina
	Tapinoma	*Tapinoma sp*
Dolichoderinae	*Technomyrmex*	*Technomyrmex sp*

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Total 6	14	21

Table 2. Total number and percentage of Species, genera collected per subfamily

Subfamily	Genera		Species	
	No of species	%	No of species	%
Ponerinae	3	21.41	3	14.28
Dorylinae	1	07.14	1	04.76
Pseuodomyrmicinae	1	07.14	3	14.28
Myrmicinae	5	35.71	7	33.33
Formicinae	2	14.28	5	23.80
Dolichoderinae	2	14.28	2	09.52
Total 6	14	100	21	100

Table 3. Distribution of ant species in three different areas

S.No	Ant species	Collected area		
		RA	CA	IA
1.	*Leptogenys processionalis*	+	+	+
2.	*Diacamma ceylonense*	+	+	+
3.	*Pachycondyla crassa*	+	+	-
4.	*Dorylus labiatus*	+	-	-
5.	*Tetraponera allaborans*	+	+	+
6.	*Tetraponera nigra*	+	+	+
7.	*Tetraponera rufonigra*	-	+	+
8.	*Aphaenogaster sp*	+	-	-
9.	*Cardiocondyla wroughtonii*	-	+	+
10.	*Monomorium criniceps*	+	+	+
11.	*Monomorium subopacum*	+	+	+
12.	*Pheidole sp*	-	+	+
13.	*Solenopsis invicta*	+	+	+
14.	*Solenopsis sp*	+	+	+
15.	*Camponotus compressus*	+	+	+
16.	*Camponotus sericeus*	+	+	+
17.	*Camponotus parius*	+	+	-
18.	*Camponotus sp*	+	+	-
19.	*Oecophylla smaragdina*	+	+	+
20.	*Tapinoma sp*	+	+	+
21.	*Technomyrmex sp*	-	+	+
	Total Number of Species	17	19	15

Note: + - Present, - - Absent RA - Riverine area, CA - Cultivated area, IA - Industrial area

Table 4. Ant species distribution in different collected areas

Sl No	Antspecies	Collected areas						
		Riverine area		Cultivated area			Industrial area	
		CR	AU	PY	SC	GN	SM	RM
1.	Leptogenys processionalis	+	+	+	+	-	+	-
2.	Diacamma ceylonense	-	+	+	-	+	+	+
3.	Pachycondyla crassa	+	-	+	-	+	-	-
4.	Dorylus labiatus	+	-	-	+	-	-	-
5.	Tetraponera allaborans	+	+	-	-	+	+	-
6.	Tetraponera nigra	+	+	+	+	+	-	+
7.	Tetraponera rufonigra	-	-	-	-	+	+	-
8.	Aphaenogaster sp	-	-	-	-	+	-	-
9.	Cardiocondyla wroughtonii	-	-	-	-	+	-	+
10.	Monomorium criniceps	+	-	+	+	+	+	-
11.	Monomorium subopacum	+	-	+	-	+	+	-
12.	Pheidole sp	-	-	-	-	+	+	+
13.	Solenopsis invicta	+	+	+	+	+	-	+
14.	Solenopsis sp	+	-	+	+	+	-	+
15.	Camponotus compressus	+	-	+	-	-	+	-
16.	Camponotus sericeus	-	+	-	+	-	-	+
17.	Camponotus parius	+	+	-	-	+	-	-
18.	Camponotus sp	+	-	+	+	-	-	-
19.	Oecophylla smaragdina	+	-	+	-	+	+	-
20.	Tapinoma sp	+	+	+	+	-	+	+
21.	Technomyrmex sp	-	-	-	+	-	+	-
	Total number of species	14	8	12	10	14	11	8

Note: CR (Cauvery River), Au (Arasalaru), PY (Paddy), SC (Sugarcane), GN (Groundnut), SM (Sugar mill), RM (Rice mill). + = Present, - = Absent

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Figures:

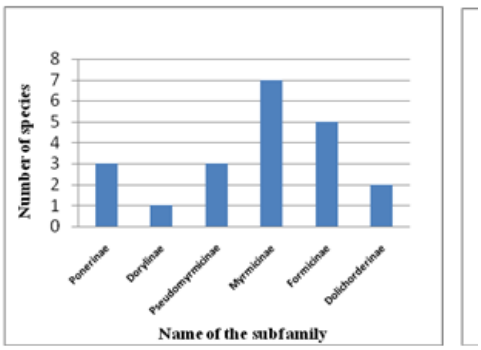

Figure 1: Subfamily wise distribution of ant genera and species.

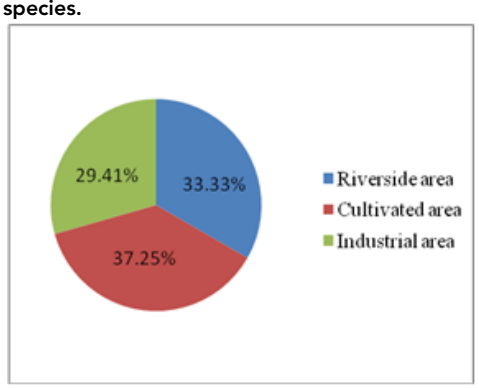

Figure 2: Distribution of ant species in three different study areas.

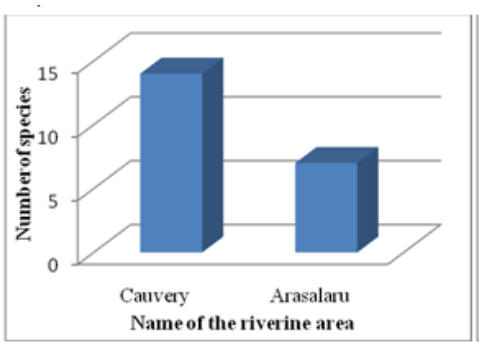

Figure 3: Ant species distribution in two riverine areas

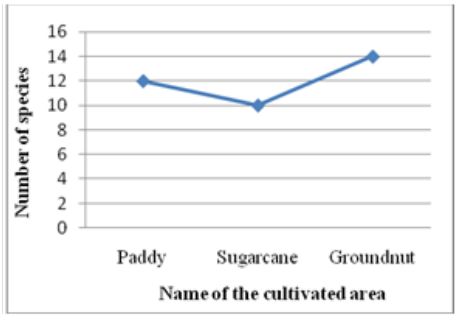

Figure 4: Ant species distri bution in three cultivated areas

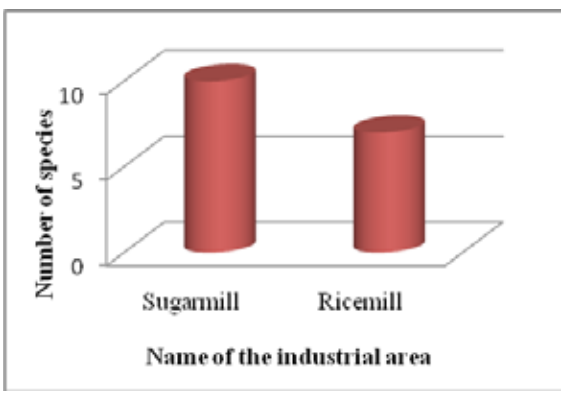

Figure 5: Ant species distribution in two industrial areas

REFERENCE

[1] Agosti, D., Major, J., Alonso, E., and Schultz, T.R. (2000), "Ants: Standard Methods for Measuring and monitoring Biodiversity." Biological Diversity Hand book Series. Smithsonian Institution Press. Washington D.C | [2] Ali, T.M. (1991), "Ant fauna of Karnataka." IUSSI Newsletter 5: 1-8. | [3] Ali, T.M. (1992), "Ant fauna of Karnataka." IUSSI Newsletter 6: 1-7. | [4] Aravind Chavhan., and Pawar, S.S. (2011), "Distribution and diversity of Ant Species (Hymenoptera: Formicidae) in and Around Amravati City of Maharashtra, India." World Journal of Zoology 6(4): 395-400 | [5] Bingham, C.T. (1903), "Fauna of British India." Vol. II. Taylor Francis, London. Pp: 106. | [6] Bolton, B. (1994), "Identification guide to the ant genera of the world." Harvard University Press, Cambridge, Massachusetts, USA. | [7] Donisthore, H. (1942), "Ants from Colombo museum Expadition to South India." Ann Mag. Hist. London. 9: 449-461. | [8] Douglas, J.M., and Sudd, J. (1980), "Behavioral co-ordination between an aphid (Symydobius oblongus) and the ant that attends it (Formica lugubris): An ethological analysis." Animal Behavior 28(4):1127-1139. | [9] Gadagkar, R., Chandrasekhar, K., and Nair, P. (1990), "Insect species diversity in the tropics- sampling methods and case study." Journal of the Bombay Natural History Society 87(3): 337-353. | [10] Gadagkar, R., Nair, P., and Bhat, D.M. (1993), "Ant species richness and diversity in some selected localities in Western Ghats, India." Hexapoda 5(2): 79-94. | [11] Holldobler, and Wilson. (1990), "The Ants". Springer – verlag. | [12] Kumaresan, V. (1998), "Host plant range of arboreal nesting red ants in Kanyakumari District of Tamilnadu (India)." Journal of the Bombay Natural History Society 95: 70-75. | [13] Odum, E.R. (1997), "Fundamentals of Ecology". pp.148-158. W.B.Saunders Limited. | [14] Palanisamy, P., Baskaran, S., and Mohandoss, A. (1995), "Insect pollination of Moringa plant. Moringa concanensis inimmo Linn". Environmental Ecology 13(1): 47-51. | [15] Rajagopal, T., Severkodione, S.P., and Manimozhi, A. (2005), "Ant diversity in some selected localities of Sattur Taluk, Virudhunagar district of Tamilnadu." Zoos, Print Journal 20(6): 1887-1888. | [16] Ramesh, T., Jahir Hussain, K. (2010), "Diversity, Distribution and Species Composition of Ants fauna at Department of Atomic Energy (DAE) Campus Kalpakkam, South India". World Journal of Zoology 5(1): 56-65. | [17] Rastogi, N., Nair, P., Kolatkar, M., William, H., and Gadagkar, R. (1997), "Ant fauna of The Indian Institute of Science Campus – Survey an,d some preliminary observations." J.Indian Inst.Sci 77: 133-140. | [18] Robinson, W. (1996), "Urbon Entomology". pp.262-284 Chapman Hall, London. | [19] Sunilkumar, M., Srihari, K.T., Nair, P., Varghese, T., and Gadagkar, R. (1997), "Ant Species richness in selected localities of Bangalore." Insect Environment 3(1): 3-5. | [20] Tiwari, R.N. (1999), "Taxonomic studies on Ants of a Southern India (Insecta: Hymenoptera: Formicidae)." Memories. 18: 1-96. | [21] Varghese,T. (2002), "Record of Strumigenys emmae (Emery) (Formicidae: Myrmicinae) from Bangalore, Karnataka and a key to Indian species of Agriculture, Mysore state." | [22] Varghese, T., (2003), "Ants of the Indian Institute of science campus". Technical report no 93, Centre for Ecological Sciences, Bangalore. | [23] Ward, P.S. (2001), "Taxonomy, phylogeny and biogeography of the ant genus Tetraponera (Hymenoptera: Formicinae) in the Oriental and Australian regions." Invertebrate Taxonomy. 15: 589-665.