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Species composition and occurrence of thrips on different host plants in Southern dry zone of Karnataka (Mandya)

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Abstract
Extensive random surveys were conducted during 2016-17 in southern dry zone of Karnataka to study the diversity of thrips. Out of 60 different plants collected during the survey, 33 species have showed the presence of thrips. The study revealed the occurrence of 21 thrips species belonging to 15 genera. Out of 15 genera, 4 belonged to the suborder, Tubulifera whereas, 11 belonged to the suborder, Terebrantia. Flower inhabiting thrips species are: *Ayyaria chaetophora* Karny, *Frankliniella schultzei* (Trybom), *Haplothrips ganglbaueri* Schmutz, *Megalurothrips usitatus* (Bagnall), *Microcephalothrips abdominalis* (D. L. Crawford), *Rhipiphorothrips cruentatus* Hood, *Scirtothrips bispinosus* (Bagnall), *Scirtothrips dorsalis* Hood, *Thrips flavus* Schrank, *Thrips florum* Schmutz, *Thrips hawaiiensis* (Morgan), *Thrips orientalis* (Bagnall), *Thrips palmi* Karny and *Thrips tabaci* Lindeman. Two tubuliferan species *viz.*, *Gynaikothrips bengalensis* Ananthakrishnan, and *Gigantothrips elegans* Zimmermann were found to be associated with the leaves of *Ficus benjamina.* Thripsbelonged to 2 tubuliferan genera and 6 terebrantian genera were collected from different weed hosts. The terebrantian thrips collected on weeds are: *Anaphothrips sudanensis* Trybom, *Arorathrips mexicanus* (D. L. Crawford), *Exothrips hemavarna* (Ramakrishna &Margabandhu), *Kurtomathrips morrilli* Moulton, *M. abdominalis* and *T. orientalis* whereas, *Haplothrips gowdeyi* (Franklin), *H. ganglbaueri* and *Xylaplothrips ligs* Ananthakrishnan & Jagadish were the tubuliferan members collected.

Keywords: Diversity, Flowers, Survey, Thrips, Weeds

Introduction
Thrips are minute insects, belong to the order Thysanoptera, which is subdivided into two suborders *viz.*, Terebrantia and Tubulifera (Mound *et al*., 1980) [17]. Thrips are with appreciable economic importance, having distinct characters from other group of insects. They possess fringed wings, asymmetrical mouth parts, a protrusible bladder at the tarsaltip and a pre pupal stage between larval and pupal stage. Their body size ranges from 0.5 to 15 mm in length and have rapid growth andbreeding potential (Ananthakrishnan, 1969) [2]. Thrips pupates and spend part of its life cycle in soil or ground litter (Lewis, 1973) [12].

The world record indicates the occurrence of nearly 6147 species of thrips (Anon, 2017) [5]. In India, a total of 739 species belonged to 259 genera are listed, of which 309 species in 116 genera belonged to the suborder Terebrantia and 430 species in 143 genera belonged to the suborder Tubulifera (Tyagi and Kumar, 2016) [22].

Thrips are found more in warm tropical areas than intemperate regions. About 50% of them are fungal feeders, while 40 percent feed on living tissues of dicotyledonous plants, grasses and remaining exploit primitive plants are predatory (Morse and Hoddle, 2006) [14].

Phytophagous thrips exhibit remarkable diversity in terms of habit and habitat. Majority of thrips are found on leaves, shoots, flowers, flower buds, axillary buds, young fruits and cones of Conifers (Lewis, 1973) [12]. Those infesting living tissues of plants are sap feeders while flower dwelling species feed on pollen. Few thrips predate on mites, scale insects and other thrips. Thrips also inhabit lichens, mosses, ferns, dead tree trunks and leaf litter (Mound, 2004) [16].

Thrips are mainly plant pests (Lewis, 1973; Morse and Hoddle, 2006) [12, 14] causing scarring and silvering of leaves, petals and fruits, premature flower fall, pollen depletion, leaf shedding and also leaf deformity. A few of them form leaf galls (Lewis, 1973; Raman and Ananthakrishnan, 1984) [12]. Furthermore, they are important vectors of tospoviruses that cause serious crop losses around the world (Mound, 1996; Lewis, 1973) [15, 12].

In India, lot of importance has been given to floriculture due to its multiple uses, satisfying the aesthetic needs of the people, creating more employment, ensuring higher rate of returns to rural people and facilitating earning more foreign exchange. More specifically, they are being

used as raw materials in the manufacture of essence, perfumes, medicines and confectioneries for direct consumption by the society. As the aesthetic sense of people to decorate their home and earth with flowers is increasing day by day. The demand for fresh flowers is increasing and more area is being brought under floriculture, ornamental trees, shrubs, bulbs and tubers etc.

Karnataka is one of the states with large area under cultivation of floriculture in the country. The farmers in the state are growing flowers such as Rose, Chrysanthemum, Tuberose, Aster, Jasmine, Crossandra, Marigold, Gladiolus, and Bird of paradise in the open fields. Rose, Carnations, Gerbera, and Anthurium are grown under protective covers and these have gained momentum in the last 10 years (Shreeram and Leelavathi, 2017) [19]. However, the quality of these flowers is being affected by many insects and diseases and thus causing economic loss to the growers (Butani, 1974) [9].

Thrips were earlier considered as minor insect pests on horticultural crops but nowadays they are gaining more importance due to their ability to cause economic losses, to subsist on new hosts and their polyphagous nature (Dahiya *et al*., 1995) [10]. Keeping this in view, the present study was undertaken in southern dry zone of Karnataka (Mandya) to understand the species composition of thrips on floricultural crops.

Materials and Methods

The study was undertaken at College of Agriculture, V. C. Farm, Mandya during 2016-17. A total of 60plant species were observed and from each plant, five flowers were collected randomly for the study.

Collection of thrips: For the studies on biodiversity of thrips from each species of flowering plants, five flowers were randomly collected. Those cut flowers were immediately placed into a labelled polyethylene bags. Later flowers were tapped against a white sheet of paper to dislodge the thrips. The thrips that fell onto the white paper were individually collected using a fine paint brush and transferred into vials filled with thrips preservative media (9 parts10% alcohol+ 1part glacial acetic acid +1 ml Triton-X-100 in 1000 ml of the mixture) (Bhatti,1999) [7]. These vials were labelled with name of host, location and date of collection for identification.

Preparation of slides: For identification, thrips specimens were mounted on slides by following the method adopted by Anantakrishnan and Sen (1980a) [3]. Specimens were mounted in Canada balsam for permanent preservation. The slides were dried and labelled with location, date of collection and host name. They were later identified using appropriate keys.

Results

During the present study, flowers from 60 plant species were collected and observed for the presence of thrips. Out of which, only 33 plant species belonging to 18 families (Table 1) harboured thrips population. The plant species are *Allamanda cathartica*, *Catharanthus roseus*, *Caesalpinia pulcherrima*, *Celosia* spp.,*Chloris barbata*, *Cosmos sulphureus*, *Cosmos bipinnatus*, *Crossandra infundibuliformis*, *Eleusine indica*, *Ficus benjamina*, *Gaillardia grandiflora*, *Gomphrena* spp., *Dactyloctenium aegyptium*, *Dendranthema grandiflora*, *Hibiscus syriacus*, *Impatiens balsamina*, *Jasminum grandiflorum*, *Jasminum multiflorum*, *Jasminum sambac*, *Jatropha* spp., *Moringa oleifera*, *Parthenium hysterophorus*, *Passiflora* spp., *Pentas lanceolata*, *Phaseolus vulgaris*, *Portulacagrandiflora*, *Quisqualis indica*, *Rosa* spp, *Tabernaemontana* spp., *Tagetes* spp., *Tridax procumbens*, *Tabebuia* spp. and *Wedelia chinensis.* Of these 33 plant species, 18 and 14 species had individual flowers and flower clusters, respectively and 1 species (*F. benjamina*) had leaf clusters.

A total of 21 thrips species (Table 4) were recorded from the surveyed flowering plants. The species recorded were *Anaphothrips sudanensis* Trybom, *Arorathrips mexicanus* (D. L. Crawford), *Ayyaria chaetophora* Karny, *Exothrips hemavarna* (Ramakrishna and Margabandhu), *Frankliniella schultzei* (Trybom), *Gynaikothrips bengalensis* Ananthakrishnan, *Haplothrips ganglbaueri* Schmutz, *Haplothrips gowdeyi* (Franklin), *Kurtomathrips morrilli* Moulton, *Megalurothrips usitatus* (Bagnall), *Microcephalothripsabdominalis* (D.L. Crawford), *Rhipiphorothrips cruentatus* Hood, *Scirtothrips bispinosus* (Bagnall), *S. dorsalis* Hood, *Thrips florum* (Bagnall), *Thrips flavus* Schrank, *Thrips hawaiiensis* (Morgan), *Thrips orientalis* (Bagnall), *Thrips palmi* Karny, *Thrips tabaci* Lindeman and *Xylaplothrips ligs* Ananthakrishnan and Jagadish.

Table 1: Species composition of thrips on different flowering from Southern dry zone of Karnataka (Mandya)

Sl. No.	Thrips species	Abundance	Plant family (Host)	Scientific name of the host
1	*Anaphothrips sudanensis* Trybom	+	Poaceae	*Dactyloctenium aegyptium* (I)
2	*Arorathrips mexicanus* (D. L. Crawford)	+		
3	*Ayyaria chaetophora* Karny	+ +	Oleaceae	*Jasminum multiflorum* (C)
4	*Exothrips hemavarna* (Ramakrishna and Margabandhu)	+	Poaceae	*Chloris barbata* (C)
5	*Frankliniella schultzei* (Trybom)	+ + +	Acanthaceae	*Crossandra infundibuliformis* (C)
			Asteraceae	*Dendranthema grandiflora*(I)
				Cosmos bipinnatus (I)
				Gaillardia grandiflora (I)
			Bignoniaceae	*Tabebuia spp* (C)
			Balsaminaceae	*Impatiens balsamina* (I)
			Fabaceae	*Phaseolus vulgaris* (C)
			Malvaceae	*Hibiscus syriacus* (I)
			Oleaceae	*Jasminum sambac* (C)
6	*Gynaikothrips bengalensis** Ananthakrishnan	+ + +	Moraceae	*Ficus benjamina* (C)
7	*Haplothrips ganglbaueri* Schmutz	+ + +	Asteraceae	*Dendranthema grandiflora* (I)
				Cosmos sulphureus (I)
				Cosmos bipinnatus (I)

Table 1: *Contd….*

				Gaillardia grandiflora (I)
				Tagetes spp. (I)
				Tridax procumbens(I)
			Amaranthaceae	*Celosia spp.* (I)
			Oleaceae	*Jasminum sambac* (C)
			Poaceae	*Dactyloctenium aegyptium* (I)
				Eleusine indica (I)
			Rubiaceae	*Pentas lanceolata* (C)
8	*Haplothrips gowdeyi* (Franklin)	+	Acanthaceae	*Crossandra infundibuliformis* (I)
			Asteraceae	*Wedelia chinensis* (I)
9	*Kurtomathrips morrilli* Moulton	+	Asteraceae	*Parthenium hysterophorus* (C)
10	*Microcephalothrips abdominalis* (D. L. Crawford)	+ + +	Asteraceae	*Dendranthema grandiflora* (I)
				Cosmos bipinnatus (I)
				Tagetes spp. (I)
			Amaranthaceae	*Gomphrena spp.* (I)
			Rosaceae	*Rosa spp* (I)
11	*Megalurothrips usitatus* (Bagnall)	+	Fabaceae	*Phaseolus vulgaris* (C)
12	*Rhipiphorothrips cruentatus* Hood	+	Euphorbiaceae	*Jatropa spp.* (C)
13	*Scirtothrips bispinosus* (Bagnall)	+	Moringaceae	*Moringa oleifera* (C)
			Passifloraceae	*Passiflora spp* (I)
14	*Scirtothrips dorsalis* Hood	+ +	Rosaceae	*Rosa spp* (I)

Table 1: *Contd….*

15	*Thrips florum* (Bagnall)	+ + +	Apocynaceae	*Tabernaemontana spp* (I)
			Asteraceae	*Dendranthema grandiflora* (I)
			Bignoniaceae	*Tabebuia spp* (C)
			Fabaceae	*Caesalpinia pulcherrima* (C)
			Malvaceae	*Hibiscus syriacus* (I)
			Oleaceae	*Jasminum grandiflorum* (C)
				Jasminum multiflorum (C)
16	*Thrips flavus* Schrank	+	Amaranthaceae	*Celosia spp.* (I)
17	*Thrips hawaiiensis* (Morgan)	+	Apocynaceae	*Allamanda cathartica* (C)
				Catharanthus roseus (I)
				Tabernaemontana spp (I)
			Combretaceae	*Quisqualis indica* (C)
18	*Thrips orientalis* (Bagnall)	+	Apocynaceae	*Catharanthus roseus* (I)
			Asteraceae	*Parthenium hysterophorus* (C)
19	*Thrips palmi* Karny	+	Portulacaceae	*Portulaca grandiflora* (I)
20	*Thrips tabaci* Lindeman	+	Combretaceae	*Quisqualis indica* (C)
21	*Xylaplothrips ligs* Ananthakrishnan and Jagadish	+	Amaranthaceae	*Gomphrena spp.* (I)

Abundance: + - 1-2 thrips/ flower, + + 3-5 thrips / flower, >6 thrips/ flower + + +, C = Clusters, I = Individual flowers

A. mexicanus and *A. sudanensis* were collected from flowers of *D. aegyptium*. *A. chaetophora*, *E. hemavarna*, *K. morrilli*, *M. usitatus*, *R. cruentatus*, *S. dorsalis*, *T. flavus*, *T. palmi*, *T. tabaci*, *X. ligs* and *G. benghalensis* were recorded on the flowers of *J. multiflorum*, *C. barbata*, *P. hysterophorus*, *P. vulgaris*, *Jatropha* spp., *Rosa* spp., *Celosia* spp., *P. grandiflora*, *Q. indica*, *Gomphrena* spp.,andleaves of *F. benjamina*, respectively. *H. gowdeyi* was collected from the flowers of *C. infundibuliformis* and *W. chinensis* and *S. bispinosus* from *M. oleifera* and *Passiflora* spp. Whereas, *T. orientalis* was noticed on the flowers of *C. roseus* and *P. hysterophorus*. Thrips species *viz.*, *T. hawaiiensis*, *M. abdominalis*, *T. florum*, *F. schultzei* and *H. ganglbaueri* were seemed to be polyphagous in nature as they have been reported from different four, five, seven, nine and eleven flowering plants, respectively during the survey.

Discussion

A total of 21 thrips species have been collected and identified from 33 flowering plants in the Southern dry zone of Karnataka. In the present study, *A. sudanensis* and *A. mexicanus* were reported on host plant, *Dactyloctenium aegyptium* belonging to family, Poaceae. Balou *et al.* (2014) and Tillekaratne *et al.* (2011) [6, 20] also recorded, *A. sudanensis* and *A. mexicanus* on plants species belonging to family Poaceae. On *C. barbata* (F: Poaceae), *E. hemavarna* was recorded and Anantakrishnan and Sen (1980b) [4] also reported the same specieson host plant belonging Poaceae family. *A. chaetophora* was collected on flower species, *J. multiflorum* which belonged to family, Oleaceae. The findings are in line with the results of Singh and Varatharajan (2013) [18] and Maisnam and Varatharajan (2015) [13] who also reported occurrence of *A. chaetophora* on the flowers. *K. morilli* was recorded on *P. hysterophorous* belonged to family Asteraceae in line with the observations of Borbon and Manuel (2004) [8] who also the species from same host.

M. usitatus was observed on *P. vulgaris* as similar to the studies of Jyothirmai *et al.* (2011) [11] and Tillekaratne *et al.* (2011) [20]. Both of them reported the same species on pulses. *R. cruentatus* and *S. dorsalis* were collected on *Jatropha spp.*

and *Rosa spp.*, respectively and the findings confirmed the results of Akhtar and Azim (2013) [1] and Anantakrishnan and Sen (1980b) [4]. *X. ligs was* recorded on host belonged to Amranthaceae family. But earlier worker, Tyagi (2012) [21] recorded the same species on plant which belonged to Asteraceae family. The difference could be due to different crops and locality surveyed.

On foliage of *F. benjamina*, thrips, *G. bengalensis* was recorded. Many previous workers (Balou *et al.* (2014); Maisnam and Varatharajan (2015) [6, 13] also recorded the same species from *F. benjamina*. Polyphagous thrips species *viz., H. gowdeyi*, *M. abdominalis*, *F. schultzei* and *H. ganglbaueri* were collected from numerous host plants as reported by many earlier workers.

Conclusion

The present study gives information regarding the thrips species associated with flowers and foliage. During the survey, 21 thrips species belonged to two different suborders were recorded from thirty-three plant species in Southern dry zone of Karnataka (Mandya). Of these, seventeen thrips species belonged to suborder, Terebrantia and remaining four species belonged to suborder, Tubulifera. Our survey confirms the presence of these thrips species from different host plants in Karnataka. Documentation on host plants of thrips from Karnataka is lacking and our work demands further survey and study in this field from Karnataka state.

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