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A revised host list of fruit flies (Diptera : Tephritidae) from the Northern Territory of Australia

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Abstract

Host records for 19 indigenous fruit flies in the Northern Territory are reported. One species, *Dacus aquilonis* (May), has recently extended its host range and developed into a major pest of cultivated fruit in the Darwin area. *D. jarvisi* (Tryon) also appears to have the potential to increase in economic importance. Although 11 host fruits have been infested concomitantly by these two sympatric species, there is no evidence that interspecific competition occurs between them.

Two other species (*D. bryoniae* (Tryon) and *D. cucumis* French) recorded as being economic in other localities of the South Pacific region have not been reared from commercial hosts in the Northern Territory.

INTRODUCTION

Occurrences of fruit fly species have quarantine implications for horticultural industries within Australia and overseas. Although several of the species recorded in this paper are apparently confined to some coastal areas of the Northern Territory (NT) most are more widely distributed within Australia (May 1953). During the past decade, research work on fruit flies in the NT has resulted in: the detection and description of seven new species (Drew 1979; Drew *et al.* 1981; Drew and Hardy 1981; Drew 1988); the preparation of host records for many of the indigenous fruit flies (Allwood and Angeles 1979); and ecological studies on several species (Fitt 1981*a*, 1981*b*, 1983).

Allwood and Angeles (1979) reviewed fruit fly work in the NT up to 1978 and listed the known hosts and recorded localities for 13 fruit flies. Those records were compiled from older collections and intensive fruit sampling between 1975 and 1978. In April 1985, the native species *Dacus aquilonis* (May) suddenly expanded its host range in the Darwin area to include many cultivated fruits. This species is extremely difficult to separate taxonomically from Queensland fruit fly, *Dacus tryoni* (Froggatt) and will produce viable offspring when crossed under laboratory conditions (Drew and Lambert 1986). The emergence of *D. aquilonis* as a pest prompted the collection of more introduced fruit samples than previously when the emphasis had been on the collection of native plant hosts.

To date, 26 species of tephritids have been recorded in the NT, seven of which are of the subfamily Trypetinae and 19 of the subfamily Dacinae. This paper includes those records published earlier (Allwood and Angeles 1979; Drew 1979; Fitt 1981*a*). Records of exotic fruit fly species reared from Quarantine interceptions of infested fruit grown outside the NT are not included. Botanical nomenclature of hosts is as listed in Dunlop (1987).

MATERIALS AND METHODS

Fruits of native hosts were collected at localities representative of a large area of the NT between 1976 and June 1987. Where possible, mature fruits were collected both from

trees and the ground. Subsamples were allocated for identification by the Botany Section of the Conservation Commmission of the NT.

Cultivated hosts were collected in a similar manner. However, from March 1986 to June 1987, emphasis was placed on regular weekly sampling of fruiting species in an experimental orchard of introduced tropical fruit species located at Berrimah Research Farm near Darwin, and regular or more frequent samplings of other introduced fruits in urban and rural situations near Darwin than had previously occurred.

After collection, fruits were counted and held for pupation and adult emergence in clear plastic boxes with gauze covered aeration holes in the lid. Environmental conditions in the rearing room were maintained at 25°±4°C and 70%±15% relative humidity (r.h.) with natural daylight supplemented during the day by a bank of fluorescent tubes. Sieved sawdust (moistened as necessary) was provided as a pupation medium. Fleshy fruit was removed after 12 days (by which time larvae would have emerged from the fruit) to avoid a build up of infestations of mites and *Drosophila* sp. and to avoid excessive moisture in the sawdust.

When flies emerged, they were offered water and a sugar–protein mix for 3 to 4 days to allow development of colour, then killed and identified. Several specimens of each species from each host were mounted and retained in a reference collection. After 30 days, numbers of each fruit fly species and of emerging parasites were recorded and the fruit remnants and sawdust discarded.

RESULTS

More than 2500 samples of introduced and native fruits representing 285 plant species from 77 plant families were collected for fruit fly rearing. Native hosts have been recorded for 19 species of NT fruit flies and are listed in Tables 1 to 3. Many samples of fruit yielded two species of fruit fly and the frequency of multiple species infestation increased after March 1985 when *D. aquilonis* emerged as a significant pest species. Host fruits which were infested simultaneously with more than one species of fly are listed in Table 4.

Table 1. Recorded plant hosts of some Tephritidae in the Northern Territory

Fruit fly species	Plant host species	Host Family	Number of occurrences		
			Host sampled	Flies sampled	Multiples
Trypetinae					
Adrama biseta Malloch	*Barringtonia acutangula* (L.) Gaertner	Lecythidaceae	10	3	0
Adrama sp.	*Ipomoea abrupta* R. Br.	Convolvulaceae	1	1	0
Callistomyia horni Hendel	*Micromelum minutum* (Forster f.)Wight & Arn.	Rutaceae	2	2	0
	Glycosmis pentaphylla (Retz.) DC.	Rutaceae	7	2	1
	Glycosmis trifoliata (Blume) Sprengel	Rutaceae	15	5	3
	Glycosmis sp.	Rutaceae	2	2	0
Ceratitella sp.	*Amyema maidenii* (Blakely) Barlow	Loranthaceae	2	2	0
Gen. et sp. nov.	*Capparis* sp.	Capparaceae	1	1	0

Table 1. Recorded plant hosts of some Tephritidae in the Northern Territory

Fruit fly species	Plant host species	Host Family	Number of occurrences		
			Host sampled	Flies sampled	Multiples
Dacinae					
Callantra axana (Hering)	*Luffa cylindrica* (L.) M. Roemer	Cucurbitaceae	3	2	1
Dacus aquilonis (May)	See Table 2—64 spp.	Table 2			
Dacus bryoniae (Tryon)	*Diplocyclos palmatus* (L.) C. Jeffrey (=*Bryonopsis laciniosa*)	Cucurbitaceae	Fitt 1981*a*	Fitt 1981*a*	
	Passiflora suberosa L.	Passifloraceae	2	1	0
	Strychnos lucida R. Br.	Loganiaceae	49	3	0
Dacus cucumis French	*Luffa cylindrica* (L.) M. Roemer	Cucurbitaceae	3	1	1
	Passiflora edulis Sims	Passifloraceae	13	1	0
Dacus decurtans (May)	*Carallia brachiata* (Lour.) Merr.	Rhizophoraceae	14	10	0
Dacus sp. nov. (sp. C)	*Diospyros maritima* Blume	Ebenaceae	26	8	1
Dacus hardyi Drew	*Cynanchum* sp.	Asclepiadaceae	Drew 1979	Drew 1979	
Dacus jarvisi (Tryon)	See Table 3—21 spp.	Table 3			
Dacus mendosus (May)	*Pouteria sericea* (Aiton) Baehni	Sapotaceae	4	4	0
Dacus opiliae Drew and Hardy	*Mangifera indica* L.	Anacardiaceae	131	2	0
	Terminalia ferdinandiana Exell	Combretaceae	Fitt 1981*a*	Fitt 1981*a*	
	Mukia maderaspatana (L.) M. Roemer	Cucurbitaceae	4	2	2
	Opilia amentacea Roxb.	Opiliaceae	42	22	0
Dacus pallidus (Perkins and May)	*Hibiscus tiliaceus* L.	Malvaceae	5	1	0
	Nauclea orientalis (L.) L.	Rubiaceae	25	11	0
Dacus tenuifascia (May)	*Planchonella arnhemica* (F. Muell.) P. Royen	Sapotaceae	Fitt 1981*b*	Fitt 1981*b*	
	Planchonella pohlmaniana (F. Muell.)	Sapotaceae	15	10	0
Dacus signatifer (Tryon)	*Capparis sepiaria* L.	Capparaceae	1	1	0
	Capparis sp.	Capparaceae	3	2	0
Dacus sp. nov. (sp.B.)	*Secamone elliptica* R. Br.	Asclepiadaceae	6	1	0

Table 2. Recorded host plants of *Dacus aquilonis* (May) in the Northern Territory

Plant host species	Host Family	Number of occurrences to March 1985			Number of occurrences after March 1985		
		Host sampled	Flies emerged	Multiple fly spp.	Host sampled	Flies emerged	Multiple fly spp.
Anacardium occidentale L.	Anacardiaceae	4	0	n.a.	8	2	0
Mangifera indica L.	Anacardiaceae	68	0	n.a.	64	21	2
Spondias cytherea Sonn.	Anacardiaceae	2	0	0	23	4	1
Annona muricata L.	Annonaceae	2	0	n.a.	19	9	1
Annona reticulata L.	Annonaceae	0	0	n.a.	6	1	0
Annona squamosa L.	Annonaceae	0	n.a.	n.a.	5	2	0
Polyalthia australis (Benth.) Jessup	Annonaceae	4	1	0	0	n.a.	n.a.
Rollinia deliciosa Saff.	Annonaceae	0	n.a.	n.a.	3	3	0
Rollinia mucosa Baill.	Annonaceae	0	n.a.	n.a.	4	4	0
Livistona humilis R. Br.	Arecaceae	8	3	0	14	0	n.a.
Maranthes corymbosa Blume	Chrysobalanaceae	9	7	1	0	n.a.	n.a.
Terminalia catappa L.	Combretaceae	2	0	0	14	14	0
Terminalia erythrocarpa F. Muell.	Combretaceae	6	2	0	0	n.a.	n.a.
Terminalia ferdinandiana Exell	Combretaceae	81	40	0	45	17	0
Terminalia grandiflora Benth.	Combretaceae	5	1	0	1	0	n.a.
Terminalia platyphylla F. Muell.	Combretaceae	7	1	0	0	n.a.	n.a.
Diospyros ebenaster L.	Ebenaceae	0	n.a.	n.a.	30	6	0
Diospyros maritima Blume	Ebenaceae	26	1	1	0	n.a.	n.a.
Elaeocarpus grandis F. Muell.	Elaeocarpaceae	1	1	0	0	n.a.	n.a.
Petalostigma pubescens Domin	Euphorbiaceae	20	1	0	13	0	n.a.
Phyllanthus acidus (L.) Skeels.	Euphorbiaceae	1	0	n.a.	17	2	0
Flacourtia jangomas (Lour.) Rauschel	Flacourtiaceae	0	n.a.	n.a.	7	1	0
Flacourtia rukam Zoll. & Mor.	Flacourtiaceae	0	n.a.	n.a.	16	1	n.a.
Cryptocarya cunninghamii Meissner	Lauraceae	2	1	0	0	n.a.	n.a.
Persea americana Mill.	Lauraceae	1	0	n.a.	6	2	0
Malpighia glabra L.	Malpighiaceae	0	n.a.	n.a.	22	20	0
Malpighia puniciflora L.	Malpighiaceae	0	n.a.	n.a.	13	5	0
Aglaia rufa Miq.	Meliaceae	4	1	0	0	n.a.	n.a.
Musa acuminata Colla	Musaceae	2	0	n.a.	4	3	1
Musa acuminata x M. *balbisiana* cv. Lady's finger	Musaceae	0	0	n.a.	1	1	0
Acmena hemilampra (F. Muell. ex Bailey) Merr. & Perry	Myrtaceae	6	1	0	0	n.a.	n.a.
Acmenosperma claviflorum (Roxb.) Kausel	Myrtaceae	2	2	0	0	n.a.	n.a.
Psidium guajava	L.Myrtaceae	55	6	0	133	72	18
Psidium littorale Raddi var. littorale Bail.	Myrtaceae	0	n.a.	n.a.	11	11	2

Table 2. Recorded host plants of *Dacus aquilonis* (May) in the Northern Territory—*continued*

Plant host species	Host Family	Number of occurrences to March 1985			Number of occurrences after March 1985		
		Host sampled	Flies emerged	Multiple fly spp.	Host sampled	Flies emerged	Multiple fly spp.
Syzygium aqueum (Burm) Alston	Myrtaceae	0	n.a.	n.a.	4	4	0
Syzygium armstrongii (Benth.) B. Hyland	Myrtaceae	13	1	1	0	n.a.	n.a.
Syzygium angophoroides (F. Muell.) B. Hyland	Myrtaceae	2	1	0	0	n.a.	n.a.
Syzygium fibrosum (Bailey) Hartly & Perry	Myrtaceae	8	1	0	4	2	0
Syzygium forte (F Muell.) B. Hyland	Myrtaceae	2	2	1	0	n.a.	n.a.
Syzygium jambos (L.) Alston	Myrtaceae	0	n.a.	n.a.	4	4	0
Syzygium malaccense (L.) Merr. & Perr	Myrtaceae	2	0	n.a.	1	1	0
Syzygium operculata Roxbg.	Myrtaceae	4	1	0	0	n.a.	n.a.
Syzygium suborbiculare (Benth.) Hartly & Perry	Myrtaceae	39	8	5	4	3	1
Eugenia uniflora L.	Myrtaceae	1	0	n.a.	1	1	0
Averrhoa carambola L.	Oxalidaceae	6	0	n.a.	201	143	0
Ziziphus mauritiana Lam.	Rhamnaceae	3	0	n.a.	6	4	0
Eriobotrya japonica (Thunb.) Lindl.	Rosaceae	0	n.a.	n.a.	1	1	0
Malus sylvestris Mill.	Rosaceae	0	n.a.	n.a.	2	2	0
Prunus persica (L.) Batsch	Rosaceae	2	1	0	8	2	0
Ixora klanderana F. Muell.	Rubiaceae	4	1	0	4	0	n.a.
Citrus limon (L.) Burm. f.	Rutaceae	3	0	n.a.	54	14	0
Citrus grandis (L.) Osbeck	Rutaceae	0	0	n.a.	12	5	0
Citrus paradisi Macf.	Rutaceae	6	1	0	32	11	1
Citrus reticulata Blanco	Rutaceae	2	0	n.a.	23	2	0
Citrus sp.	Rutaceae	3	3	0	0	n.a.	n.a.
Fortunella crassifolia Swingle (Meiwa var.)	Rutaceae	0	n.a.	n.a.	6	1	0
Glycosmis pentaphylla (Retz.) DC.	Rutaceae	6	2	1	0	n.a.	n.a.
Glycosmis trifoliata (Blume) Sprengel	Rutaceae	10	3	1	2	2	2
Micromelum minutum (Forster f.) Wight & Arn.	Rutaceae	23	3	0	7	0	n.a.
Blighia sapida Koenig	Sapindaceae	0	n.a.	n.a.	11	1	0
Chrysophyllum cainito L.	Sapindaceae	0	n.a.	n.a.	2	1	0
Manilkara zapota (L.) Van Royen	Sapindaceae	0	n.a.	n.a.	1	1	0
Capsicum annuum L.	Solanaceae	0	n.a.	n.a.	4	4	0
Lycopersicon esculentum Miller	Solanaceae	4	0	n.a.	16	9	0

n.a.=not applicable.

Table 3. Recorded host plants of *Dacus jarvisi* (Tryon) in the Northern Territory

Plant host species	Host Family	Number of occurrences to March 1985			Number of occurrences after March 1985		
		Host sampled	Flies emerged	Multiple fly spp.	Host sampled	Flies emerged	Multiple fly spp.
Mangifera indica L.	Anacardiaceae	68	26	0	64	7	2
Spondias cytherea Sonn.	Anacardiaceae	2	1	0	23	1	1
Annona muricata L.	Annonaceae	2	0	n.a.	19	1	1
Carica papaya L.	Caricaceae	5	2	0	14	1	0
Maranthes corymbosa Blume	Chrysobalanaceae	9	1	1	0	n.a.	n.a.
Terminalia arostrata Ewart & O.B. Davies	Combretaceae	2	0	n.a.	1	1	0
Terminalia catappa L.	Combretaceae	2	1	0	14	0	0
Mukia maderaspatana (L.) M. Roemer	Cucurbitaceae	4	2	2	0	n.a.	n.a.
Planchonia careya (F. Muell.) Knuth	Lecythidaceae	61	32	0	7	7	0
Musa acuminata Colla	Musaceae	2	0	n.a.	4	1	1
Psidium guajava L.	Myrtaceae	55	13	0	133	30	18
Psidium littorale Raddi var. littorale Bail.	Myrtaceae	0	n.a.	n.a.	11	2	2
Syzygium armstrongii (Benth.) B. Hyland	Myrtaceae	13	4	1	0	n.a.	n.a.
Syzygium eucalyptoides ssp. *bleeseri* (O. Schwarz) B. Hyland	Myrtaceae	2	2	0	0	n.a.	n.a.
Syzygium malaccense (L.) Merr. & Perry	Myrtaceae	2	1	0	1	0	n.a.
Syzygium forte (=*S. rubiginosum*) (F. Muell.) B. Hyland	Myrtaceae	2	1	1	0	n.a.	n.a.
Syzygium suborbiculare (Blume) Hartley & Perry	Myrtaceae	39	29	5	4	1	1
Syzygium sp.	Myrtaceae	6	2	0	0	n.a.	n.a.
Averrhoa bilimbi L.	Oxalidaceae	0	n.a.	n.a.	9	1	0
Punica granatum L.	Punicaceae	2	1	0	1	0	n.a.
Citrus paradisi Macf.	Rutaceae	6	0	n.a.	26	1	1
Citrus sinensis (L.) Osbeck	Rutaceae	9	2	0	8	0	n.a.

n.a.=not applicable.

DISCUSSION

Hosts of five Dacine species (namely *Callantra aequalis* (Coquillet), *D. allwoodi* Drew, *D. bellulus* Drew and Hancock, *D. newmani* (Perkins) and *Dacus* sp. D*) which have been collected at male lure traps in the NT are as yet unknown while several species of Trypetines, occasionally collected at lure traps, are unlikely to damage fruit. In addition, fruit sampling produced evidence of a non-indigenous species of fruit fly *Ceratitis capitata* (Wiedemann) (Mediterranean fruit fly) which had infested cultivated hosts in Alice Springs. The latter had been detected and field outbreaks successfully eradicated in two separate control programmes mounted from December 1976 to April 1977 and December 1981 to March 1982 at Alice Springs.

* Three new species identified here as *Dacus* sp. B, *Dacus* sp. C and *Dacus* sp. D. are described in Drew (1988).

Table 4. Fruit samples from which more than one species of fruit fly emerged

Fruit fly species	Plant host species	Host Family	Number occurrences
Callantra axana *Dacus cucumis*	*Luffa cylindrica*	Cucurbitaceae	1
Dacus opiliae *Dacus jarvisi*	*Mukia maderaspatana*	Cucurbitaceae	2
Dacus aquilonis *Dacus* sp. nov. (sp. C)	*Diospyros maritima*	Ebenaceae	1
Dacus aquilonis	*Glycosmis pentaphylla*	Rutaceae	1
Callistomyia horni	*Glycosmis trifoliata*	Rutaceae	3
Dacus aquilonis	*Annona muricata*	Annonaceae	1
Dacus jarvisi	*Citrus paradisi*	Rutaceae	1
	Mangifera indica	Myrtaceae	2
	Maranthes corymbosa	Chrysobalanaceae	1
	Musa acuminata (cv. Cavendish)	Musaceae	1
	Psidium guajava	Myrtaceae	18
	Psidium littorale	Myrtaceae	2
	Spondias cythera	Anacardiaceae	1
	Syzygium armstrongii	Myrtaceae	1
	Syzygium forte (=*S. rubiginosum*)	Myrtaceae	1
	Syzygium suborbiculare	Myrtaceae	6

D. aquilonis

This species occurs only in north-western Australia and is geographically separated from closely related species in eastern Australia (Drew and Lambert 1986). Allwood and Angeles (1979) found that *D. aquilonis* showed more diversity in host range than other indigenous fruit flies, having 12 native (*Pouteria sericea* was listed in error) and 4 cultivated hosts. Since their list was compiled, the known host range of this pest has increased to 63 species (Table 2) of which 40 are cultivated or introduced plants and 23 are native plants. These hosts range over 21 plant families and include 14 species in Myrtaceae. However, of the 40 cultivated hosts listed in Table 2, 34 have been recorded since April 1985 and all within a limited area extending up to 80 km from Darwin. *D. aquilonis* is now recognised as a pest species which has eclipsed *D. jarvisi* (Tryon) in importance in the NT.

The reason for the sudden and dramatic change in host preference remains unknown but a damaging strain of *D. aquilonis* would appear to exist which is still expanding both its territorial and host range. Specimens reared from this strain are morphologically indistinguishable from the original strain but *D. aquilonis* has not been reared from cultivated hosts outside this limited territorial range since April 1985 whereas it is consistently reared from at least some of these hosts within the range. The presence of the noxious strain is readily detected by infestations in the widely planted host *Averrhoa carambola* and in *Mangifera indica*, the most commonly grown domestic and commercial fruit trees in the tropical region of the NT. Prior to April 1985, these fruits were not attacked by *D. aquilonis* (Table 2) but since that time, 71% (143/201) of *A. carambola* samples and 33% (21/64) of mango samples were infested. These infestation rates could have been even higher since many samples were taken from commercial plantings where chemical spraying had been carried out and were also diluted by samplings from areas where the harmful strain had not yet reached.

D. jarvisi

D. jarvisi also increased its host range from nine (four cultivated) species in 1979 to 21 (12 cultivated) species (Table 3). However, as Fitt (1986) showed, this species strongly prefers its native host *Planchonia careya* for oviposition and most of the records of *D. jarvisi* from cultivated fruit occurred outside the fruiting season of this native host. It is probable that *D. jarvisi* will increase in numbers and extend its range when more cultivated fruit becomes available so that it will be supported from season to season by cultivated hosts as occurs in coastal Queensland (May 1963).

D. cucumis French

Until recently very few specimens and no hosts of *D. cucumis* had been recorded in the NT although the species was regarded as a potential pest of commercial cucurbits (Fitt 1980). The species is of major importance in Queensland where it infests cucurbits, tomatoes and pawpaws (Drew 1982). *D. cucumis* was reared from cultivated *Luffa cylindrica* and a single specimen from passionfruit (*Passiflora edulis*). Following the collection of numerous specimens on leaves of *Ficus racemosa* in August 1986, a laboratory culture was established and has been readily maintained by females ovipositing into and larvae rearing in cut cucumber. In the NT, *D. cucumis* has also been collected from Katherine, over 200 km inland.

D. bryoniae (Tryon)

Records of *D. bryoniae* from capsicum, mango and passionfruit in Queensland (Drew 1982) are incorrect (Drew 1988). This species is known only from banana in Papua New Guinea (Drew 1982) and from three native hosts in the NT. It is possible that it could develop into a commercial pest there.

D. opiliae Drew and Hardy

D. opiliae (=*Dacus* sp. A—Allwood and Angeles 1979) has now been recorded from three native hosts but has not been reared from mangoes since 1969 (Allwood and Angeles 1979). Fitt (1981*a*) indicates that this fly is unlikely to develop into an economically important species.

Callistomyia horni Hendel

There are now three known native hosts of *Callistomyia horni* (*Barringtonia acutangula* was recorded incorrectly by Allwood and Angeles (1979)) but this species is unlikely to develop into an economic pest.

All other species listed in Table 1 are probably monophagous and possibly univoltine and are therefore very unlikely to develop into pest species of commercial fruit.

The rapid change and expansion in host range of *D. aquilonis* is also evident in the dual infestations recorded in Table 4. Allwood and Angeles (1979) reported two species of fruit fly from the same fruit in three host fruits. In each instance *D. aquilonis* was one of the species. The list (Table 4) has now been increased to 16 host fruits, 14 of which include *D. aquilonis*. Of these 14 species, seven were recorded to March 1985 and seven from March 1985 to June 1987. The former included only native fruits while the latter were all cultivated. This was despite the more frequent sampling of these cultivated fruits (135 samples) in the period to April 1985 than the corresponding native fruits (105 samples).

The most favoured hosts infested by *D. jarvisi* were *Planchonia careya*, *Psidium guajava* and *Syzygium suborbiculare* while *D. aquilonis* regularly infested many hosts, including *Annona muricata*, *Averrhoa carambola*, *Citrus paradisi*, *Malpighia glabra*, *Man-*

gifera indica, *Psidium* spp., some *Syzygium* spp. and *Terminalia* spp. As indicated by Fitt (1987), there is little evidence that interspecific competition occurs between these two sympatric species. For example, *D. jarvisi* was reared from 23.6% (13/55) of guava samples collected before March 1985 and from 22.6% (30/133) of samples collected since that time and was unaffected by competition from *D. aquilonis* which infrequently (6/55) infested guava before March 1985 but emerged from 54.1% (72/133) of samples collected post March 1985 and 18 of these 133 samples (=13.5%) had dual infestation of both fruit fly species.

Similar results were reported in a study involving other sympatric fruit flies in Queensland where Gibbs (1967) showed that, although using the same host fruits for oviposition and larval development, *D. tryoni* and *D. neohumeralis* Hardy did not exert any deleterious effect on one another.

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